SANS The most trusted source for cybersecurity training, certifications, degrees, and research

GIAC CERTIFICATIONS

Cybersecurity Training and Certifications

2020 Course Catalog

SANS Focus Areas

- Cyber Defense Essentials
- Blue Team Operations
- Penetration Testing
- Digital Forensics, Incident Response, and Threat Hunting
- Security Management, Legal, and Audit
- DevSecOps
- Industrial Control Systems
- Cloud Security
- Team-Based Training
- Purple Team Training

"You cannot beat the quality of SANS courses and instructors. I came back to work and was able to implement the skills I learned in class on day one. Invaluable."

— Melissa Sokolowski, **Xerox**

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"SANS gives you hands-on training you can use right away!"

— Manuel Wallace, **ABC Financial LLC**

SANS The most trusted source for cybersecurity training, certifications, degrees, and research

GIAC CERTIFICATIONS

At the SANS Institute, our mission is to deliver the cutting-edge information security knowledge and skills that companies, military organizations, and governments need to protect their people and assets.

TRAINING ON THE CUTTING EDGE

SANS offers more than 65 unique courses, all designed to align with dominant security team roles, duties, and disciplines. Our courses prepare students to face today's threats and tomorrow's challenges.

The SANS curriculum spans the full range of cybersecurity fields, including Cyber Defense, Penetration Testing & Ethical Hacking, Digital Forensics & Incident Response, Threat Hunting, Audit, Management, Critical Infrastructure and Control Systems Security, Secure Software Development, and more.

In SANS courses, students are immersed in hands-on lab exercises designed to help them practice, hone, and perfect what they've learned. And we constantly update and rewrite our courses to be sure the tools and techniques we're teaching are always current, and on the cutting edge.

LEARN FROM THE BEST

The SANS faculty is simply unmatched. All of our instructors are active security practitioners who bring their extensive knowledge and real-world experiences directly to the classroom.

SANS instructors work for high-profile organizations as red team leaders, CISOs, technical directors, and research fellows. In addition to their respected technical credentials, they're also expert teachers. Their passion for the topics they teach shines through, making the SANS classroom—both live and online—dynamic and effective.

GIAC CERTIFICATION

GIAC certifications are designed to ensure that students can apply their knowledge and skills in a real-world setting. More than 30 certifications align with SANS training courses, validating student mastery for professional use in critical, specialized InfoSec domains and job-specific roles. See **giac.org** for more information.

A TRAINING FORMAT FOR EVERY STUDENT

SANS holds more than 300 live training events around the world each year, so you can find a convenient time and place to take your course. These events provide an engaging learning environment and multiple opportunities to network with other security professionals and with SANS instructors and staff.

SANS training is also offered online, with several convenient options to suit your learning style. All of our online courses include at least four months of access to the course material, so students can revisit and rewind content anytime, anywhere.

RECOGNIZED AS A SUPERIOR INVESTMENT

Information security professionals from every member of the Fortune 100, and from small and mid-sized firms alike, say they return to SANS training again and again because they trust their training will result in practical and high-quality capabilities. SANS training is also embedded in government and military programs in the United States and allies around the world for the same reason.

Customer feedback drives our continuous effort to maintain the quality and impact of SANS training, so that we continue to deserve your trust.

THE SANS PROMISE

At the heart of everything we do is the SANS Promise: Students will be able to use their new skills as soon as they return to work.

REGISTER FOR SANS TRAINING

Learn more about SANS courses, and register online, at **sans.org**

Test drive 45+ SANS courses

For those new to SANS or unsure of the subject area or skill level to select for your next training course, SANS offers free one-hour course previews via our OnDemand platform. Preview our courses at **sans.org/demo**

SANS Faculty

"SANS instructors are the best in the game. Their technical knowledge combined with presentation skills and real-world examples make for an unparalleled training experience. SANS rocks!"

— Chris Gergen, **Bank of North Dakota**

At SANS, our course authors and instructors are renowned cybersecurity experts who share their knowledge by drawing on their own real-world experiences and top-shelf curriculum. Industry professionals choose SANS training again and again, year after year, for access to these highly regarded experts.

There are only about 120 individuals in the world currently qualified as SANS Certified Instructors. Each is selected after proving his or her technical and teaching expertise through years of work and success. The instructors are the founders of international cybersecurity organizations, authors of best-selling books, and developers of the world's most advanced cyber ranges and Capture-the-Flag challenges. Many are regularly called upon to share their expertise with government and commercial organizations around the world.

In addition to their impressive résumés, every member of the SANS faculty is fully committed to providing the most comprehensive training possible. Our instructors do more than just stand in front of a classroom—they're present for their students every step of the way, with follow-ups, webcasts, mentoring, and more. Their goal is your success, and that dedication is what truly sets SANS training apart from all the rest.

Whether you train with SANS online or at one of our live events, we promise you'll be able to apply what you learn from these top-tier instructors as soon as you return to work.

Meet the SANS faculty:
sans.org/instructors

Build a High-Performing Security Organization

Based on our global research, SANS has identified effective strategies for building an information security group:

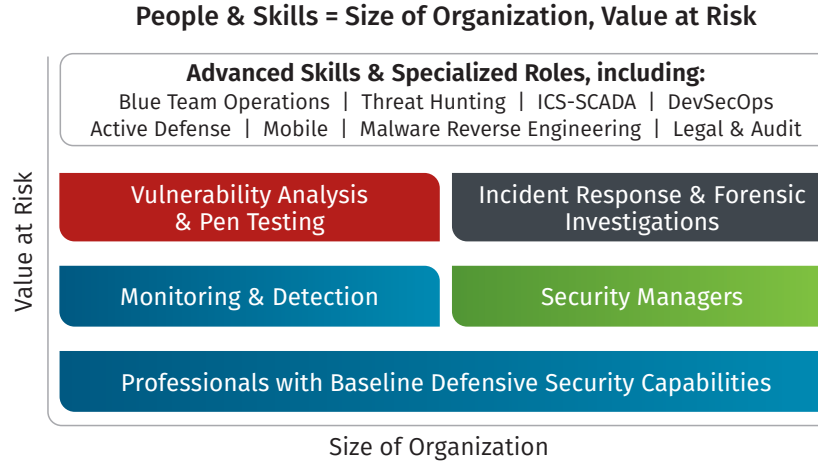
Use practical organizing principles to design your plan. Nearly all of the more complex frameworks may be reduced to a few simpler constructs, such as "Build and Maintain Defenses – Monitor and Detect Intrusion – Proactively Self-Assess – Respond to Incidents."

Prioritize your efforts within these areas using the **Center for Internet Security Critical Controls** as you mature your own organization.

Determine the number and types of professionals you need to perform the hands-on work, then **launch an ongoing campaign** to develop a team with the appropriate skills in mind. Cybersecurity is a specialized practice area within IT, and demands specialized training.

The job roles and skills required in information security grow and change as the organization scales. While every professional needs a baseline of knowledge and capabilities in cyber defense and incident response, over time you will develop specialized members of your team to work together in particular areas.

Four critical job roles typically emerge:



- **Security Monitoring & Detection Professionals** – Identifying security anomalies within your environment requires an increasingly sophisticated set of skills. All too often, vendor training teaches to the tool, without explaining how the tool works or how it can be best used. To deploy detection and monitoring tools and interpret their output, you need a more robust understanding of tools, techniques, and analysis.
- **Pen Testers & Vulnerability Analysts** – A professional who can find weaknesses is often a different breed than one focused exclusively on building defenses. A basic tenet of red team/blue team deployments is that finding vulnerabilities requires a different set of tools and a different way of thinking, but it's still essential in improving defenses.
- **Forensic Investigators & Incident Responders** – Large organizations need specialized professionals who can move beyond first-level incident response. Whether you're maintaining a trail of evidence or hunting for threats, you need the skills to analyze attacks and develop appropriate remediation and recovery plans.
- **Security Managers** – As their staffs of talented technologists grow, organizations require effective leaders to manage them. These managers won't necessarily perform hands-on work, but they must understand enough about underlying technologies and frameworks to help set security strategy, develop appropriate policies, interact with their skilled practitioners, and measure outcomes.

Within (or beyond) these four areas, a high-performing security organization will develop its professional staff even further, with some individuals covering more areas while others go deeper into just one specialty. Along the entire spectrum from active defense to cloud defense, and from Python for InfoSec professionals to malware reengineering, SANS offers more than 30 courses to train for specialized roles or learn about more advanced topics, meeting the needs of security professionals at every level.

Training Roadmap

SANS' comprehensive course offerings enable professionals to deepen their technical skills in key practice areas. The courses also address other topics and audiences, such as security training for software developers, industrial control engineers, and non-technical personnel in management, legal, and audit.

Baseline Skills

New to Cyber Security — Concepts, Terms, & Skills

Cyber Security Fundamentals	SEC301 **Introduction to Cyber Security** | GISF

You are experienced in technology, but need to learn hands-on, essential security skills and techniques

Core Techniques — Prevent, Defend, Maintain

Every Security Professional Should Know

Security Essentials	SEC401 **Security Essentials Bootcamp Style** | GSEC
Hacker Techniques	SEC504 **Hacker Tools, Techniques, Exploits, and Incident Handling** | GCIH

All professionals entrusted with hands-on cybersecurity work should be trained to possess a common set of capabilities enabling them to secure systems, practice defense-in-depth, understand how attacks work, and manage incidents when they occur. To be secure, you should set a high bar for the baseline set of skills in your security organization.

Security Management — Managing Technical Security Operations

Every Security Manager Should Know

Leadership Essentials	MGT512 **Security Leadership Essentials for Managers** | GSLC
Critical Controls	SEC566 **Implementing and Auditing the Critical Security Controls – In-Depth** | GCCC

With an increasing number of talented technologists, organizations require effective leaders to manage their teams and processes. Those managers will not necessarily perform hands-on work, but they must know enough about the underlying technologies and frameworks to help set strategy, develop appropriate policies, interact with skilled practitioners, and measure outcomes.

Focus Job Roles

You are experienced in security, preparing for a specialized job role or focus

Monitoring & Detection — Intrusion Detection, Monitoring Over Time

Scan Packets & Networks

Intrusion Detection	SEC503 **Intrusion Detection In-Depth** | GCIA
Monitoring & Operations	SEC511 **Continuous Monitoring and Security Operations** | GMON

The detection of what is happening in your environment requires an increasingly sophisticated set of skills and capabilities. Identifying security anomalies requires increased depth of understanding to deploy detection and monitoring tools and to interpret their output.

Penetration Testing — Vulnerability Analysis, Ethical Hacking

Every Pen Tester Should Know

Networks	SEC560 **Network Penetration Testing and Ethical Hacking** | GPEN
Web Apps	SEC542 **Web App Penetration Testing and Ethical Hacking** | GWAPT

The professional who can find weakness is often a different breed than one focused exclusively on building defenses. A basic tenet of red team/blue team deployments is that finding vulnerabilities requires a different way of thinking, and different tools, but it's essential for defense specialists to improve their defenses.

Incident Response & Threat Hunting — Host & Network Forensics

Every Forensics and IR Professional Should Know

Endpoint Forensics	FOR500 **Windows Forensic Analysis** | GCFE FOR508 **Advanced Incident Response, Threat Hunting, and Digital Forensics** | GCFA
Network Forensics	FOR572 **Advanced Network Forensics: Threat Hunting, Analysis, and Incident Response** | GNFA

Whether you're seeking to maintain a trail of evidence on host or network systems, or hunting for threats using similar techniques, large organizations need specialized professionals who can move beyond first-response incident handling in order to analyze an attack and develop an appropriate remediation and recovery plan.

CISSP® Training	MGT414 **SANS Training Program for CISSP® Certification** | GISP

Crucial Skills, Specialized Roles

You are a candidate for advanced or specialized training

Cyber Defense Operations — Harden Specific Defenses

Specialized Defensive Area

Blue Team	SEC450 **Blue Team Fundamentals: Security Operations and Analysis**
OSINT	SEC487 **Open-Source Intelligence (OSINT) Gathering and Analysis**
Advanced Generalist	SEC501 **Advanced Security Essentials – Enterprise Defender** | GCED
Cloud Security	SEC545 **Cloud Security Architecture and Operations**
Windows/Powershell	SEC505 **Securing Windows and PowerShell Automation** | GCWN
Linux/ Unix Defense	SEC506 **Securing Linux/Unix** | GCUX
SIEM	SEC555 **SIEM with Tactical Analytics** | GCDA

Other Advanced Defense Courses

Security Architecture	SEC530 **Defensible Security Architecture and Engineering** | GDSA
Adversary Emulation	SEC599 **Defeating Advanced Adversaries – Purple Team Tactics and Kill Chain Defenses** | GDAT

Specialized Penetration Testing — Focused Techniques & Areas

In-Depth Coverage

Vulnerability Assessment	SEC460 **Enterprise Threat and Vulnerability Assessment** | GEVA
Networks	SEC660 **Advanced Penetration Testing, Exploit Writing, and Ethical Hacking** | GXPN SEC760 **Advanced Exploit Development for Penetration Testers**
Web Apps	SEC642 **Advanced Web App Testing, Ethical Hacking, and Exploitation Techniques**
Mobile	SEC575 **Mobile Device Security and Ethical Hacking** | GMOB
Wireless	SEC617 **Wireless Penetration Testing and Ethical Hacking** | GAWN
Python Coding	SEC573 **Automating Information Security with Python** | GPYC

Digital Forensics, Malware Analysis, & Threat Intel — Specialized Investigative Skills

Malware Analysis

Malware Analysis	FOR610 **Reverse-Engineering Malware: Malware Analysis Tools and Techniques** | GREM

Threat Intelligence

Cyber Threat Intelligence	FOR578 **Cyber Threat Intelligence** | GCTI

Digital Forensics & Media Exploitation

Battlefield Forensics & Data Acquisition	FOR498 **Battlefield Forensics & Data Acquisition**
Smartphones	FOR585 **Smartphone Forensic Analysis In-Depth** | GASF
Memory Forensics	FOR526 **Advanced Memory Forensics & Threat Detection**
Mac Forensics	FOR518 **Mac and iOS Forensic Analysis and Incident Response**

Advanced Management — Advanced Leadership, Audit, Legal

Management Skills

Planning, Policy, Leadership	MGT514 **Security Strategic Planning, Policy, and Leadership** | GSTRT
Managing Vulnerabilities	MGT516 **Managing Security Vulnerabilities: Enterprise and Cloud**
Project Management	MGT525 **IT Project Management, Effective Communication, and PMP® Exam Prep** | GCPM

Audit & Legal

Audit & Monitor	AUD507 **Auditing & Monitoring Networks, Perimeters, and Systems** | GSNA
Law & Investigations	LEG523 **Law of Data Security and Investigations** | GLEG

Industrial Controls

Every ICS Security Professionals Should Know

Essentials	ICS410 **ICS/SCADA Security Essentials** | GICSP
ICS Defense & Response	ICS515 **ICS Active Defense and Incident Response** | GRID
ICS Security In-Depth	ICS612 **ICS Cyber Security In-Depth**

NERC Protection

NERC Security Essentials	ICS456 **Essentials for NERC Critical Infrastructure Protection** | GCIP

DevSecOps

Every Developer Should Know

Secure Web Apps	DEV522 **Defending Web Applications Security Essentials** | GWEB
Secure DevOps	SEC540 **Cloud Security and DevOps Automation** | GCSA

COURSE LISTING KEY:

Topic: Essentials — Course Code: ICS410 **ICS/SCADA Security Essentials** | GICSP — GIAC Certification

Course Title

To learn more about additional SANS courses, go to: **sans.org/courses**

65+ hands-on courses

See in-depth course descriptions and the digital version of this roadmap at: **sans.org/roadmap**

SANS **The most trusted source for cybersecurity training, certifications, degrees, and research**

SANS Training Formats

You can take SANS courses when, where, and how you want—regardless of your training path. Whether you opt for a live event or one of our many online options, your SANS training experience will always exceed expectations.

Live Classroom Instruction

Training Events

Our live events feature SANS instructors teaching multiple courses at a single location. You'll get:

- Focused, immersive learning without distractions
- Direct access to SANS Certified Instructors
- Opportunities to network with and learn from other cybersecurity professionals
- The chance to attend SANS@Night events, NetWars, vendor presentations, industry receptions, and many other activities

Our live events in North America serve thousands of students annually in Orlando, Washington DC, Las Vegas, New Orleans, and San Diego. Smaller, regional events are scheduled in most major metropolitan areas throughout the year.

Summits

SANS Summits take place over one or two days, and focus on a single topic of particular interest to the community. We curate our presentations and speakers to ensure that participants get the most relevant and applicable information.

Before or after each Summit we offer SANS courses that are closely aligned with the topic, so you can enhance your Summit experience with in-depth training while you're there.

Community SANS Courses

Our Community events offer SANS courses, courseware, and labs taught by up-and-coming instructors in more local, regional areas.

With smaller classes, you get more direct interaction with your instructor, and the regional location means an easier, less expensive commute.

Private Classes

A SANS Certified Instructor can train your staff privately at your location, incorporating insights, experiences, and questions specific to your business objectives.

Private training allows your team to freely discuss sensitive issues, and spend more time focusing on the topics most relevant to your organization.

"The decision to take five days away from the office is never easy, but so rarely have I come to the end of a course and had no regret whatsoever. This was one of the most useful weeks of my professional life."

— Dan Trueman, **Novae PLC**

Online Training

SANS Online Training features top course authors and instructors teaching our most popular courses, delivered via four flexible online platforms:

- **OnDemand:** Learn anytime, anywhere with our custom OnDemand platform
- **vLive:** Attend virtual evening sessions with SANS instructors
- **Simulcast:** Livestream a daytime SANS course from a live event
- **SelfStudy:** Self-paced learning with books and MP3s

Our online training platforms include either four or six months of access to your course, as well as support from a team of SANS subject-matter experts. Access to all course labs and the ability to revisit content without limits ensures that you can master the content at your own pace.

Because you can rewind, revisit, and reinforce the course material, retention is easier and your learning outcome will be the same as if you attended live SANS training. Try out the OnDemand platform by viewing a course preview at **sans.org/demo**.

"I love the material, I love the SANS Online delivery, and I want the entire industry to take these courses."

— Nick Sewell, **IIT**

SANS **Flagship Programs** and **Free Resources**

GIAC CERTIFICATIONS

GIAC Certifications

SANS courses are the ideal preparation for a GIAC Certification, the highest standard in cybersecurity certification. More than 30 GIAC Certifications allow you to demonstrate your unique expertise in specialized areas of cybersecurity. No other certification program in the world comes close to GIAC in validating real-world knowledge and skill, due largely to the extensive exam preparation process and team of expert contributors.

giac.org

SANS Technology Institute

SANS Technology Institute

Graduate and Undergraduate Programs in Cybersecurity

The SANS Technology Institute offers a leadership-focused master's degree program and job-specific graduate certificate programs for working InfoSec professionals and an undergraduate certificate program for college students and mid-career professionals seeking to launch a career in cybersecurity. Corporate tuition reimbursement or VA education benefits often apply.

sans.edu

CyberTalent

SANS CyberTalent

SANS CyberTalent provides innovative workforce development and talent management solutions for the cybersecurity industry. Our web-based assessment tools and Immersion Academies help organizations build, retain, and motivate a high-performance cybersecurity team as well as grow the cybersecurity workforce.

sans.org/cybertalent

SANS SECURITY AWARENESS

SANS Security Awareness

SANS Security Awareness offers a robust suite of computer-based security awareness training modules, support materials, and online phishing training that is engaging and effective. You can host our training on any learning management system, in many languages, to create a secure culture within your organization.

sans.org/awareness

Join the SANS.org Community

to Gain Access to the Following Free Resources and Much More | sans.org/join

Newsletters
Three SANS e-newsletters, available for free

SANS Posters
Tools, tips, and techniques to hang in your office

Blogs
Read what SANS instructors are thinking about in practice-area-specific blogs

SANS Webcasts
Live, topical presentations from SANS experts, instructors, and trusted vendors

SANS Reading Room
Constantly updated library of industry white papers

Tip of the Day
Learn a new tip each day from the SANS Security Awareness team

Internet Storm Center
The Internet's early warning system

20 Critical Controls
Find supporting courses and case studies related to the Critical Security Controls

Security Policy Templates
Build your own security policy using one of the templates provided

Securing **Approval** and **Budget** for Training

Download detailed training justification letters from the course description pages at sans.org

As a cybersecurity professional, you already know that SANS is the most trusted resource for the training you need. But getting buy-in from your manager or the C-Suite can be a challenge—especially if they don't yet understand the benefits that SANS training can bring. By following some simple guidelines, you can show them what they need to know, and get them to support your training.

Packaging matters

Submit a formal request

- Most successful training requests are made via written document—a short memo or a few slides—justifying the need for training. Training request templates are available for popular SANS courses. They can be found in the "Justify Your Training" section of the course page. Most managers will respect and value the effort you put in to provide written justification.
- A formal request is a chance for you to provide all the necessary information in one place. If you include additional SANS resources, you can give your manager context and present your request as a complete package. Some helpful additions include the "Why SANS?" web page, the Training Roadmap, an instructor bio, and a course description.

Clearly state the benefits

Be specific

- How does the course relate to your job? Will it help you establish baseline skills? Transition to a more focused role? Decision-makers need to understand the plan.
- Highlight specific tasks you'll be able to do as a result of the training. Each SANS course description includes a section titled "You Will Be Able To;" include this section in your request to make the benefits clear. Match the training to your job tasks and goals.

Set the context

Establish long-term expectations

- Cybersecurity is a specialized career path within IT. Its practices evolve as attacks change. Because of this, organizations should expect to spend 6%-10% of team salaries to keep skills current. Training for such a dynamic field is an annual, per-person expense—not a once-and-done item.
- Sign up for the related GIAC certification, in order to validate that you learned the skills taught in the class. Your employer can be confident you learned what they paid for, since GIAC exams are psychometrically designed to confirm competency in job-related tasks.
- Consider offering trade-offs for the investment. Many professionals build annual training expenses into their employment agreements when they're hired; some offer to stay for a year after they complete the training.

SANS

Voucher Program

The SANS Voucher Program is a cybersecurity workforce training management system that allows you to easily procure and manage your organization's training needs.

As a SANS Voucher Program participant, you will be able to:

- Provide your cybersecurity team with the highest standard of skill training and certification available
- Give employees a simple way to select and procure the training they need, when they need it
- Easily approve and manage student enrollment
- Monitor employee training progress and exam scores to ensure satisfactory completion
- Track investments, debits, and account balance for optimal budgeting

Voucher Funds purchased can be applied to any live and online SANS training courses, SANS Summit events, GIAC Certifications, or certification renewals.* Voucher Funds must be used within 12 months, but the term can be extended with additional investments.

Get Started

Visit www.sans.org/vouchers and submit the contact request form to have a SANS representative in your region call or email you within 24 business hours. In as little as one week, your eligible team members can begin their training.

*Current exceptions from the SANS Voucher Program are the Partnership program, Security Awareness training, and SANS workshops hosted at events run by other organizations.

sans.org/vouchers

GIAC
The Highest Standard in Cybersecurity Certification

Job-Specific, Specialized Focus

Today's cyber attacks are highly sophisticated and exploit specific vulnerabilities. Broad and general InfoSec certifications are no longer enough. Professionals need the specific skills and specialized knowledge required to meet multiple and varied threats. That's why GIAC has more than 30 certifications, each focused on specific job skills and each requiring unmatched and distinct knowledge.

Deep, Real-World Knowledge

Theoretical knowledge is the ultimate security risk. Deep, real-world knowledge and hands-on skills are the only reliable means to reduce security risk. Nothing comes close to a GIAC certification to ensure that this level of real-world knowledge and skill has been mastered.

Most Trusted Certification Design

The design of a certification exam impacts the quality and integrity of a certification. GIAC exam content and question design are developed through a rigorous process led by GIAC's on-staff psychometrician and reviewed by experts in each area. More than 78,000 certifications have been issued since 1999. GIAC certifications meet ANSI standards.

"Earning 3 GIAC certifications after I graduated from college has enabled me to enter the InfoSec field. Not only did they set me apart from my peers, GIAC certs also made my résumé more appealing to recruiters."

— Kim Ngoc, GuardSight, Inc.

GIAC

DEEPER KNOWLEDGE. ADVANCED SECURITY.

GIAC.ORG

"Attackers are always evolving, and having a GIAC cert prepares you to evolve with them. It allows you to implement the appropriate methods and best practices in your company while understanding it's a continuous fight."

– Jason Sevilla, Cyber Intelligence Analyst

Want to launch a career in cybersecurity?

Earn an Undergraduate Certificate in Applied Cybersecurity

Gain fundamental technical knowledge and skills, choose an elective course to begin developing a specialized skillset, and earn GIAC certifications that employers are looking for.

Rapid Career Preparation

Complete the program in 18 months or choose an accelerated option to finish in less than a year.

Flexibility

Pursue the certificate alongside a degree program or while working full-time. Take courses online or at immersive weeklong events throughout the country.

"I was having a hard time getting a job in information security due to my lack of hands-on experience. SANS gave me extraordinary training and the opportunity to rise to the top of the résumé pile."

– AJ Langlois
Cyber Analyst II, BB&T

SANS Technology Institute

A Curriculum Designed to Launch Careers in Cybersecurity

CyberStart Essentials
SEC 401 | GSEC Certification
SEC 504 | GCIH Certification
Elective Course | GIAC Certification

New to the field? No problem.

Prior cybersecurity experience isn't needed, but you must have completed at least 2 years of college.

Learn more at **sans.edu/acs**

SEC401: **Security Essentials Bootcamp Style**

GSEC
Security Essentials
giac.org/gsec

6 Day Program	46 CPEs	Laptop Required

You Will Be Able To

- Apply what you learned directly to your job when you go back to work
- Design and build a network architecture using VLANs, NAC, and 802.1x based on advanced persistent threat indicators of compromise
- Run Windows command line tools to analyze the system looking for high-risk items
- Run Linux command line tools (ps, ls, netstat, etc.) and basic scripting to automate the running of programs to perform continuous monitoring of various tools
- Install VMWare and create virtual machines to create a virtual lab to test and evaluate the tools/security of systems
- Create an effective policy that can be enforced within an organization and design a checklist to validate security and create metrics to tie into training and awareness
- Identify visible weaknesses of a system using various tools and, once vulnerabilities are discovered, cover ways to configure the system to be more secure
- Build a network visibility map that can be used for hardening of a network – validating the attack surface and covering ways to reduce that surface by hardening and patching
- Sniff open protocols like telnet and ftp and determine the content, passwords, and vulnerabilities using WireShark

"SEC401 is a great intro and overview of network security. It covered just enough information to get a baseline level of knowledge without going too in-depth on any one topic."

— Josh Winter, **Washington County, MN**

Learn the most effective steps to prevent attacks and detect adversaries with actionable techniques that you can directly apply when you get back to work. Learn tips and tricks from the experts so that you can win the battle against the wide range of cyber adversaries that want to harm your environment.

Is SEC401: Security Essentials Bootcamp Style the right course for you?

STOP and ask yourself the following questions:

- Do you fully understand why some organizations get compromised and others do not?
- If there were compromised systems on your network, are you confident that you would be able to find them?
- Do you know the effectiveness of each security device and are you certain that they are all configured correctly?
- Are proper security metrics set up and communicated to your executives to drive security decisions?

If you do not know the answers to these questions, then SEC401 will provide the information security training you need in a bootcamp-style format that is reinforced with hands-on labs.

Learn to build a security roadmap that can scale today and into the future.

SEC401: Security Essentials Bootcamp Style is focused on teaching you the essential information security skills and techniques you need to protect and secure your organization's critical information assets and business systems. Our course will show you how to prevent your organization's security problems from being headline news in the *Wall Street Journal*!

PREVENTION IS IDEAL BUT DETECTION IS A MUST

With the rise in advanced persistent threats, it is almost inevitable that organizations will be targeted. Whether the attacker is successful in penetrating an organization's network depends on the effectiveness of the organization's defense. Defending against attacks is an ongoing challenge, with new threats emerging all of the time, including the next generation of threats. Organizations need to understand what really works in cybersecurity. What has worked, and will always work, is taking a risk-based approach to cyber defense. Before your organization spends a dollar of its IT budget or allocates any resources or time to anything in the name of cybersecurity, three questions must be answered:

- What is the risk?
- Is it the highest priority risk?
- What is the most cost-effective way to reduce the risk?

Security is all about making sure you focus on the right areas of defense. In SEC401 you will learn the language and underlying theory of computer and information security. You will gain the essential and effective security knowledge you will need if you are given the responsibility for securing systems and/or organizations. This course meets both of the key promises SANS makes to our students: (1) You will learn up-to-the-minute skills you can put into practice immediately upon returning to work; and (2) You will be taught by the best security instructors in the industry.

***SEC401** is available via (subject to change):*

Live Training sans.org/events

Austin Winter	Austin, TX	Jan 6-11
Miami	Miami, FL	Jan 13-18
Anaheim	Anaheim, CA	Jan 20-25
Las Vegas	Las Vegas, NV	Jan 27 - Feb 1
San Francisco East Bay	Emeryville, CA	Jan 27 - Feb 1
Security East	**New Orleans, LA**	**Feb 3-8**
N. VA – Fairfax	Fairfax, VA	Feb 10-15
New York City Winter	New York City, NY	Feb 10-15
Scottsdale	Scottsdale, AZ	Feb 17-22
San Diego	San Diego, CA	Feb 17-22
Jacksonville	Jacksonville, FL	Feb 24-29
N. VA – Reston Spring	Reston, VA	Mar 2-7
St. Louis	St. Louis, MO	Mar 8-13
Dallas	Dallas, TX	Mar 9-14
Norfolk	Norfolk, VA	Mar 16-21
San Francisco Spring	San Francisco, CA	Mar 22-27
Seattle Spring	Seattle, WA	Mar 23-28
Philadelphia	Philadelphia, PA	Mar 30 - Apr 4
SANS 2020	**Orlando, FL**	**Apr 5-10**
Bethesda	Bethesda, MD	Apr 14-19
Minneapolis	Minneapolis, MN	Apr 14-19
Boston Spring	Boston, MA	Apr 20-25
Pen Test Austin	Austin, TX	Apr 27 - May 2
Baltimore Spring	Baltimore, MD	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
N. VA – Alexandria	Alexandria, VA	May 17-22
San Antonio	San Antonio, TX	May 17-22
Atlanta Spring	Atlanta, GA	May 26-31
Nashville Spring	Nashville, TN	May 26-31
Chicago Spring	Chicago, IL	Jun 1-6
New Orleans	New Orleans, LA	Jun 8-13
Las Vegas Spring	Las Vegas, NV	Jun 8-13
SANSFIRE	**Washington, DC**	**Jun 15-20**
Pittsburgh	Pittsburgh, PA	Jun 22-27

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Network Security Essentials

A key way that attackers gain access to a company's resources is through a network connected to the Internet. A company wants to try to prevent as many attacks as possible, but in cases where it cannot prevent an attack, it must detect it in a timely manner. Therefore, an understanding of and ability to create and identify the goals of building a defensible network architecture are critical. It is just as important to know and understand the architecture of the system, types of designs, communication flow and how to protect against attacks using devices such as routers and firewalls. These essentials, and more, will be covered in this first section in order to provide a firm foundation for the consecutive sections of training.

Topics: Defensible Network Architecture; Virtualization and Cloud Security; Network Device Security; Networking and Protocols; Securing Wireless Networks; Securing Web Communications

SECTION 2: Defense-In-Depth and Attacks

To secure an enterprise network, you must understand the general principles of network security. In Section 2, we look at threats to our systems and take a "big picture" look at how to defend against them. You will learn that protections need to be layered – a principle called defense-in-depth. We explain some principles that will serve you well in protecting your systems. You will also learn about key areas of network security.

Topics: Defense-in-Depth; Access Control and Password Management; Security Policies; Critical Controls; Malicious Code and Exploit Mitigations; Advanced Persistent Threat (APT)

SECTION 3: Threat Management

Whether targeting a specific system or just searching the Internet for an easy target, an attacker uses an arsenal of tools to automate finding new systems, mapping out networks, and probing for specific, exploitable vulnerabilities. This phase of an attack is called reconnaissance, and it can be launched by an attacker any amount of time before exploiting vulnerabilities and gaining access to systems and networks. In fact, evidence of reconnaissance activity can be a clue that a targeted attack is on the horizon.

Topics: Vulnerability Scanning and Penetration Testing; Network Security Devices; Endpoint Security; SIEM/Log Management; Active Defense

SECTION 4: Cryptography, Risk Management, and Response

There is no silver bullet when it comes to security. However, there is one technology that would help solve a lot of security issues, though few companies deploy it correctly. This technology is cryptography. Concealing the meaning of a message can prevent unauthorized parties from reading sensitive information. This course section looks at various aspects of encryption and how it can be used to secure a company's assets. A related area called steganography, or information hiding, is also covered.

Topics: Cryptography; Cryptography Algorithms and Deployment; Applying Cryptography; Incident Handling and Response; Contingency Planning – BCP/DRP; IT Risk Management

Who Should Attend

- Security professionals who want to fill the gaps in their understanding of technical information security
- Managers who want to understand information security beyond simple terminology and concepts
- Operations personnel who do not have security as their primary job function but need an understanding of security to be effective
- IT engineers and supervisors who need to know how to build a defensible network against attacks
- Administrators responsible for building and maintaining systems that are being targeted by attackers
- Forensic specialists, penetration testers, and auditors who need a solid foundation of security principles to be as effective as possible at their jobs
- Anyone new to information security with some background in information systems and networking

SECTION 5: Windows Security

Remember when Windows was simple? Windows XP desktops in a little workgroup...what could be easier? A lot has changed over time. Now, we have Windows tablets, Azure, Active Directory, PowerShell, Office 365, Hyper-V, Virtual Desktop Infrastructure (VDI), and so on. Microsoft is battling Google, Apple, Amazon.com, and other cloud giants for supremacy. The trick is to do it securely, of course. Windows is the most widely-used and targeted operating system on the planet. At the same time, the complexities of Active Directory, PKI, BitLocker, AppLocker, and User Account Control represent both challenges and opportunities. This section will help you quickly master the world of Windows security while showing you the tools that can simplify and automate your work. You will complete the section with a solid grounding in Windows security by looking at automation, auditing and forensics.

Topics: Windows Security Infrastructure; Service Packs, Hot Fixes, and Backups; Windows Access Controls; Enforcing Security Policy; Securing Windows Network Services; Automation, Auditing, and Forensics

SECTION 6: Linux Security

While organizations do not have as many Unix/Linux systems, those that they do have are often some of the most critical systems that need to be protected. This final course section provides step-by-step guidance to improve the security of any Linux system. The course combines practical "how to" instructions with background information for Linux beginners, as well as security advice and best practices for administrators of all levels of expertise. This module discusses the foundational items that are needed to understand how to configure and secure a Linux system. It also provides an overview of the operating system and mobile markets. To lay a foundation, it provides an overview of the different operating systems that are based on Linux.

Topics: Linux Security: Structure, Permissions and Access; Hardening and Securing Linux Services; Monitoring and Attack Detection; Security Utilities

Community Events

New York, NY . . . . . Jan 27 - Feb 1
Dallas, TX . . . . . Feb 3-8
Columbus, OH . . . . . Feb 10-15
Chicago, IL . . . . . Mar 2-7
Houston, TX . . . . . Mar 16-21

Mentor Events

Pensacola, FL . . . . . Jan 11 - Feb 8
Philadelphia, PA . . . . . Feb 4 - Mar 5

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

vLive

Online Training . . . . . Feb 10 - Mar 18

Simulcast

Online Training . . . . . Jan 13-18
Online Training . . . . . Feb 3-8
Online Training . . . . . Mar 9-14
Online Training . . . . . Apr 5-10
Online Training . . . . . May 26-31
Online Training . . . . . Jun 15-20

SEC504: **Hacker Tools, Techniques, Exploits, and Incident Handling**

GCIH
Incident Handler
giac.org/gcih

6 Day Program	37 CPEs	Laptop Required

You Will Be Able To

- Apply incident handling processes in-depth, including preparation, identification, containment, eradication, and recovery, to protect enterprise environments
- Analyze the structure of common attack techniques in order to evaluate an attacker's spread through a system and network, anticipating and thwarting further attacker activity
- Utilize tools and evidence to determine the kind of malware used in an attack, including rootkits, backdoors, and trojan horses, choosing appropriate defenses and response tactics for each
- Use built-in command-line tools such as Windows tasklist, wmic, and reg as well as Linux netstat, ps, and lsof to detect an attacker's presence on a machine
- Analyze router and system ARP tables along with switch CAM tables to track an attacker's activity through a network and identify a suspect
- Use memory dumps and the Volatility tool to determine an attacker's activities on a machine, the malware installed, and other machines the attacker used as pivot points across the network
- Gain access to a target machine using Metasploit, and then detect the artifacts and impacts of exploitation through process, file, memory, and log analysis
- Analyze a system to see how attackers use the Netcat tool to move files, create backdoors, and build relays through a target environment
- Run the Nmap port scanner and Nessus vulnerability scanner to find openings on target systems, and apply tools such as tcpdump and netstat to detect and analyze the impacts of the scanning activity

The Internet is full of powerful hacking tools and bad guys using them extensively. If your organization has an Internet connection and one or two disgruntled employees (and whose does not!), your computer systems will get attacked. From the five, ten, or even one hundred daily probes against your Internet infrastructure to the malicious insider slowly creeping through your most vital information assets, attackers are targeting your systems with increasing viciousness and stealth. As defenders, it is essential we understand these hacking tools and techniques.

This course enables you to turn the tables on computer attackers by helping you understand their tactics and strategies in detail, giving you hands-on experience in finding vulnerabilities and discovering intrusions, and equipping you with a comprehensive incident handling plan. It addresses the latest cutting-edge insidious attack vectors, the "oldie-but-goodie" attacks that are still prevalent, and everything in between. Instead of merely teaching a few hack attack tricks, this course provides a time-tested, step-by-step process for responding to computer incidents, and a detailed description of how attackers undermine systems so you can prepare for, detect, and respond to them. In addition, the course explores the legal issues associated with responding to computer attacks, including employee monitoring, working with law enforcement, and handling evidence. Finally, students will participate in a hands-on workshop that focuses on scanning, exploiting, and defending systems. This course will enable you to discover the holes in your system before the bad guys do!

The course is particularly well-suited to individuals who lead or are a part of an incident handling team. General security practitioners, system administrators, and security architects will benefit by understanding how to design, build, and operate their systems to prevent, detect, and respond to attacks.

"I will almost always recommend SEC504 as a baseline so that everyone is speaking the same language. I want my sys-admins to take it, my network admins to take it, even my devs to take it, regardless of whether they're going to eventually move into an incident handling role. In my opinion it is the most critical, foundational class that SANS offers."

— Kevin Wilcox, **Information Security Specialist**

***SEC504** is available via (subject to change):*

Live Training sans.org/events

Austin Winter	Austin, TX	Jan 6-11	St. Louis	St. Louis, MO	Mar 8-13	**Security West**	**San Diego, CA**	**May 8-13**
Miami	Miami, FL	Jan 13-18	Dallas	Dallas, TX	Mar 9-14	N. VA – Alexandria	Alexandria, VA	May 17-22
Anaheim	Anaheim, CA	Jan 20-25	Norfolk	Norfolk, VA	Mar 16-21	San Antonio	San Antonio, TX	May 17-22
Las Vegas	Las Vegas, NV	Jan 27 - Feb 1	San Francisco Spring	San Francisco, CA	Mar 22-27	Atlanta Spring	Atlanta, GA	May 26-31
San Francisco East Bay	Emeryville, CA	Jan 27 - Feb 1	Seattle Spring	Seattle, WA	Mar 23-28	Nashville Spring	Nashville, TN	May 26-31
Security East	**New Orleans, LA**	**Feb 3-8**	Philadelphia	Philadelphia, PA	Mar 30 - Apr 4	Chicago Spring	Chicago, IL	Jun 1-6
N. VA – Fairfax	Fairfax, VA	Feb 10-15	**SANS 2020**	**Orlando, FL**	**Apr 5-10**	New Orleans	New Orleans, LA	Jun 8-13
New York City Winter	New York City, NY	Feb 10-15	Bethesda	Bethesda, MD	Apr 14-19	Las Vegas Spring	Las Vegas, NV	Jun 8-13
Scottsdale	Scottsdale, AZ	Feb 17-22	Minneapolis	Minneapolis, MN	Apr 14-19	**SANSFIRE**	**Washington, DC**	**Jun 15-20**
San Diego	San Diego, CA	Feb 17-22	Boston Spring	Boston, MA	Apr 20-25	Pittsburgh	Pittsburgh, PA	Jun 22-27
Jacksonville	Jacksonville, FL	Feb 24-29	Pen Test Austin	Austin, TX	Apr 27 - May 2			
N. VA – Reston Spring	Reston, VA	Mar 2-7	Baltimore Spring	Baltimore, MD	Apr 27 - May 2			

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Incident Handling Step-by-Step and Computer Crime Investigation

The first part of this section looks at the invaluable Incident Handling Step-by-Step Model, which was created through a consensus process involving experienced incident handlers from corporations, government agencies, and educational institutes, and has been proven effective in hundreds of organizations. This section is designed to provide students a complete introduction to the incident handling process, using the six steps (preparation, identification, containment, eradication, recovery, and lessons learned) necessary to prepare for and deal with a computer incident. The second part of this section examines from-the-trenches case studies to understand what does and does not work in identifying computer attackers. This section provides valuable information on the steps a systems administrator can take to improve the chances of catching and prosecuting attackers.

Topics: Preparation; Identification; Containment; Eradication; Recovery; Special Actions for Responding to Different Types of Incidents; Incident Record-Keeping; Incident Follow-Up

SECTION 2: Computer and Network Hacker Exploits – Part 1

Seemingly innocuous data leaking from your network could provide the clue needed by an attacker to blow your systems wide open. This day-long section covers the details associated with reconnaissance and scanning, the first two phases of many computer attacks.

Topics: Reconnaissance; Scanning; Intrusion Detection System (IDS) Evasion

Who Should Attend

- Incident handlers
- Leaders of incident handling teams
- System administrators who are on the front lines defending their systems and responding to attacks
- Other security personnel who are first responders when systems come under attack

SECTION 3: Computer and Network Hacker Exploits – Part 2

Computer attackers are ripping our networks and systems apart in novel ways while constantly improving their techniques. This course section covers the third phase of many hacker attacks – gaining access. Attackers employ a variety of strategies to take over systems from the network level up to the application level. This section covers the attacks in depth, from the details of buffer overflow and format string attack techniques to the latest in session hijacking of supposedly secure protocols.

Topics: Network-Level Attacks; Gathering and Parsing Packets; Operating System and Application-Level Attacks; Netcat: The Attacker's Best Friend; Endpoint Security Bypass

SECTION 4: Computer and Network Hacker Exploits – Part 3

This course section starts out by covering one of attackers' favorite techniques for compromising systems: worms. We will analyze worm developments over the last two years and project these trends into the future to get a feel for the coming Super Worms we will face. Then the course turns to another vital area often exploited by attackers: web applications. Because most organizations' homegrown web applications do not get the security scrutiny of commercial software, attackers exploit these targets using SQL injection, cross-site scripting, session cloning, and a variety of other mechanisms discussed in detail.

Topics: Password Cracking; Web Application Attacks; Denial of Service Attacks

SECTION 5: Computer and Network Hacker Exploits – Part 4

This course section covers the fourth and fifth phases of many hacker attacks: maintaining access and covering their tracks. Computer attackers install backdoors, apply Rootkits, and sometimes even manipulate the underlying kernel itself to hide their nefarious deeds. Each of these categories of tools requires specialized defenses to protect the underlying system. In this course, we will analyze the most commonly used malicious code specimens, as well as explore future trends in malware, including BIOS-level and combo malware possibilities.

Topics: Maintaining Access; Covering the Tracks; Putting It All Together

SECTION 6: Hacker Tools Workshop

Over the years, the security industry has become smarter and more effective in stopping hackers. Unfortunately, hacker tools are becoming smarter and more complex. One of the most effective methods to stop the enemy is to actually test the environment with the same tools and tactics an attacker might use against you. This workshop lets you put what you have learned over the past week into practice.

Topics: Hands-on Analysis

Summit Events

Cyber Threat Intelligence . . . . . Washington, DC . . . . . Jan 22-27

Community Events

Quantico, VA . . . . . Jan 27 - Feb 1
Omaha, NE . . . . . Feb 17-22
Indianapolis, IN . . . . . Mar 9-14

Mentor Events

Bloomington, MN . . . . . Jan 8 - Feb 19

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

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vLive

Online Training . . . . . Feb 4 - Mar 12

Simulcast

Online Training . . . . . Jan 13-18
Online Training . . . . . Feb 3-8
Online Training . . . . . Mar 9-14
Online Training . . . . . Apr 5-10
Online Training . . . . . May 17-22

SEC503: **Intrusion Detection In-Depth**

GCIA
Intrusion Analyst
giac.org/gcia

6	46	Laptop
Day Program	CPEs	Required

You Will Be Able To

- Configure and run open-source Snort and write Snort signatures
- Configure and run open-source Bro to provide a hybrid traffic analysis framework
- Understand TCP/IP component layers to identify normal and abnormal traffic
- Use open-source traffic analysis tools to identify signs of an intrusion
- Comprehend the need to employ network forensics to investigate traffic to identify and investigate a possible intrusion
- Use Wireshark to carve out suspicious file attachments
- Write tcpdump filters to selectively examine a particular traffic trait
- Craft packets with Scapy
- Use the open-source network flow tool SiLK to find network behavior anomalies
- Use your knowledge of network architecture and hardware to customize placement of IDS sensors and sniff traffic off the wire

"SEC503 completely changed how I look at networking and how I approach problems, and it significantly increased my understanding of intrusion detection."

— Arnold Klein, **Topel Forman Information Services, LLC**

Reports of prominent organizations being hacked and suffering irreparable reputational damage have become all too common. How can you prevent your company from becoming the next victim of a major cyber attack?

Preserving the security of your site in today's threat environment is more challenging than ever before. The security landscape is continually changing from what was once only perimeter protection to protecting exposed and mobile systems that are almost always connected and sometimes vulnerable. Security-savvy employees who can help detect and prevent intrusions are therefore in great demand. Our goal in SEC503: Intrusion Detection In-Depth is to acquaint you with the core knowledge, tools, and techniques to defend your networks with insight and awareness. The training will prepare you to put your new skills and knowledge to work immediately upon returning to a live environment.

Mark Twain said, "It is easier to fool people than to convince them that they've been fooled." Too many IDS/IPS solutions provide a simplistic red/green, good/bad assessment of traffic and too many untrained analysts accept that feedback as the absolute truth. This course emphasizes the theory that a properly trained analyst uses an IDS alert as a starting point for examination of traffic, not as a final assessment. SEC503 imparts the philosophy that the analyst must have access and the ability to examine the alerts to give them meaning and context. You will learn to investigate and reconstruct activity to deem if it is noteworthy or a false indication.

This course delivers the technical knowledge, insight, and hands-on training you need to defend your network with confidence. You will learn about the underlying theory of TCP/IP and the most used application protocols, such as DNS and HTTP, so that you can intelligently examine network traffic for signs of an intrusion. You will get plenty of practice learning to master different open-source tools like tcpdump, Wireshark, Snort, Bro, tshark, and SiLK. Daily hands-on exercises suitable for all experience levels reinforce the course book material so that you can transfer knowledge to execution. Basic exercises include assistive hints while advanced options provide a more challenging experience for students who may already know the material or who have quickly mastered new material.

A Virtual Machine is provided with tools of the trade. It is supplemented with demonstration "pcaps," which are files that contain network traffic. This allows you to follow along on your laptop with the class material and demonstrations. The pcaps also provide a good library of network traffic to use when reviewing the material, especially for certification.

SEC503 is most appropriate for persons who monitor and defend their network, such as security analysts, although others may benefit from the course as well. Students range from seasoned analysts to novices with some TCP/IP background. Please note that the VMware image used in class is a Linux distribution, so we strongly recommend that you spend some time getting familiar with a Linux environment that uses the command line for entry, along with learning some of the core UNIX commands, before coming to class.

***SEC503** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-8**
Jacksonville	Jacksonville, FL	Feb 24-29
Dallas	Dallas, TX	Mar 9-14
Norfolk	Norfolk, VA	Mar 16-21
SANS 2020	**Orlando, FL**	**Apr 5-10**
Baltimore Spring	Baltimore, MD	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
San Antonio	San Antonio, TX	May 17-22
Las Vegas Spring	Las Vegas, NV	Jun 8-13
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Blue Team	Louisville, KY	Mar 4-9

Private Training

All courses are available through Private Training

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Fundamentals of Traffic Analysis – Part 1

Section 1 provides a refresher or introduction, depending on your background, to TCP/IP. It describes the need to understand packet structure and content. It covers the essential foundations such as the TCP/IP communication model, and the theory of bits, bytes, binary and hexadecimal. We introduce the use of open-source Wireshark and tcpdump for analysis. We begin our exploration of the TCP/IP communication model with the study of the link layer, the IP layer, both IPv4 and IPv6 and packet fragmentation in both. We describe the layers and analyze traffic not just in theory and function, but from the perspective of an attacker and defender. All traffic is discussed and displayed using the two open-source tools, Wireshark and tcpdump.

Topics: Concepts of TCP/IP; Introduction to Wireshark; Network Access/Link Layer: Layer 2; IP Layer: Layer 3

SECTION 2: Fundamentals of Traffic Analysis – Part 2

Section 2 continues where the previous section ended in understanding the TCP/IP model. Two essential tools, Wireshark and tcpdump, are further explored, using their advanced features to give you the skills to analyze your own traffic. The focus of these tools in Section 2 is on filtering traffic of interest in Wireshark using display filters and in tcpdump using Berkeley Packet Filters. We proceed with our exploration of the TCP/IP layers covering TCP, UDP, and ICMP. Once again, we describe the layers and analyze traffic not just in theory and function, but from the perspective of an attacker and defender.

Topics: Wireshark Display Filters; Writing BPF Filters; TCP; UDP; ICMP; Real-World Analysis – Command Line Tools

SECTION 3: Application Protocols and Traffic Analysis

Section 3 introduces the versatile packet crafting tool Scapy. It is a very powerful Python-based tool that allows for the manipulation, creation, reading, and writing of packets. Scapy can be used to craft packets to test the detection capability of an IDS/IPS, especially important when a new user-created IDS rule is added, for instance for a recently announced vulnerability. The examination of TCP/IP culminates with an exploration of the application protocol layer. The concentration is on some of the most widely used, and sometimes vulnerable, crucial application protocols: DNS, HTTP(S), SMTP, and Microsoft communications. Our focus is on protocol analysis, a key skill in intrusion detection. IDS/IPS evasions are the bane of the analyst, so the theory and possible implications of evasions at different protocol layers are examined.

Topics: Scapy; Advanced Wireshark; Detection Methods for Application Protocols; DNS; Microsoft Protocols; HTTP(2)/TLS; SMTP; IDS/IPS Evasion Theory; Identifying Traffic of Interest

SECTION 4: Network Monitoring: Snort and Bro

The fundamental knowledge gained from the first three sections provides a fluid progression into one of the most popular sections of SEC503. Snort and Bro are widely deployed open-source IDS/IPS solutions that have been industry standards for many years. The section begins with a discussion on network architecture, including the features of intrusion detection and prevention devices, along with a look at options and requirements of devices that can sniff and capture the traffic for inspection. Next, the topic of the analyst's role in the detection process is examined. Before Snort and Bro are discussed, the capabilities and limitations are considered. Snort detection flow, running Snort, and rules are explored with an emphasis on writing efficient rules. It is likely that false positives and negatives will occur and tips for dealing with them are presented. Bro's unique capability to use its own scripting language to write code to analyze patterns of event-driven behavior is one of the most powerful detection tools available to the analyst. We discuss how this enables monitoring and correlating activity and demonstrate with examples.

Topics: Network Architecture; Introduction to IDS/IPS Analysis; Snort; Zeek

SECTION 5: Network Traffic Forensics

The penultimate section continues the format of less instruction and more hands-on training using three separate incidents that must be analyzed. The three incident scenarios are introduced with some new material to be used in the related hands-on analysis. This material includes an introduction to network forensics analysis for the first scenario. It continues with using network flow records to assist in analysis of the traffic from the second scenario. It concludes by examining the third scenario, including Command and Control channels and managing analysis when very large packet capture files are involved.

Topics: Introduction to Network Forensics Analysis; Using Network Flow Records; Examining Command and Control Traffic; Analysis of Large pcaps

SECTION 6: Advanced IDS Capstone Event

The course culminates with a fun, hands-on, score-server-based IDS challenge. Students compete as solo players or on teams to answer many questions that require using tools and theory covered in the first five sections. The challenge presented is based on hours of live-fire, real-world data in the context of a time-sensitive incident investigation. The challenge is designed as a "ride-along" event, where students are answering questions based on the analysis that a team of professional analysts performed of this same data.

Who Should Attend

- Intrusion detection (all levels), system, and security analysts
- Network engineers/ administrators
- Hands-on security managers

"I got a deeper understanding of the topics from my class. This will help me get more data out of my investigations."

— Alphonse Wichrowski, **Allegiant Air**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Feb 3-8
Online Training. . . . . Mar 9-14
Online Training. . . . . Apr 5-10
Online Training. . . . . Jun 15-20

vLive

Online Training. . . . . Jan 13 – Mar 4

SEC511: **Continuous Monitoring and Security Operations**

GMON
Continuous Monitoring
giac.org/gmon

6 Day Program	46 CPEs	Laptop Required

You Will Be Able To

- Analyze a security architecture for deficiencies
- Apply the principles learned in the course to design a defensible security architecture
- Understand the importance of a detection-dominant security architecture and a Security Operations Center (SOC)
- Identify the key components of Network Security Monitoring (NSM)/Continuous Diagnostics and Mitigation (CDM)/ Continuous Monitoring (CM)
- Determine appropriate security monitoring needs for organizations of all sizes
- Implement robust Network Security Monitoring/Continuous Security Monitoring (NSM/CSM)
- Utilize tools to support implementation of Continuous Monitoring per NIST SP 800-137 guidelines
- Determine requisite monitoring capabilities for a SOC environment
- Determine capabilities required to support continuous monitoring of key Critical Security Controls

"SEC511 was a wonderful look into the world of the 'Blue Team.' The authors really put together a robust course full of great ideas and tactics to take on intrusion detection and continuous monitoring."

— Cameron Johns, **Tyson Foods, Inc.**

We continue to underestimate the tenacity of our adversaries! Organizations are investing a significant amount of time and financial and human resources trying to combat cyber threats and prevent cyber attacks, but despite this tremendous effort organizations are still getting compromised. The traditional perimeter-focused, prevention-dominant approach to security architecture has failed to prevent intrusions. No network is impenetrable, a reality that business executives and security professionals alike have to accept. Prevention is crucial, and we can't lose sight of it as the primary goal. However, a new proactive approach to security is needed to enhance the capabilities of organizations to detect threats that will inevitably slip through their defenses. SEC511 will teach you how to strengthen your skills to undertake that proactive approach.

The underlying challenge for organizations victimized by an attack is timely incident detection. Industry data suggest that most security breaches typically go undiscovered for an average of seven months. Attackers simply have to find one way into most organizations, because they know that the lack of visibility and internal security controls will then allow them to methodically carry out their mission and achieve their goals.

The Defensible Security Architecture, Network Security Monitoring (NSM)/Continuous Diagnostics and Mitigation (CDM)/Continuous Security Monitoring (CSM) taught in this course will best position your organization or Security Operations Center (SOC) to analyze threats and detect anomalies that could indicate cybercriminal behavior. The payoff for this new proactive approach would be early detection of an intrusion, or successfully thwarting the efforts of attackers altogether. The National Institute of Standards and Technology (NIST) developed guidelines described in NIST SP 800-137 for Continuous Monitoring (CM), and section five of this course will greatly increase your understanding and enhance your skills in implementing CM using the NIST framework.

SANS is uniquely qualified to offer this course. Course authors Eric Conrad (GSE #13) and Seth Misenar (GSE #28) hold the distinguished GIAC Security Expert Certification, and both are experienced, real-world, practitioners who apply the concepts and techniques they teach in this course on a daily basis. SEC511 will take you on quite a journey. We start by exploring traditional security architecture to assess its current state and the attacks against it. Next, we discuss and discover modern security design that represents a new proactive approach to such architecture that can be easily understood and defended. We then transition to how to actually build the network and endpoint security, and then carefully navigate our way through automation, NSM/CDM/CSM. For timely detection of potential intrusions, the network and systems must be proactively and continuously monitored for any changes in the security posture that might increase the likelihood that attackers will succeed.

Your SEC511 journey will conclude with one last hill to climb! The final section features a capture-the-flag competition that challenges you to apply the skills and techniques learned in the course to detect and defend the modern security architecture that has been designed. The competition has been designed to be fun, engaging, comprehensive, and challenging. You will not be disappointed!

With your training journey now complete and your skills enhanced and honed, it is time to go back to work and deliver on the SANS promise that you will be able to apply what you learn in this course the day you return to the office.

***SEC511** is available via (subject to change):*

Live Training sans.org/events

Las Vegas	Las Vegas, NV	Jan 27 - Feb 1	Baltimore Spring	Baltimore, MD	Apr 27 - May 2
N. VA – Fairfax	Fairfax, VA	Feb 10-15	**Security West**	**San Diego, CA**	**May 8-13**
N. VA – Reston Spring	Reston, VA	Mar 2-7	Nashville Spring	Nashville, TN	May 26-31
SANS 2020	**Orlando, FL**	**Apr 5-10**	**SANSFIRE**	**Washington, DC**	**Jun 15-20**

Summit Events

Blue Team	Louisville, KY	Mar 4-9

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Current State Assessment, SOCs, and Security Architecture

We begin with the end in mind by defining the key techniques and principles that will allow us to get there. An effective modern Security Operations Center (SOC) or security architecture must enable an organization's ability to rapidly find intrusions to facilitate containment and response. Both significant knowledge and a commitment to continuous monitoring are required to achieve this goal.

Topics: Current State Assessment, SOCs, and Security Architecture; Modern Security Architecture Principles; Frameworks and Enterprise Security Architecture; Security Architecture – Key Techniques/Practices

SECTION 2: Network Security Architecture

Understanding the problems with the current environment and realizing where we need to get to is far from sufficient; we need a detailed roadmap to bridge the gap between the current and desired state. Section 2 introduces and details the components of our infrastructure that become part of a defensible network security architecture and SOC. We are long past the days when a perimeter firewall and ubiquitous antivirus were sufficient security. There are many pieces and moving parts that make up a modern defensible security architecture.

Topics: SOCs/Security Architecture – Key Infrastructure Devices; Segmented Internal Networks; Defensible Network Security Architecture Principles Applied

SECTION 3: Network Security Monitoring

Designing a SOC or security architecture that enhances visibility and detective capabilities represents a paradigm shift for most organizations. However, the design is simply the beginning. The most important element of a modern security architecture is the emphasis on detection. The network security architecture presented in sections one and two emphasized baking visibility and detective capabilities into the design. Now we must figure out how to look at the data and continuously monitor the enterprise for evidence of compromise or changes that increase the likelihood of compromise.

Topics: Continuous Monitoring Overview; Network Security Monitoring (NSM); Practical NSM Issues; Cornerstone NSM

SECTION 4: Endpoint Security Architecture

One of the hallmarks of modern attacks is an emphasis on client-side exploitation. The days of breaking into networks via direct frontal assaults on unpatched mail, web, or DNS servers are largely behind us. We must focus on mitigating the risk of compromise of clients. Day four details ways in which endpoint systems can be both more resilient to attack and also enhance detective capabilities.

Topics: Security Architecture – Endpoint Protection; Dangerous Endpoint Applications; Patching

SECTION 5: Automation and Continuous Security Monitoring

Network Security Monitoring (NSM) is the beginning; we need to not only detect active intrusions and unauthorized actions, but also to know when our systems, networks, and applications are at an increased likelihood for compromise. A strong way to achieve this is through Continuous Security Monitoring (CSM) or Continuous Diagnostics and Mitigation (CDM). Rather than waiting for the results of a quarterly scan or an annual penetration test to determine what needs to be addressed, continuous monitoring proactively and repeatedly assesses and reassesses the current security posture for potential weaknesses that need to be addressed.

Topics: CSM Overview; Industry Best Practices; Winning CSM Techniques; Maintaining Situational Awareness; Host, Port and Service Discovery; Vulnerability Scanning; Monitoring Patching; Monitoring Applications; Monitoring Service Logs; Monitoring Change to Devices and Appliances; Leveraging Proxy and Firewall Data; Configuring Centralized Windows Event Log Collection; Monitoring Critical Windows Events; Scripting and Automation

SECTION 6: Capstone: Design, Detect, Defend

The course culminates in a team-based Design, Detect, and Defend-the-Flag competition that is a full day of hands-on work applying the principles taught throughout the week.

Topics: Security Architecture; Assessing Provided Architecture; Continuous Security Monitoring; Using Tools/Scripts Assessing the Initial State; Quickly/Thoroughly Finding All Changes Made

Who Should Attend

- Security architects
- Senior security engineers
- Technical security managers
- Security Operations Center (SOC) analysts, engineers, and managers
- CND analysts
- Individuals working to implement Continuous Diagnostics and Mitigation (CDM), Continuous Security Monitoring (CSM), or Network Security Monitoring (NSM)

"SEC511 is a VERY worthwhile addition to the Cyber Defense curriculum for Blue Teamers."

— Robert Peden, **NextGear Capital**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Jan 27 - Feb 1
Online Training. . . . . Mar 2-7
Online Training. . . . . Jun 15-20

SEC301: **Introduction to Cyber Security**

GISF
Information Security Fundamentals
giac.org/gisf

5 Day Program | 30 CPEs | Laptop Required

You Will Be Able To

- Communicate with confidence regarding information security topics, terms, and concepts
- Understand and apply the Principles of Least Privilege
- Understand and apply the Confidentiality, Integrity, and Availability (CIA) Triad
- Build better passwords that are more secure while also being easier to remember and type
- Grasp basic cryptographic principles, processes, procedures, and applications
- Understand computer network basics
- Have a fundamental grasp of any number of critical technical networking acronyms, including TCP/IP, IP, TCP, UDP, MAC, ARP, NAT, ICMP, and DNS
- Utilize built-in Windows tools to see your network settings
- Recognize and be able to discuss various security technologies, including anti-malware, firewalls, intrusion detection systems, content filters, sniffers, etc.
- Build a simple but fully functional firewall configuration
- Secure your browser using a variety of security plug-ins
- Secure a wireless access point (also known as a wireless router)
- Scan for malware, clean malware from a system, and whitelist legitimate software identified by an anti-malware scanner as "potentially unwanted"
- Access a number of websites to better understand password security, encryption, phishing, browser security, etc.

To determine if SANS SEC301: Introduction to Cyber Security is right for you, ask yourself five simple questions:

- Do you have basic computer knowledge, but are new to cybersecurity and in need of an introduction to the fundamentals?
- Are you bombarded with complex technical security terms that you don't understand?
- Are you a non-IT security manager who lays awake at night worrying that your company will be the next mega-breach headline story on the 6 o'clock news?
- Do you need to be conversant in basic security concepts, principles, and terms, even if you don't need "deep in the weeds" detail?
- Have you decided to make a career change to take advantage of the job opportunities in cybersecurity and need formal training and certification?

If you answer yes to any of these questions, then the SEC301: Introduction to Cyber Security training course is for you. Students with a basic knowledge of computers and technology but no prior cybersecurity experience can jump-start their security education with insight and instruction from real-world security experts in SEC301.

This completely revised and comprehensive five-day course covers a wide range of baseline topics, including terminology, the basics of computer networks, security policies, incident response, passwords, and even an introduction to cryptographic principles. The hands-on, step-by-step learning format will enable you to grasp all the information presented even if some of the topics are new to you. You'll learn fundamentals of cybersecurity that will serve as the foundation of your security skills and knowledge for years to come.

Written by a security professional with over 30 years of experience in both the public and private sectors, SEC301 provides uncompromising real-world insight from start to finish. The course prepares you for the Global Information Security Fundamentals (GISF) certification test, as well as for the next SANS course in this progression, SEC401: Security Essentials Bootcamp Style. It also delivers on the SANS promise: You will be able to use the knowledge and skills you learn in SEC301 as soon as you return to work.

"SEC301 provided a great foundation for the topic of security, since I deal with it on a daily basis."

— Richard Pollich, **Broadridge Financial Solutions Inc.**

***SEC301** is available via (subject to change):*

Live Training sans.org/events

Austin Winter	Austin, TX	Jan 6-10
Security East	**New Orleans, LA**	**Feb 3-7**
New York City Winter	New York City, NY	Feb 10-14
San Diego	San Diego, CA	Feb 17-21
N. VA – Reston Spring	Reston, VA	Mar 2-6
San Francisco Spring	San Francisco, CA	Mar 16-20
SANS 2020	**Orlando, FL**	**Apr 5-9**
Security West	**San Diego, CA**	**May 8-12**
San Antonio	San Antonio, TX	May 17-21
SANSFIRE	**Washington, DC**	**Jun 15-19**

Summit Events

Open-Source Intelligence	Washington, DC	Feb 19-24

Community Events

Austin, TX		Mar 2-6

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Security's Foundation

Every good security practitioner and every good security program begins with the same mantra: learn the fundamentals. SEC301 starts by instilling familiarity with core security terms and principles. By the time you leave the classroom after the first section, you will fully understand the Principle of Least Privilege and Confidentiality, Integrity, Availability (CIA), and you'll see why those principles drive all security discussions. You will be conversant in the fundamentals of risk management, security policy, and authentication/authorization/accountability.

SECTION 2: Computer Functions and Networking

This course section begins with an explanation of how computers handle numbers using decimal, binary, and hexadecimal numbering systems. It also provides an understanding of how computers encode letters using the American Standard Code for Information Interchange (ASCII). We then spend the remainder of the section on networking. All attacks or exploits have one thing in common: they take something that exists for perfectly valid reasons and misuse it in malicious ways. Always! So as security practitioners, to grasp what is invalid we must first understand what is valid – that is, how things like networks are supposed to work. Only once we have that understanding can we hope to understand the mechanics of malicious misuse of those networks – and only with that knowledge can we understand how security devices such as firewalls seek to thwart those attacks. The networking discussion begins with a non-technical explanation of how data move across a network. From there we move to fundamental terminology dealing with network types and standards. You'll learn about common network hardware such as switches and routers, and terms like "protocol" and "encapsulation." We'll give a very basic introduction to network addressing and port numbers and then work our way up the Open Systems Interconnection (OSI) protocol stack, introducing more detail only as we proceed to the next layer. In other words, we explain networking starting in non-technical terms and gradually progress to more technical detail as students are ready to take the next step. By the end of our discussions, you'll have a fundamental grasp of any number of critical technical networking acronyms that you've often heard but never quite understood, including TCP/IP, IP, TCP, UDP, MAC, ARP, NAT, ICMP, and DNS.

SECTION 3: An Introduction to Cryptography

Cryptography is one of the most complex issues faced by security practitioners. It is not a topic you can explain in passing, so we will spend some time on it. Not to worry, we won't take you through the math behind cryptography. Instead, we learn basic crypto terminology and processes. What is steganography? What is substitution and transposition? What is a "work factor" in cryptography and why does it matter? What do we mean by symmetric and asymmetric key cryptography and "cryptographic hash," and why do you need to know? How are those concepts used together in the real world to create cryptographic systems?

SECTION 4: Cybersecurity Technologies – Part 1

Our fourth section in the classroom begins our exploration of cybersecurity technologies. We begin with wireless network security (WiFi and Bluetooth), and mobile device security (i.e., cell phones). We follow that with a brief look at some common attacks. We then move into a discussion of malware and anti-malware technologies. We end the section with an examination of several data protection protocols used for email encryption, secure remote access, secure web access, secure file transfer, and Virtual Private Network (VPN) technologies.

SECTION 5: Cybersecurity Technologies – Part 2

The final section of our SEC301 journey continues the discussion of cybersecurity technologies. The section begins by looking at several security technologies, including compartmentalization, firewalls, Intrusion Detection Systems and Intrusion Prevention Systems (IDS/IPS), sniffers, content filters, etc. We then take a good look at browser and web security, and the difficulties of securing the web environment. For example, students will understand why and how their browser connects to anywhere from 5 to 100 different Internet locations each time they load a single web page. We end the section with a look at system security to include hardening operating systems, patching, virtual machines, cloud computing, and backup.

Who Should Attend

- Anyone new to cybersecurity and in need of an introduction to the fundamentals of security
- Those who feel bombarded with complex technical security terms they don't understand, but want to understand
- Non-IT security managers who deal with technical issues and understand them and who worry their company will be the next mega-breach headline story on the 6 o'clock news
- Professionals with basic computer and technical knowledge in all disciplines who need to be conversant in basic security concepts, principles, and terms, but who don't need "deep in the weeds" detail
- Those who have decided to make a career change to take advantage of the job opportunities in cybersecurity and need formal training and certification

"SEC301 is a great class for the individual who wants to learn an extensive amount of material in one week."

— **Steven Chovanec,**
Discover Financial Services

Mentor Events

Daytona Beach, FL . . . . . Jun 20 - Aug 8

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training . . . . . Feb 3-7
Online Training . . . . . Mar 16-20
Online Training . . . . . May 17-21
Online Training . . . . . Jun 15-19

SEC450: **Blue Team Fundamentals: Security Operations and Analysis** NEW

6 Day Program	36 CPEs	Laptop Required

Who Should Attend

- Security analysts
- Incident investigators
- Security engineers and architects
- Technical security managers
- Security Operations Center (SOC) managers looking to gain additional technical perspective on how to improve analysis quality, reduce turnover, and run an efficient SOC
- Anyone looking to start their career on the blue team

Course Author Statement

"As someone who has held every position from entry-level analyst to SOC manager at a 100,000-employee company, I thoroughly understand the struggle of starting your first position in cyber defense. While there is a seemingly infinite amount of information to learn, there are certain central concepts that, when explained systematically, can greatly shorten the time required to become a productive member of the team. This course was written to pass this knowledge on to you, giving you both the high- and low-level concepts required to propel your career in cyber defense. It's packed with the concepts that I expected new employees to understand, as well the thought process we tried to cultivate throughout analysts' careers to ensure the success of the individual and the organization."
— John Hubbard

Is your organization looking for a quick and effective way to onboard new security analysts, engineers, and architects? Do your Security Operations Center (SOC) managers need additional technical perspective on how to improve analysis quality, reduce turnover, and run an efficient SOC?

SEC450 is an accelerated on-ramp for new cyber defense team members and SOC managers. This course introduces students to the tools common to a defender's work environment, and packs in all the essential explanations of tools, processes, and data flow that every blue team member needs to know.

Students will learn the stages of security operations: how data is collected, where it is collected, and how threats are identified within that data. The class dives deep into tactics for triage and investigation of events that are identified as malicious, as well as how to avoid common mistakes and perform continual high-quality analysis. Students will learn the inner workings of the most popular protocols, and how to identify weaponized files as well as attacks within the hosts and data on their network.

The course employs practical, hands-on instruction using a simulated SOC environment with a real, fully-integrated toolset that includes:

- Security Information and Event Management (SIEM)
- An incident tracking and management system
- A threat intelligence platform
- Packet capture and analysis
- Automation tools

While cyber defense can be a challenging and engaging career, many SOCs are negatively affected by turnover. To preemptively tackle this problem, this course also presents research-backed information on preventing burnout and how to keep engagement high through continuous growth, automation, and false positive reduction. Students will finish the course with a full-scope view of how collection and detection work, how SOC tools are used and fit together, and how to keep their SOC up and running over the long term.

"Visualizing logs and understanding how they go to SIEM was super helpful, especially for someone about to become a SIEM admin. Malware Analysis portion was fantastic for analysts at every level."

— Troy Dinkel, **Aires**

***SEC450** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-8**
SANS 2020	**Orlando, FL**	**Apr 5-10**
Chicago Spring	Chicago, IL	Jun 1-6
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Open-Source Intelligence	Washington, DC	Feb 19-24
Blue Team	Louisville, KY	Mar 4-9

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand
Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	Feb 3-8
Online Training	Apr 5-10
Online Training	Jun 15-20

Section Descriptions

SECTION 1: Blue Team Tools and Operations

This section starts with an introduction to the blue team, the mission of a SOC, and how to understand an organization's threat model and risk appetite. It is focused on top-down learning to explain the mindset of an analyst, the workflow, and monitoring tools used in the battle against attackers. Throughout this course section students will learn how SOC information management tools fit together, including incident management systems, threat intelligence platforms, SIEMs, and SOAR tools. We end the section describing the various groups of attackers, how their methods differ, and their motivations.

Topics: Introduction to the Blue Team Mission; SOC Overview; Defensible Network Concepts; Events, Alerts, Anomalies, and Incidents; Incident Management Systems; Threat Intelligence Platforms; SIEM; Automation and Orchestration; Who Are Your Enemies?

SECTION 2: Understanding Your Network

Section 2 begins the technical journey of understanding the environment. To defend a network, you must thoroughly understand its architecture and the impact that it will have on analysis. This section introduces the concepts of a modern organization's network traffic flow by dissecting a basic home Internet connection and describing the features necessary for segmentation and monitoring. These modules ensure that students have a firm grasp on how network design affects their "view of the world" as an analyst. We then go in-depth on common network services. Section 2 provides thorough working explanations of the current and upcoming features of DNS, HTTP(S), SMTP, and more, with a focus on the most important points for analysts to understand. These sections explain what normal data look like, as well as the common fields and areas that are used to spot anomalous behavior. The focus will be on quickly recognizing the common tricks used by attackers to turn these everyday services against us.

Topics: Corporate Network Architecture; Traffic Capture and Visibility; Understanding DNS; DNS Analysis and Attacks; Understanding HTTP and HTTPS; Analyzing HTTP for Suspicious Activity; How SMTP and Email Attacks Work; Additional Important Protocols

SECTION 3: Understanding Endpoints, Logs, and Files

It is extremely difficult to succeed at cyber defense without knowing where and how your data is produced, so section 3 takes us down to the host, logging, and file level. Starting with a survey of common endpoint-based attack tactics, we orient students to the array of techniques that are used against their hosts. These first sections, followed by a section on defense in-depth, will give students an idea of how each step of the attack lifecycle aligns with its defensive tools, and what students can use to prevent and detect adversary attack advancement on their endpoints. To further prepare students for attack detection, these sections are followed by a thorough review of how Linux and Windows logging works. Reviewing logging capabilities gives students perspective on which logs will be present on any given system, where to find them, and how to interpret them. We cover several high-importance log events and provide an in-depth explanation of how to interpret Windows Kerberos logs. The course section then turns to the parsing and enrichment of logs, as well as how the SIEM normalization and categorization processes work. These topics give a complete view of what happens from the moment a log is generated to when it shows up in our security tools. Many new analysts struggle to understand how files are structured at a low level and therefore are hesitant when it comes to answering questions such as "could a file of type x be used for evil?" The final part of section 3 provides students with the concepts needed to reason through the answer, diving into files at the byte level. We explain the difference between binary and text-based files, and what makes a file a valid document, pdf, .exe, or something else. We also explain file-based exploitation methods and the features and formats most commonly seen in attacks. Concepts such as using strings, hashes, and file signatures are explained to show students how to quickly and accurately identify potentially malicious file samples. Students will finish this section understanding how different common file formats work, how they are typically weaponized, and how to quickly decide whether or not a given sample is likely to be malicious.

Topics: Endpoint Attack Tactics; Endpoint Defense In-Depth; How Windows Logging Works; How Linux Logging Works; Interpreting Important Events; Kerberos and Active Directory Events; Log Collection, Parsing, and Normalization; Files Contents and Identification; Identifying and Handling Suspicious Files

SECTION 4: Triage and Analysis

Now that the course has covered the ground required to understand the tools and data most frequently encountered by analysts, it's time to focus on analysis itself. This section will focus on how the analysis process works and explain how to avoid the common mistakes new analysts can slip into. We can combat the tendency to overlook the obvious by examining how our memory perception affects analysis and how cognitive biases cause us to fail to see what is right in front of us. The goal is to teach students not only how to think clearly, but also how to explain and leave a trail of how they reached their conclusions that can support future analysis and act as an audit trail. In addition, we will cover many of the mental models and concepts used in information security from both the offensive and defensive perspectives. Students will then use these models to look at an alert queue and get a quick and intuitive understanding of which alerts may pose the biggest threat, and thus must be attended to first. Safe analysis techniques and operational security concerns are covered to ensure that we do not give up our tactical advantage during the investigation process. We'll discuss specifics on alert triage methods and prioritization, as well as investigation techniques, so that students will leave this section better prepared to understand their alert queues and perform error-free investigation.

Topics: Alert Triage and Prioritization; Perception and Investigation; Memory and Investigation; Mental Models for Information Security; Structured Analysis Techniques; Analysis Tactics and OPSEC; Network, File, and Event Alerts; Intrusion Discovery; Incident Closing and Quality Review

SECTION 5: Continuous Improvement, Analytics, and Automation

Repetitive tasks, lack of empowerment or challenges, poorly designed manual processes – analysts know these pains all too well. While these are just some of the common experiences in day-to-day work, they are major contributing factors to unhappiness and burnout that can cause turnover in a SOC. Do things have to be this way? Of course not, but it will take some understanding and work on your part to do things differently. This section focuses squarely on improving the efficiency and enthusiasm of working in SOCs by tackling the most common problems head on. Through process optimization, careful analytic design and tuning, and workflow efficiency improvements, we can eliminate many of these common pain points. This frees us from the repetitive work we loathe and allows us to focus on what we do best – analysis! Having the time for challenging and novel work leads to a virtuous cycle of growth and engagement throughout the SOC – and improving everyone's life in the process. This section will focus on tuning your tools using clever analysis techniques and process automation to remove the monotonous and non-value-added activities from your day. We also cover containment activities, including the tools you can use and how to decide how to halt a developing incident or infection from the host or network angle. We'll wrap up the day with recommendations on skill growth, long-term career development, and how to get more involved in the cyber defense community.

Topics: Improving Life in the SOC; Analytic Features and Enrichment; New Analytic Design, Testing, and Sharing; Tuning and False Positive Reduction; Automation and Orchestration; Improving Operational Efficiency and Workflow; Containing Identified Intrusions; Skill and Career Development

SECTION 6: Capstone: Defend the Flag

The course culminates in a team-based Design, Detect, and Defend-the-Flag competition. Powered by NetWars, section six provides a full day of hands-on work applying the principles taught throughout the week. Your team will be challenged to progress through multiple levels and missions designed to ensure mastery of the concepts and data covered during the course.

SEC487: **Open-Source Intelligence (OSINT) Gathering and Analysis**

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Create an OSINT process
- Conduct OSINT investigations in support of a wide range of customers
- Understand the data collection life cycle
- Create a secure platform for data collection
- Analyze customer collection requirements
- Capture and record data
- Create sock puppet accounts
- Create your own OSINT process
- Harvest web data
- Perform searches for people
- Access social media data
- Assess a remote location using online cameras and maps
- Examine geolocated social media
- Research businesses
- Use government-provided data
- Collect data from the dark web
- Leverage international sites and tools

Immeasurable amounts of personal and potentially incriminating data are currently stored in the websites, apps, and social media platforms that people access and update daily via their devices. Those data can become evidence for citizens, governments, and businesses to use in solving real financial, employment, and criminal issues with the help of a professional information gatherer.

Many people think using their favorite Internet search engine is sufficient to find the data they need and do not realize that most of the Internet is not indexed by search engines. SEC487 teaches students legitimate and effective ways to find, gather, and analyze these data from the Internet. You'll learn about reliable places to harvest data using manual and automated methods and tools. Once you have the information, we'll show you how to ensure that it is sound, how to analyze what you've gathered, and how to make sure it is useful to your investigations.

This is a foundational course in open-source intelligence (OSINT) gathering and, as such, will move quickly through many areas of the field. You will learn current, real-world skills, techniques, and tools that law enforcement, private investigators, cyber attackers, and defenders use to scour the massive amount of information across the Internet, analyze the results, and pivot on interesting pieces of data to find other areas for investigation. Our goal is to provide the OSINT knowledge base for students to be successful in their fields whether they are cyber defenders, threat intelligence analysts, private investigators, insurance claims investigators, intelligence analysts, law enforcement personnel, or just someone curious about OSINT.

Throughout the course week, students will participate in numerous hands-on labs using the tools and techniques that are the basis for gathering free data from the Internet. More than 20 labs in this course use the live Internet and dark web to help students gain real-world confidence. You'll leave the course knowing not just how to use search features on a website, but all of the scenario-based requirements and OSINT techniques needed to gather truly important OSINT data.

Course Author Statement

"I recognized that the barrier to performing excellent OSINT was not that there was no free data on the Internet. It was that there was too much data on the Internet. The challenge transitioned from 'how do I find something' to 'how do I find only what I need?' This course was born from this need to help others learn the tools and techniques to effectively gather and analyze OSINT data from the Internet."
— Micah Hoffman

"Fantastic introduction to a wide spectrum of OSINT techniques and practices, with great interactive labs and lots of deep dives!"

— Dave Huffman, **Rockwell Automation**

***SEC487** is available via (subject to change):*

Live Training sans.org/events

Las Vegas	Las Vegas, NV	Jan 27 - Feb 1	Pen Test Austin	Austin, TX	Apr 27 - May 2
Jacksonville	Jacksonville, FL	Feb 24-29	**Security West**	**San Diego, CA**	**May 8-13**
St. Louis	St. Louis, MO	Mar 8-13	Atlanta Spring	Atlanta, GA	May 26-31
SANS 2020	**Orlando, FL**	**Apr 5-10**	Las Vegas Spring	Las Vegas, NV	Jun 8-13
Bethesda	Bethesda, MD	Apr 14-19	**SANSFIRE**	**Washington, DC**	**Jun 15-20**

Summit Events

Cyber Threat Intelligence	Washington, DC	Jan 22-27
Open-Source Intelligence	Washington, DC	Feb 19-24
Blue Team	Louisville, KY	Mar 4-9

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Foundations of OSINT

We begin with the basics and answer the questions "what is OSINT" and "how do people use it." This first section is about level-setting and ensuring that all students understand the background behind what we do in the OSINT field. We also establish the foundation for the rest of the week by learning how to document findings and set up an OSINT platform, and we discuss effective research habits for OSINT analysts. This section is a key component for the success of an OSINT analyst because without these concepts and processes in place, researchers can get themselves into serious trouble during assessments by inadvertently alerting their targets or improperly collecting data, making them less useful when delivered to the customer.

Topics: Understanding OSINT; Goals of OSINT Collection; Diving into Collecting; Taking Excellent Notes; Determining Your Threat Profile; Setting Up an OSINT Platform; Effective Research Habits; Creating Sock Puppets

SECTION 2: Gathering, Searching, and Analyzing OSINT

OSINT data collection begins on section two after we get a glimpse of some of the fallacies that could influence our conclusions and recommendations. From this point in the class forward, we examine distinct categories of data and think about what it could mean for our investigations. Retrieving data from the Internet could mean using a web browser to view a page or, as we learn in this section, using command line tools, scripts, and helper applications.

Topics: Data Analysis Challenges; Creating Your OSINT Process; Harvesting Web Data; OSINT Frameworks; Basic Data: Street Addresses; Basic Data: Phone Numbers; Basic Data: Email Addresses; User Names; Avatars and Reverse Image Searches; Leveraging Search Engines

SECTION 3: Social Media and Geolocation

Finding data on people, especially basic content such as email addresses, home addresses, and phone numbers, can be made easier using online people search engines. This is how section three kicks off, examining free and paid choices in this data aggregator area and understanding how to use the data we receive from them. Some of these engines provide social media content in their results. This makes a terrific transition for us to move into social media data.

Topics: People Searching; Facebook Analysis; LinkedIn Data; Instagram; Twitter Data; Geolocation; Dating and Adult Websites; Web and Traffic Cameras; File Metadata Analysis

SECTION 4: Imagery, Networks, Government, and Business

Day four focuses on many different but related OSINT issues. We begin by looking at how various mapping sites can assist our assessments with aerial data, distance-measuring, and "street view" imagery. Moving beyond using just one vendor's mapping system, students will work with a variety of free, online mapping resources.

Topics: Remote Location Recon; IP Address and Whois; IP Address Geolocation; Domain Name System (DNS); Wireless Networks; Recon Tool Suites and Frameworks; U.S. Government Data; Researching Companies

SECTION 5: The Dark Web and International Issues

The entire morning of section five focuses on understanding and using three of the most popular dark web networks for OSINT purposes. Students will learn why people use Freenet, I2P, and Tor. Each network is discussed at length so that students don't just know how and why to use it, but also gain an understanding of how those networks work. With the Tor network being such a big player in the dark web, the course spends extra time diving into its resources. The first module in the afternoon examines how blue teamers (cyber defenders) can use monitoring to receive alerts when data of interest appear on the Internet. We then shift our focus to data found on "paste" sites. These websites sometimes contain content such as user names and passwords of compromised user accounts, detailed network information about our target's systems, or just data that our customers need to know.

Topics: The Surface, Deep, and Dark Webs; The Dark Web; Freenet; I2P – Invisible Internet Project; Tor; Monitoring and Alerting; International Issues; Vehicle Searches

SECTION 6: Capstone: Capture (and Present) the Flag

The capstone for the course is a group event that brings together everything that students learned throughout the week. This is not a "canned" Capture the Flag (CTF) event where specific flags are planted and your team must find them. It is a competition where each team will collect specific OSINT data about a certain group of people. The output from this work will be turned in as a "deliverable" to the "client" (the instructor), and then the three teams with the most-complete work will present their research to the class for voting. This multi-hour, hands-on event will reinforce what the students practiced in the Solo CTF the section before and add the complexity of performing OSINT assessments under pressure and in a group.

Who Should Attend

- Cyber incident responders
- Digital Forensics and Incident Response (DFIR) analysts
- Penetration testers
- Social engineers
- Law enforcement personnel
- Intelligence personnel
- Recruiters
- Private investigators
- Insurance investigators
- Human resources personnel
- Researchers

"The application of OSINT is broad. This course provides opportunities to apply it to my day-to-day work."

— Timothy DeBlock, **Premise Health**

Community Events

Kansas City, MO . . . . . Jan 6-11

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Feb 19-24
Online Training. . . . . Apr 14-19
Online Training. . . . . May 26-31

SEC501: **Advanced Security Essentials – Enterprise Defender**

GCED
Enterprise Defender
giac.org/gced

6 Day Program	38 CPEs	Laptop Required

You Will Be Able To

- Identify the threats against network infrastructures and build defensible networks that minimize the impact of attacks
- Access tools that can be used to analyze a network to prevent attacks and detect the adversary
- Decode and analyze packets using various tools to identify anomalies and improve network defenses
- Understand how the adversary compromises networks and how to respond to attacks
- Perform penetration testing against an organization to determine vulnerabilities and points of compromise
- Apply the six-step incident handling process
- Use various tools to identify and remediate malware across your organization
- Create a data classification program and deploy data loss prevention solutions at both a host and network level

Who Should Attend

- Incident response and penetration testers
- Security Operations Center engineers and analysts
- Network security professionals
- Anyone who seeks technical in-depth knowledge about implementing comprehensive security solutions

Effective cybersecurity is more important than ever as attacks become stealthier, have a greater financial impact, and cause broad reputational damage. SEC501: Advanced Security Essentials – Enterprise Defender builds on a solid foundation of core policies and practices to enable security teams to defend their enterprise.

It has been said of security that "prevention is ideal, but detection is a must." However, detection without response has little value. Network security needs to be constantly improved to prevent as many attacks as possible and to swiftly detect and respond appropriately to any breach that does occur. This PREVENT - DETECT - RESPONSE strategy must be in place both externally and internally. As data become more portable and networks continue to be porous, there needs to be an increased focus on data protection. Critical information must be secured regardless of whether it resides on a server, in a robust network architecture, or on a portable device.

Despite an organization's best efforts to prevent network attacks and protect its critical data, some attacks will still be successful. Therefore, organizations need to be able to detect attacks in a timely fashion. This is accomplished by understanding the traffic that is flowing on your networks, looking for indications of an attack, and performing penetration testing and vulnerability analysis against your organization to identify problems and issues before a compromise occurs.

Finally, once an attack is detected we must react quickly and effectively and perform the forensics required. Knowledge gained by understanding how the attacker broke in can be fed back into more effective and robust preventive and detective measures, completing the security lifecycle.

Course Author Statement

"I started off working as a network engineer and architect building enterprise networks. This role organically transitioned into secure design and engineering. My interest at the time in penetration testing and exploitation allowed me to verify that our designs being put into production were truly hardened. This interest eventually drove me into a career in full-blown reverse engineering and 0-day bug discovery/exploit development. After a long history of writing and teaching courses for SANS on advanced penetration testing and exploit writing, I am excited to take that experience and apply it back into defense. We selected a group of rock star authors to build the SEC501 syllabus and content, including Dave Shackleford, Phil Hagen, Matt Bromiley, and Rob Vandenbrink."
— Stephen Sims

"SEC501 is a very valuable course to a Network/Security Administrator. The first chapter of Defensible Network Architecture is worth the price of admission in and of itself."

— Ryan Bast, **Subzero Group, Inc.**

***SEC501** is available via (subject to change):*

Live Training sans.org/events

San Diego	San Diego, CA	Feb 17-22
N. VA – Reston Spring	Reston, VA	Mar 2-7
Security West	**San Diego, CA**	**May 8-13**
San Antonio	San Antonio, TX	May 17-22
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	Jun 15-20

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Defensive Network Architecture

This course section will focus on security in the design and configuration of various enterprise infrastructures. From a security perspective, proper design and configuration protects both the components being configured, as well as the rest of the organization that depends on that gear to defend other components from attacks. In other words, a good house needs a good foundation!

Topics: Security Benchmarks, Standards, and the Role of Audit in Defending Infrastructure; Defense Using Authentication and Authorization, and Defending Those Services; The Use of Logging and Security Information and Event Management (SIEM) in Defending an Organization from Attack; Attacking and Defending Critical Protocols; Several Man-in-the-Middle Attack Methods, and Defenses against Each; Infrastructure Defense Using IPS, Next-Generation Firewalls, and Web Application Firewalls; Defense of Critical Servers and Services; Active Defense; Defense of Private and Public Cloud Architectures

SECTION 2: Penetration Testing

Security is all about understanding, mitigating, and controlling the risk to an organization's critical assets. An organization must understand the changing threat landscape and have the capacity to compare it against its own vulnerabilities that could be exploited to compromise the environment. On section two, students will learn about the variety of tests that can be run against an organization and how to perform effective penetration tests to better understand the security posture for network services, operating systems, and applications. In addition, we'll talk about social engineering and reconnaissance activities to better emulate increasingly prevalent threats to users.

Topics: Introduction to Penetration Testing Concepts; Penetration Testing Scoping and Rules of Engagement; Online Reconnaissance and Offensive Counterintelligence; Social Engineering; Network Mapping and Scanning Techniques; Enterprise Vulnerability Scanning; Network Exploitation Tools and Techniques; Web Application Exploitation Tools and Techniques; Post-Exploitation and Pivoting; OS and Application Exploit Mitigations; Reporting and Debriefing

SECTION 3: Security Operations Foundations

"Prevention is ideal, but detection is a must" is a critical motto for network security professionals. While organizations always want to prevent as many attacks as possible, some adversaries will still sneak into the network. In cases where an attack is not successfully prevented, network security professionals need to analyze network traffic to discover attacks in progress, ideally stopping them before significant damage is done. Packet analysis and intrusion detection are at the core of such timely detection. Organizations need to not only detect attacks but also to react in a way that ensures those attacks can be prevented in the future.

Topics: Network Security Monitoring; IP, TCP, and UDP Refresher; Advanced Packet Analysis; Introduction to Network Forensics with Security Onion; Identifying Malicious Content and Streams; Extracting and Repairing Content from PCAP files; Traffic Visualization Tools; Intrusion Detection and Intrusion Prevention; Handling Encrypted Network Traffic

SECTION 4: Digital Forensics and Incident Response

In this section, you will learn the core concepts of both "Digital Forensics" and "Incident Response." We'll explore some of the hundreds of artifacts that can give forensic investigators specific insight into what occurred during an incident. You will also learn how incident response currently operates, after years of evolving, in order to address the dynamic procedures used by attackers to conduct their operations. We'll look at how to integrate DFIR practices into a continuous security operations program.

Topics: DFIR Core Concepts: Digital Forensics; DFIR Core Concepts: Incident Response; Modern DFIR: A Live and Continuous Process; Widening the Net: Scaling the DFIR Process and Scoping a Compromise

SECTION 5: Malware Analysis

Malicious software is responsible for many incidents in almost every type of organization. Types of malware vary widely, from Ransomware and Rootkits to Crypto Currency Miners and worms. We will define each of the most popular types of malware and walk through multiple examples. The four primary phases of malware analysis will be covered: Fully Automated Analysis, Static Properties Analysis, Interactive Behavior Analysis, and Manual Code Reversing. You will complete various in-depth labs requiring you to fully dissect a live Ransomware specimen from static analysis through code analysis. You will get hands-on experience with tricking the malware through behavioral analysis techniques, as well as decrypting files encrypted by Ransomware by extracting the keys through reverse engineering. All steps are well defined and tested to ensure that the process to achieve these goals is actionable and digestible.

Topics: Introduction to Malware Analysis; The Many Types of Malware; ATM/Cash Machine Malware; Building a Lab Environment for Malware Analysis; Malware Locations and Footprints; Fully Automated Malware; Cuckoo Sandbox; Static Properties Analysis; Interactive Behavior Analysis; Manual Code Reversing; Tools such as IDA, PeStudio, ILSpy, Process Hacker, Process Monitor, NoFuserEx, etc.

SECTION 6: Enterprise Defender Capstone

The concluding section of the course will serve as a real-world challenge for students by requiring them to work in teams, use the skills they have learned throughout the course, think outside the box, and solve a range of problems from simple to complex. A web server scoring system and Capture-the-Flag engine will be provided to score students as they submit flags to score points. More difficult challenges will be worth more points. In this defensive exercise, challenges include packet analysis, routing protocols, scanning, malware analysis, and other challenges related to the course material.

SEC505: **Securing Windows and PowerShell Automation**

GCWN
Windows Security Administrator
giac.org/gcwn

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Configure mitigations against attacks such as pass-the-hash, Kerberos golden tickets, Remote Desktop Protocol (RDP) man-in-the-middle, Security Access Token abuse, and other attacks discussed in SEC504 and other SANS hacking courses
- Execute PowerShell commands on remote systems and begin to write your own PowerShell scripts
- Harden PowerShell itself against abuse, and enable transcription logging for your SIEM
- Use Group Policy and PowerShell to grant administrative privileges in a way that reduces the harm if an attack succeeds (assume breach)
- Block hacker lateral movement and malware Command & Control channels using Windows Defender Firewall, IPsec, DNS sinkholes, admin credential protections, and more
- Prevent exploitation using AppLocker and other Windows OS hardening techniques in a scalable way with PowerShell
- Configure PowerShell remoting to use Just Enough Admin (JEA) policies to create a Windows version of Linux sudo and setuid root
- Install and manage a full Windows Public Key Infrastructure (PKI), including smart cards, certificate auto-enrollment, Online Certificate Status Protocol (OCSP) web responders, and detection of spoofed root Certification Authorities (CAs)
- Harden must-have protocols against exploitation, such as SSL/TLS, RDP, DNS, DNSSEC, PowerShell Remoting, and SMB
- Use PowerShell to access the WMI service for remote command execution, searching event logs, reconnaissance, and more

Hackers know how to use PowerShell for evil. Do you know how to use it for good? In SEC505 you will learn how to use PowerShell to automate Windows security management across an Active Directory enterprise. You won't just learn PowerShell syntax, you'll learn how to leverage PowerShell as a platform for security.

You've run a vulnerability scanner and applied patches – now what? A major theme of this course is defensible architecture: we have to assume that there will be a breach, so we need to build in damage control from the beginning. Whack-a-mole incident response cannot be our only defensive strategy – we'll never win, and we'll never get ahead of the game. By the time your monitoring system tells you a Domain Admin account has been compromised, IT'S TOO LATE. We need to prevent pass-the-hash attacks and Kerberos Golden Ticket attacks as much as possible, not just detect them.

Perhaps you've taken a hacking course at SANS and now you want to learn more Windows and Active Directory attack mitigations: SEC505 is that course.

Learning PowerShell is also useful for another kind of security: job security. Employers are looking for people with these skills. You don't have to know any PowerShell to attend the course, we will learn it together. About half the labs during the week are PowerShell, while the rest use graphical security tools. Many of the PowerShell scripts written by the course author are free in GitHub (go to http://SEC505.com).

If you are an IT manager or CIO, the aim for this course is to have it pay for itself 10 times over within two years, because automation isn't just good for security, it can save money too.

SEC505 is designed for the blue team to block the attacks of the red team.

The focus of this course is on how to automate the NSA Top 10 Mitigations, the CIS Critical Security Controls related to Windows, and the MITRE ATT&CK mitigations for Windows, especially the ones that are the most difficult to implement in large environments.

SEC505 will also prepare you for the GIAC Certified Windows Security Administrator (GCWN) certification exam to prove your Windows security expertise. The GCWN certification counts towards a Master's Degree in Information Security from the SANS Technology Institute (sans.edu) and satisfies the Department of Defense 8140 computing environment requirement. The GCWN is also a foundational certification for soldiers in the U.S. Army's 255-S Information Protection Program. For DoD students, we will see how to apply the NSA/DISA Secure Host Baseline.

This is a fun course and a real eye-opener, even for Windows administrators with years of experience. We don't cover patch management, share permissions, or other such basics – the aim is to go far beyond that. Come have fun learning PowerShell and Windows security at the same time!

***SEC505** is available via (subject to change):*

Live Training sans.org/events

SANS 2020	**Orlando, FL**	**Apr 5-10**
Security West	**San Diego, CA**	**May 8-13**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Learn PowerShell Scripting

This course section covers what you need to know to get started using PowerShell. You don't need to have any prior scripting or programming experience. We have PowerShell labs throughout the week, so today is not the only PowerShell material. We start with the essentials, then go more in depth as the week progresses. Don't worry, you won't be left behind, the PowerShell labs walk you through every step.

Topics: Why Is PowerShell So Important and Dangerous?; Writing Your Own Scripts, Functions, and Modules; PowerShell Remoting; Getting Up and Running Quickly with PowerShell

SECTION 2: Host Hardening and Active Directory Scripting

Running a vulnerability scanner is easy, but remediating vulnerabilities in a large enterprise is hard. Most vulnerabilities are fixed by applying patches, but this course does not talk about patch management, you're doing that already. What about the other vulnerabilities, the ones not fixed by applying patches? These vulnerabilities are, by definition, remediated by configuration changes. That's the hard part. We need a secure architecture designed for SecOps/DevOps.

Topics: Continuous Secure Configuration Enforcement; Remote PowerShell Script Execution with Group Policy; Server Hardening Automation; PowerShell for Active Directory

SECTION 3: Smart Tokens and Public Key Infrastructure (PKI)

Running a Public Key Infrastructure (PKI) is pretty much mandatory for Microsoft security and cloud computing today. The best form of multi-factor authentication (MFA) is a USB smart token integrated into Active Directory. We need digital certificates for SSL/TLS, wireless authentication, VPN gateways, code signing, and much more. This section of the course is basically one long hands-on lab to install and configure a full Windows Server PKI. This includes a root Certification Authority (CA), Group Policy certificate auto-enrollment on endpoints, Online Certificate Status Protocol (OCSP) revocation checking, private key roaming for users, smart card/token certificate deployment, and, of course, lots of PowerShell examples.

Topics: Why Is a PKI Necessary?; How to Install the Windows PKI; How to Manage Your PKI; Deploying Smart Cards

SECTION 4: Protecting Admin Credentials and PowerShell JEA

Why do submarines have pressure doors to seal off compartments? Because they are designed to assume a breach will occur. In a Windows environment, a security breach will occur, so we must design the architecture with an "assume breach" mindset as well. If we assume that some day the computers and credentials of our administrators will be compromised, then how do we build damage control into the network from the beginning? This is not about detection and incident response. The challenge here is how to design for damage control when we delegate administrative privileges. We need to proactively design damage control into the architecture, not wait until after there is a breach (when it's too late).

Topics: Restricting Unnecessary Admin Privileges; Compromise of Administrative Powers; PowerShell Just Enough Admin (JEA); Active Directory Permissions and Delegation

SECTION 5: Thwarting Hackers Inside the Network

You are already applying patches and updating anti-virus signatures. But endpoint protection is much more than that. Because most advanced malware infections start with a compromised endpoint, we want to proactively build defensibility and damage control into our systems using a "zero trust" or "assume breach" model. How? AppLocker is an application whitelisting tool built into Windows to control which executables, scripts, DLLs and installer packages users may run. If hackers or malware attempt to launch an unauthorized process post-exploitation, the aim is to block it and log it. In the lab, we'll use PowerShell and Group Policy to manage AppLocker. Application whitelisting can be hard to manage if used too aggressively, so we'll also talk about how to get started without making the help desk phone ring off the hook.

Topics: Anti-Exploitation; TCP/UDP Port Permissions for Role-Based Access Control; Windows Defender Firewall

SECTION 6: Blue Team PowerShell: WMI, DNS, RDP, and SMB

Hackers love the Windows Management Instrumentation (WMI) service, and so should we. We are the linebackers on the Blue Team and the WMI service was made to benefit us, not hackers. The WMI service is enabled by default and accessible over the network. Through WMI we can do remote command execution (without PowerShell being installed at the target), forcibly log off the user, reboot the machine, stop services, search for processes running as Administrator, kill any process, and much more. The WMI service is nearly all-powerful and it's built for remote administration. PowerShell is tightly integrated into WMI, and we'll look at several PowerShell examples.

Topics: PowerShell and WMI; Hardening DNS; Dangerous Protocols We Can't Live Without

Who Should Attend

- Security Operations personnel
- Blue Team players who were terrified by SEC504
- Windows endpoint and server administrators
- Anyone who wants to learn PowerShell automation
- Anyone implementing the NSA Top 10 Mitigations
- Anyone implementing the CIS Critical Security Controls
- DoD admins applying the NSA/DISA Secure Host Baseline
- Individuals deploying or managing a PKI or smart cards
- Anyone wanting a more rugged Windows architecture

"This class provided real-world examples and sample scripts to make a Windows-centric environment fundamentally more secure."

— Nick Boardman, **HRSD**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Apr 5-10

Online Training. . . . . Jun 15-20

SEC506: **Securing Linux/Unix**

GCUX
Unix Security Administrator
giac.org/gcux

6	36	Laptop
Day Program	CPEs	Required

You Will Be Able To

- Significantly reduce the number of vulnerabilities in the average Linux/Unix system by disabling unnecessary services
- Protect your systems from buffer overflows, denial-of-service, and physical access attacks by leveraging OS configuration settings
- Configure host-based firewalls to block attacks from outside
- Deploy SSH to protect administrative sessions, and leverage SSH functionality to securely automate routine administrative tasks
- Use sudo to control and monitor administrative access
- Create a centralized logging infrastructure with Syslog-NG, and deploy log monitoring tools to scan for significant events
- Use SELinux to effectively isolate compromised applications from harming other system services
- Securely configure common Internet-facing applications such as Apache and BIND
- Investigate compromised Unix/Linux systems with the Sleuthkit, lsof, and other open-source tools
- Understand attacker rootkits and how to detect them with AIDE and rkhunter/chkrootkit

This course provides in-depth coverage of Linux and Unix security issues that includes specific configuration guidance and practical, real-world examples, tips, and tricks. We examine how to mitigate or eliminate general problems that apply to all Unix-like operating systems, including vulnerabilities in the password authentication system, file system, virtual memory system, and applications that commonly run on Linux and Unix.

The course will teach you the skills to use freely available tools to handle security issues, including SSH, AIDE, sudo, lsof, and many others. SANS's practical approach uses hands-on exercises every day to ensure that you will be able to use these tools as soon as you return to work. We will also put these tools to work in a special section that covers simple forensic techniques for investigating compromised systems.

Topics

- Memory Attacks, Buffer Overflows
- File System Attacks, Race Conditions
- Trojan Horse Programs and Rootkits
- Monitoring and Alerting Tools
- Unix Logging and Kernel-Level Auditing
- Building a Centralized Logging Infrastructure
- Network Security Tools
- SSH for Secure Administration
- Server Lockdown for Linux and Unix
- Controlling Root Access with sudo
- SELinux and chroot() for Application Security
- DNSSEC Deployment and Automation
- mod_security and Web Application Firewalls
- Secure Configuration of BIND, Sendmail, and Apache
- Forensic Investigation of Linux Systems

Course Author Statement

"A wise man once said, 'How are you going to learn anything if you know everything already?' And yet there seems to be a quiet arrogance in the Unix community that we have figured out all of our security problems, as if to say, 'Been there, done that.' All I can say is that what keeps me going in the Unix field, and the security industry in particular, is that there is always something new to learn, discover, or invent. In 20 plus years on the job, what I have learned is how much more there is that I can learn. I think this is also true for the students in my courses. I regularly get comments back from students who say things like, 'I have been using Unix for 20 years, and I still learned a lot in this class.' That is really rewarding."
— Hal Pomeranz

"Linux security courses are a rare commodity and a valuable resource to the security professional."

— Trevor Sellers, **IDA Center for Communications Research**

***SEC506** is available via (subject to change):*

Live Training sans.org/events

SANS 2020 . . . . . **Orlando, FL** . . . . . **Apr 5-10**
SANSFIRE . . . . . **Washington, DC** . . . . . **Jun 15-20**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training . . . . . Apr 5-10

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Hardening Linux/Unix Systems – Part 1

This course section tackles some of the most important techniques for protecting your Linux/Unix systems from external attacks, and it also covers what those attacks are so that you know what you're defending against. This is a full-disclosure course with in-class demos of actual exploits and hands-on exercises to experiment with various examples of malicious software, as well as different techniques for protecting Linux/Unix systems.

Topics: Memory Attacks and Overflows; Vulnerability Minimization; Boot-Time Configuration; Encrypted Access; Host-Based Firewalls

SECTION 2: Hardening Linux/Unix Systems – Part 2

Continuing our exploration of Linux/Unix security issues, this course section focuses on local exploits and access control issues. What do attackers do once they gain access to your systems? How can you detect their presence? How do you protect against attackers with physical access to your systems? What can you do to protect against mistakes (or malicious activity) by your own users?

Topics: Rootkits and Malicious Software; File Integrity Assessment; Physical Attacks and Defenses; User Access Controls; Root Access Control with sudo; Warning Banners; Kernel Tuning for Security

SECTION 3: Hardening Linux/Unix Systems – Part 3

Monitoring your systems is critical for maintaining a secure environment. This course section digs into the different logging and monitoring tools available in Linux/Unix, and looks at additional tools for creating a centralized monitoring infrastructure such as Syslog-NG. Along the way, the course introduces a number of useful SSH tips and tricks for automating tasks and tunneling different network protocols in a secure fashion.

Topics: Automating Tasks With SSH; AIDE via SSH; Linux/Unix Logging Overview; SSH Tunneling; Centralized Logging with Syslog-NG

SECTION 4: Application Security – Part 1

This course section examines common application security tools and techniques. The SCP-Only Shell will be presented as an example of using an application under chroot() restriction, and as a more secure alternative to file-sharing protocols like anonymous FTP. The SELinux application whitelisting mechanism will be examined in-depth. Tips for troubleshooting common SELinux problems will be covered and students will learn how to craft new SELinux policies from scratch for new and locally developed applications. Significant hands-on time will be provided for students to practice these concepts.

Topics: chroot() for Application Security; The SCP-Only Shell; SELinux Basics; SELinux and the Reference Policy

SECTION 5: Application Security – Part 2

This course section is a full day of in-depth analysis on how to manage some of the most popular application-level services securely on a Linux/Unix platform. We will tackle the practical issues involved with securing three of the most commonly used Internet servers on Linux and Unix: BIND, Sendmail, and Apache. Beyond basic security configuration information, we will take an in-depth look at topics like DNSSec and Web Application Firewalls with mod_security and the Core Rules.

Topics: BIND; DNSSec; Apache; Web Application Firewalls with mod_security

SECTION 6: Digital Forensics for Linux/Unix

This hands-on course section is designed to be an information-rich introduction to basic forensic principles and techniques for investigating compromised Linux and Unix systems. At a high level, it introduces the critical forensic concepts and tools that every administrator should know and provides a real-world compromise for students to investigate using the tools and strategies discussed in class.

Topics: Tools Throughout; Forensic Preparation and Best Practices; Incident Response and Evidence Acquisition; Media Analysis; Incident Reporting

Who Should Attend

- Security professionals looking to learn the basics of securing Unix operating systems
- Experienced administrators looking for in-depth descriptions of attacks on Unix systems and how they can be prevented
- Administrators needing information on how to secure common Internet applications on the Unix platform
- Auditors, incident responders, and InfoSec analysts who need greater insight into Linux and Unix security tools, procedures, and best practices

"This course gave me a better understanding of Linux internals and specific threat hunting ideas that I will use in my environment."

— Shelby Peterson, **Adobe**

SEC530: Defensible Security Architecture and Engineering

GDSA
Defensible Security Architecture
giac.org/gdsa

6	36	Laptop
Day Program	CPEs	Required

You Will Be Able To

- Analyze a security architecture for deficiencies
- Implement technologies for enhanced prevention, detection, and response capabilities
- Comprehend deficiencies in security solutions and understand how to tune and operate them
- Apply the principles learned in the course to design a defensible security architecture
- Determine appropriate security monitoring needs for organizations of all sizes
- Maximize existing investment in security architecture by reconfiguring existing assets
- Determine capabilities required to support continuous monitoring of key Critical Security Controls
- Configure appropriate logging and monitoring to support a Security Operations Center and continuous monitoring program

"There are no other courses out there that cover practical hands-on security architecture."

— Chris Kuhl, **Premier Health**

SEC530: Defensible Security Architecture and Engineering is designed to help students establish and maintain a holistic and layered approach to security. Effective security requires a balance between detection, prevention, and response capabilities, but such a balance demands that controls be implemented on the network, directly on endpoints, and within cloud environments. The strengths and weaknesses of one solution complement another solution through strategic placement, implementation, and fine-tuning.

The changing threat landscape requires a change in mindset, as well as a repurposing of many devices. Where does this leave our classic perimeter devices such as firewalls? What are the ramifications of the "encrypt everything" mindset for devices such as Network Intrusion Detection Systems?

In this course, students will learn the fundamentals of up-to-date defensible security architecture and how to engineer it. There will be a heavy focus on leveraging current infrastructure (and investment), including switches, routers, and firewalls. Students will learn how to reconfigure these devices to significantly improve their organizations' prevention capabilities in the face of today's dynamic threat landscape. The course will also delve into the latest technologies and their capabilities, strengths, and weaknesses.

While this is not a monitoring course, it will dovetail nicely with continuous security monitoring, ensuring that security architecture not only supports prevention, but also provides the critical logs that can be fed into a Security Information and Event Management (SIEM) system in a Security Operations Center.

Hands-on labs will reinforce key points in the course and provide actionable skills that students will be able to leverage as soon as they return to work.

You Will Learn To

- Layer security solutions ranging from network to endpoint and cloud-based technologies
- Understand the implications of proper placement of technical controls
- Tune, adjust, and implement security techniques, technologies, and capabilities
- Think outside the box on using common security solutions in innovative ways
- Balance detection with prevention while allowing for better response times and capabilities
- Understand where prevention technologies are likely to fail and how to supplement them with specific detection technologies
- Understand how security infrastructure and solutions work at a technical level and how to better implement them

***SEC530** is available via (subject to change):*

Live Training sans.org/events

Austin Winter	Austin, TX	Jan 6-11
Security East	**New Orleans, LA**	**Feb 3-8**
N. VA – Fairfax	Fairfax, VA	Feb 10-15
Scottsdale	Scottsdale, AZ	Feb 17-22
SANS 2020	**Orlando, FL**	**Apr 5-10**
Baltimore Spring	Baltimore, MD	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
Nashville Spring	Nashville, TN	May 26-31
Chicago Spring	Chicago, IL	Jun 1-6
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Blue Team	Louisville, KY	Mar 4-9

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Defensible Security Architecture and Engineering

This first section of the course describes hardening systems and networks at every layer, from layer one (physical) to layer seven (applications and data). To quote Richard Bejtlich's *The Tao of Network Security Monitoring*, defensible networks "encourage, rather than frustrate, digital self-defense."

Topics: Traditional Security Architecture Deficiencies; Defensible Security Architecture; Threat, Vulnerability, and Data Flow Analysis; Layer 1 Best Practices; Layer 2 Best Practices; NetFlow

SECTION 2: Network Security Architecture and Engineering

Section 2 continues hardening the infrastructure and moves on to layer three: routing. Actionable examples are provided for hardening routers, with specific Cisco IOS commands to perform each step. The section then continues with a deep dive on IPv6, which currently accounts for 23% of Internet backbone traffic, according to Google, while simultaneously being used and ignored by most organizations. This section will provide deep background on IPv6, discuss common mistakes (such as applying an IPv4 mindset to IPv6), and provide actionable solutions for securing the protocol. The section wraps up with a discussion of VPN and stateful layer three/four firewalls.

Topics: Layer 3: Router Best Practices; Layer 3 Attacks and Mitigation; Layer 2 and 3 Benchmarks and Auditing Tools; Securing SNMP; Securing NTP; Bogon Filtering, Blackholes, and Darknets; IPv6; Securing IPv6; VPN; Layer 3/4 Stateful Firewalls; Proxy

SECTION 3: Network-Centric Security

Organizations own or have access to many network-based security technologies ranging from next-generation firewalls to web proxies and malware sandboxes. Yet the effectiveness of these technologies is directly affected by their implementation. Too much reliance on built-in capabilities like application control, antivirus, intrusion prevention, data loss prevention, or other automatic evil-finding deep packet inspection engines leads to a highly preventative-focused implementation, with huge gaps in both prevention and detection.

Topics: NGFW; NIDS/NIPS; Network Security Monitoring; Sandboxing; Encryption; Secure Remote Access; Distributed Denial-of-Service (DDOS)

SECTION 4: Data-Centric Security

Organizations cannot protect something they do not know exists. The problem is that critical and sensitive data exist all over. Complicating this even more is that data are often controlled by a full application stack involving multiple services that may be hosted on-premise or in the cloud.

Topics: Application (Reverse) Proxies; Full Stack Security Design; Web Application Firewalls; Database Firewalls/Database Activity Monitoring; File Classification; Data Loss Prevention (DLP); Data Governance; Mobile Device Management (MDM) and Mobile Application Management (MAM); Private Cloud Security; Public Cloud Security; Container Security

SECTION 5: Zero Trust Architecture: Addressing the Adversaries Already in Our Networks

Today, a common security mantra is "trust but verify." But this is a broken concept. Computers are capable of calculating trust on the fly, so rather than thinking in terms of "trust but verify" organizations should be implementing "verify then trust." By doing so, access can be constrained to appropriate levels at the same time that access can become more fluid.

Topics: Zero Trust Architecture; Credential Rotation; Compromised Internal Assets; Securing the Network; Tripwire and Red Herring Defenses; Patching; Deputizing Endpoints as Hardened Security Sensors; Scaling Endpoint Log Collection/Storage/Analysis

SECTION 6: Hands-On Secure-the-Flag Challenge

The course culminates in a team-based Design-and-Secure-the-Flag competition. Powered by NetWars, section six provides a full day of hands-on work applying the principles taught throughout the week. Your team will progress through multiple levels and missions designed to ensure mastery of the modern cyber defense techniques promoted throughout this course. Teams will assess, design, and secure a variety of computer systems and devices, leveraging all seven layers of the OSI model.

Topics: Capstone – Design/Detect/Defend

Who Should Attend

- Security architects
- Network engineers
- Network architects
- Security analysts
- Senior security engineers
- System administrators
- Technical security managers
- CND analysts
- Security monitoring specialists
- Cyber threat investigators

"Every day of SEC530 has provided new insight and information. The labs are great, and I can't wait to put it all together. No matter how experienced a professional you are, SANS always teaches you something new."

— Ron Foupht, **Sirius Computer Solutions**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Feb 3-8

Online Training. . . . . Apr 5-10

Online Training. . . . . May 8-13

SEC545: **Cloud Security Architecture and Operations**

5 Day Program	30 CPEs	Laptop Required

You Will Be Able To

- Revise and build internal policies to ensure cloud security is properly addressed
- Understand all major facets of cloud risk, including threats, vulnerabilities, and impact
- Articulate the key security topics and risks associated with SaaS, PaaS, and IaaS cloud deployment models
- Evaluate Cloud Access Security Brokers to better protect and monitor SaaS deployments
- Build security for all layers of a hybrid cloud environment, starting with hypervisors and working to application layer controls
- Evaluate basic virtualization hypervisor security controls
- Design and implement network security access controls and monitoring capabilities in a public cloud environment
- Design a hybrid cloud network architecture that includes IPSec tunnels
- Integrate cloud identity and access management into security architecture
- Evaluate and implement various cloud encryption types and formats
- Develop multi-tier cloud architectures in a virtual private cloud, using subnets, availability zones, gateways, and NAT
- Integrate security into DevOps teams, effectively creating a DevSecOps team structure
- Build automated deployment workflows using Amazon Web Services and native tools
- Incorporate vulnerability management, scanning, and penetration testing into cloud environments

Who Should Attend

- Security analysts
- Security architects
- Senior security engineers
- Technical security managers
- Security monitoring analysts
- Cloud security architects
- DevOps and DevSecOps engineers
- System administrators
- Cloud administrators

As more organizations move data and infrastructure to the cloud, security is becoming a major priority. Operations and development teams are finding new uses for cloud services, and executives are eager to save money and gain new capabilities and operational efficiency by using these services. But will information security prove to be an Achilles' heel? Many cloud providers do not provide detailed control information about their internal environments, and quite a few common security controls used internally may not translate directly to the public cloud.

SEC545: Cloud Security Architecture and Operations will tackle these issues one by one. We'll start with a brief introduction to cloud security fundamentals, then cover the critical concepts of cloud policy and governance for security professionals. For the rest of section one and all of section two, we'll move into technical security principles and controls for all major cloud types (SaaS, PaaS, and IaaS). We'll learn about the Cloud Security Alliance framework for cloud control areas, then delve into assessing risk for cloud services, looking specifically at technical areas that need to be addressed.

The course then moves into cloud architecture and security design, both for building new architectures and for adapting tried-and-true security tools and processes to the cloud. This will be a comprehensive discussion that encompasses network security (firewalls and network access controls, intrusion detection, and more), as well as all the other layers of the cloud security stack. We'll visit each layer and the components therein, including building secure instances, data security, identity and account security, and much more. We'll devote an entire day to adapting our offense and defense focal areas to the cloud. This will involve looking at vulnerability management and pen testing, as well as covering the latest and greatest cloud security research. On the defense side, we'll delve into incident handling, forensics, event management, and application security.

We wrap up the course by taking a deep dive into SecDevOps and automation, investigating methods of embedding security into orchestration and every facet of the cloud life cycle. We'll explore tools and tactics that work, and even walk through several cutting-edge use cases where security can be automated entirely in both deployment and incident detection-and-response scenarios using APIs and scripting.

"SEC545 helped to better align our policies to include cloud systems, and it gave me more insight into cloud systems and their configurations."

— Craig Lunde, **Discovery Benefits Inc.**

***SEC545** is available via (subject to change):*

Live Training sans.org/events

Austin Winter . . . . . Austin, TX . . . . . Jan 6-10	Dallas . . . . . Dallas, TX . . . . . Mar 9-13	**Security West** . . . . . **San Diego, CA** . . . . . **May 8-12**
Las Vegas . . . . . Las Vegas, NV . . . . . Jan 27-31	San Francisco Spring . . . San Francisco, CA . . . . Mar 16-20	Atlanta Spring . . . . . Atlanta, GA . . . . . May 26-30
Security East . . . . . **New Orleans, LA** . . . . . **Feb 3-7**	**SANS 2020** . . . . . **Orlando, FL** . . . . . **Apr 5-9**	**SANSFIRE** . . . . . **Washington, DC** . . . . . **Jun 15-19**
Scottsdale . . . . . Scottsdale, AZ . . . . . Feb 17-21	Minneapolis . . . . . Minneapolis, MN . . . . . Apr 14-18	
Jacksonville . . . . . Jacksonville, FL . . . . . Feb 24-28	Boston Spring . . . . . Boston, MA . . . . . Apr 20-24	

Summit Events

Blue Team . . . . . Louisville, KY . . . . . Mar 4-8

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Cloud Security Foundations

The first section of the course starts out with an introduction to the cloud, including terminology, taxonomy, and basic technical premises. We also examine what is happening in the cloud today, and cover the spectrum of guidance available from the Cloud Security Alliance, including the Cloud Controls Matrix, the 14 major themes of cloud security, and other research available. Next we spend time on cloud policy and planning, delving into the changes an organization needs to make for security and IT policy to properly embrace the cloud. After all the legwork is done, we'll start talking about some of the main technical considerations for the different cloud models. We'll start by breaking down Software-as-a-Service (SaaS) and some of the main types of security controls available. A specialized type of Security-as-a-Service (SecaaS) known as Cloud Access Security Brokers (CASBs) will also be explained, with examples of what to look for in such a service. We'll wrap up with an introduction to Platform-as-a-Service (PaaS) and Infrastructure-as-a-Service (IaaS) controls, which will set the stage for the rest of the course.

Topics: Introduction to the Cloud and Cloud Security Basics; Cloud Security Alliance Guidance; Cloud Policy and Planning; SaaS Security; Cloud Access Security Brokers; Intro to PaaS and IaaS Security Controls

SECTION 2: Core Security Controls for Cloud Computing

The second section of SEC545 compares traditional in-house controls with those in the cloud today. Some controls are similar and mostly compatible, but not all of them. Since most cloud environments are built on virtualization technology, we walk through a short virtualization security primer, which can help teams building hybrid clouds that integrate with internal virtualized assets, and also help teams properly evaluate the controls cloud providers offer in this area. We'll then break down cloud network security controls and tradeoffs, since this is an area that is very different from what we've traditionally run in-house. For PaaS and IaaS environments, it's critical to secure virtual machines (instances) and the images we deploy them from, so we cover this next. At a high level, we'll also touch on identity and access management for cloud environments to help control and monitor who is accessing the cloud infrastructure, as well as what they're doing there. We also cover data security controls and types, including encryption, tokenization, and more. Specific things to look for in application security are laid out as the final category of overall controls. We then pull it all together to demonstrate how you can properly evaluate a cloud provider's controls and security posture.

Topics: Cloud Security: In-House versus Cloud; A Virtualization Security Primer; Cloud Network Security; Instance and Image Security; Identity and Access Management; Data Security for the Cloud; Application Security for the Cloud; Provider Security: Cloud Risk Assessment

SECTION 3: Cloud Security Architecture and Design

Instead of focusing on individual layers of our cloud stack, we start section three by building the core security components. We'll break down cloud security architecture best practices and principles that most high-performing teams prioritize when building or adding cloud security controls and processes to their environments. We start with infrastructure and core component security – in other words, we need to look at properly locking down all the pieces and parts we covered on section two! This then leads to a focus on major areas of architecture and security design. The first is building various models of access control and compartmentalization. This involves breaking things down into two categories: identity and access management (IAM) and network security. We delve into these in significant depth, as they can form the backbone of a sound cloud security strategy. We then look at architecture and design for data security, touching on encryption technologies, key management, and what the different options are today. We wrap up our third section with another crucial topic: availability. Redundant and available design is as important as ever, but we need to use cloud provider tools and geography to our advantage. At the same time, we need to make sure we evaluate the cloud provider's disaster recovery and continuity, and so this is covered as well.

Topics: Cloud Security Architecture Overview; Cloud Architecture and Security Principles; Infrastructure and Core Component Security; Access Controls and Compartmentalization; Confidentiality and Data Protection; Availability

SECTION 4: Cloud Security – Offense and Defense

There are many threats to our cloud assets, so the fourth section of the course begins with an in-depth breakdown of the types of threats out there. We'll look at numerous examples. The class also shows students how to design a proper threat model focused on the cloud by using several well-known methods such as STRIDE and attack trees and libraries. Scanning and pen testing the cloud used to be challenging due to restrictions put in place by the cloud providers themselves. But today it is easier than ever. There are some important points to consider when planning a vulnerability management strategy in the cloud, and this class touches on how to best scan your cloud assets and which tools are available to get the job done. Pen testing naturally follows this discussion, and we talk about how to work with the cloud providers to coordinate tests, as well as how to perform testing yourself. On the defensive side, we start with network-based and host-based intrusion detection, and how to monitor and automate our processes to better carry out this detection. This is an area that has definitely changed from what we're used to in-house, so security professionals need to know what their best options are and how to get this done. Our final topics on section four include incident response and forensics (also topics that have changed significantly in the cloud). The tools and processes are different, so we need to focus on automation and event-driven defenses more than ever.

Topics: Threats to Cloud Computing; Vulnerability Management in the Cloud; Cloud Pen Testing; Intrusion Detection in the Cloud; Cloud IR and Event Management; Cloud Forensics

SECTION 5: Cloud Security Automation and Orchestration

On our final section, we'll focus explicitly on how to automate security in the cloud, both with and without scripting techniques. We will use tools like the AWS CLI and AWS Lambda to illustrate the premises of automation, then turn our attention toward SecDevOps principles. We begin by explaining what that really means, and how security teams can best integrate into DevOps and cloud development and deployment practices. We'll cover automation and orchestration tools like Ansible and Chef, as well as how we can develop better and more efficient workflows with AWS CloudFormation and other tools. Continuing some of the topics from section four, we will look at event-driven detection and event management, as well as response and defense strategies that work. While we won't automate everything, some actions and scenarios really lend themselves to monitoring tools like CloudWatch, tagging assets for identification in security processes, and initiating automated response and remediation to varying degrees. We wrap up the class with a few more tools and tactics, followed by a sampling of real-world use cases.

Topics: Scripting and Automation in the Cloud; SecDevOps Principles; Creating Secure Cloud Workflows; Building Automated Event Management; Building Automated Defensive Strategies; Tools and Tactics; Real-World Use Cases; Class Wrap-Up

Community Events

Burbank, CA . . . . . Jan 13-17

Seattle, WA . . . . . Feb 3-7

Mentor Events

Salt Lake City, UT . . . . . Jan 8 - Feb 19

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

SEC555: **SIEM with Tactical Analytics**

GCDA
Detection Analyst
giac.org/gcda

6 Day Program	46 CPEs	Laptop Required

You Will Be Able To

- Deploy the SANS SOF-ELK VM in production environments
- Demonstrate ways most SIEMs commonly lag current open-source solutions (e.g., SOF-ELK)
- Get up to speed on SIEM use, architecture, and best practices
- Know what type of data sources to collect logs from
- Deploy a scalable logs solution with multiple ways to retrieve logs
- Operationalize ordinary logs into tactical data
- Develop methods to handle billions of logs from many disparate data sources
- Understand best practice methods for collecting logs
- Dig into log manipulation techniques challenging many SIEM solutions
- Build out graphs and tables that can be used to detect adversary activities and abnormalities
- Combine data into active dashboards that make analyst review more tactical
- Utilize adversary techniques against them by using frequency analysis in large data sets
- Develop baselines of network activity based on users and devices
- Develop baselines of Windows systems with the ability to detect changes from the baseline
- Apply multiple forms of analysis such as long tail analysis to find abnormalities
- Correlate and combine multiple data sources to achieve more complete understanding
- Provide context to standard alerts to help understand and prioritize them

Many organizations have logging capabilities but lack the people and processes to analyze them. In addition, logging systems collect vast amounts of data from a variety of data sources that require an understanding of those sources for proper analysis. This class is designed to provide students with the training, methods, and processes to enhance existing logging solutions. The class will also help you understand the when, what, and why behind the logs. This is a lab-heavy course that utilizes SOF-ELK, a SANS-sponsored free Security Information and Event Management (SIEM) solution, to provide hands-on experience and the mindset for large-scale data analysis.

Today, security operations do not suffer from a "Big Data" problem but rather a "Data Analysis" problem. Let's face it, there are multiple ways to store and process large amounts of data without any real emphasis on gaining insight into the information collected. Added to that is the daunting idea of an infinite list of systems from which one could collect logs. It is easy to get lost in the perils of data saturation. This class moves away from the typical churn-and-burn log systems and moves instead towards achieving actionable intelligence and developing a tactical Security Operations Center (SOC).

This course is designed to demystify the SIEM architecture and process by navigating the student through the steps of tailoring and deploying a SIEM to full SOC integration. The material will cover many bases in the "appropriate" use of a SIEM platform to enrich readily available log data in enterprise environments and extract actionable intelligence. Once the information is collected, the student will be shown how to present the gathered input into usable formats to aid in eventual correlation. Students will then iterate through the log data and events to analyze key components that will allow them to learn how rich this information is, how to correlate the data, how to start investigating based on the aggregate data, and finally, how to go hunting with this newly gained knowledge. They will also learn how to deploy internal post-exploitation tripwires and breach canaries to nimbly detect sophisticated intrusions. Throughout the course, the text and labs will not only show how to manually perform these actions, but also how to automate many of the processes mentioned so students can employ these tasks the day they return to the office.

The underlying theme is to actively apply Continuous Monitoring and analysis techniques by utilizing modern cyber threat attacks. Labs will involve replaying captured attack data to provide real-world results and visualizations.

"This course uses real-world events and hands-on training to allow me to immediately improve my organization's security stance. Day 1 back in the office, I was implementing what I learned."

— Frank Giachino, **Bechtel Corp.**

***SEC555** is available via (subject to change):*

Live Training sans.org/events

Anaheim	Anaheim, CA	Jan 20-25
Security East	**New Orleans, LA**	**Feb 3-8**
Seattle Spring	Seattle, WA	Mar 23-28
Philadelphia	Philadelphia, PA	Mar 30 - Apr 4
SANS 2020	**Orlando, FL**	**Apr 5-10**
Baltimore Spring	Baltimore, MD	Apr 27 - May 2
Nashville Spring	Nashville, TN	May 26-31
Chicago Spring	Chicago, IL	Jun 1-6
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Blue Team	Louisville, KY	Mar 4-9

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: SIEM Architecture

This section will introduce free logging and analysis tools and focus on techniques to make sense of and augment traditional logs. It also covers how to handle the big data problem of handling billions of logs and how advances in free tools are starting to give commercial solutions a run for their money. Day one is designed to get them up to speed on SIEM concepts and to bring all students to a base level to carry them through the rest of the class. It is designed to also cover SIEM best practices. During section one we will be introducing Elasticsearch, Logstash, and Kibana within SOF-ELK and immediately go into labs to get students comfortable with ingesting, manipulating, and reporting on log data.

Topics: State of the SOC/SIEM; Log Monitoring; Logging Architecture; SIEM Platforms; Planning a SIEM; SIEM Architecture; Ingestion Techniques and Nodes; Data Queuing and Resiliency; Storage and Speed; Analytical Reporting

SECTION 2: Service Profiling with SIEM

This section covers how to collect and handle this massive amount of data. Methods for collecting these logs through service logs such as from DNS servers will be covered, as will be passive ways of pulling the same data from the network itself. Techniques will be demonstrated to augment and add valuable context to the data as they are collected. Finally, analytical principles will be covered for finding the needles in the stack of needles. We will cover how, even if we have the problem of searching through billions of logs, we can surface only meaningful items of interest. Active dashboards will be designed to quickly find the logs of interest and to provide analysts with additional context for what to do next.

Topics: Detection Methods and Relevance to Log Analysis; Analyzing Common Application Logs that Generate Tremendous Amounts of Data; Applying Threat Intelligence to Generic Network Logs; Active Dashboards and Visualizations

Who Should Attend

- Security analysts
- Security architects
- Senior security engineers
- Technical security managers
- Security Operations Center analysts, engineers, and managers
- CND analysts
- Security monitoring specialists
- System administrators
- Cyber threat investigators
- Individuals working to implement Continuous Security Monitoring
- Individuals working in a hunt team capacity

SECTION 3: Advanced Endpoint Analytics

The value in endpoint logs provides tremendous visibility in detecting attacks. In particular, with regard to finding post-compromise activity, endpoint logs can quickly become second to none. However, logs even on a single desktop can range in the tens if not hundreds of thousands of events per day. Multiply this by the number of systems in your environment and it is no surprise that organizations get overwhelmed. This section will cover the how and more importantly the why behind collecting system logs. Various collection strategies and tools will be used to gain hands-on experience and to provide simplification with handling and filtering the seemingly infinite amount of data generated by both servers and workstations. Workstation log strategies will be covered in depth due to their value in today's modern attack vectors. After all, modern-day attacks typically start and then spread from workstations.

Topics: Endpoint Logs

SECTION 4: Baselining and User Behavior Monitoring

This section focuses on applying techniques to automatically maintain a list of assets and their configurations as well as methods to distinguish if they are authorized or unauthorized. Key locations to provide high-fidelity data will be covered and techniques to correlate and combine multiple sources of data together will be demonstrated to build a master inventory list. Other forms of knowing thyself will be introduced such as gaining hands-on experience in applying network and system baselining techniques. We will monitor network flows and identify abnormal activity such as C2 beaconing as well as look for unusual user activity. Finally, we will apply large data analysis techniques to sift through massive amounts of endpoint data. This will be used to find things such as unwanted persistence mechanisms, dual-homed devices, and more.

Topics: Identifying Authorized and Unauthorized Assets; Identifying Authorized and Unauthorized Software; Baseline Data

SECTION 5: Tactical SIEM Detection and Post-Mortem Analysis

This section focuses on combining multiple security logs for central analysis. More importantly, we will cover methods for combining multiple sources to provide improved context to analysts. We will also show how providing context with asset data can help prioritize analyst time, saving money and addressing risks that matter. After covering ways to optimize traditional security alerts, we will jump into new methods to utilize logging technology to implement virtual tripwires. While it would be ideal to prevent attackers from gaining access to your network, it is a given that at some point you will be compromised. However, preventing compromise is the beginning, not the end goal. Adversaries will crawl your systems and network to achieve their own ends. Knowing this, we will implement logging-based tripwires—and if a single one is tripped, we can quickly detect it and respond to the adversary.

Topics: Centralizing NIDS and HIDS Alerts; Analyzing Endpoint Security Logs; Augmenting Intrusion Detection Alerts; Analyzing Vulnerability Information; Correlating Malware Sandbox Logs with Other Systems to Identify Victims Across the Enterprise; Monitoring Firewall Activity; SIEM Tripwires; Post-Mortem Analysis

SECTION 6: Capstone: Design, Detect, Defend

The course culminates in a team-based Design, Detect, and Defend-the-Flag competition. Powered by NetWars, section six provides a full day of hands-on work applying the principles taught throughout the week. Your team will progress through multiple levels and missions designed to ensure mastery of the modern cyber defense techniques promoted all week long. From building a logging architecture to augmenting logs, analyzing network logs, analyzing system logs, and developing dashboards to find attacks, this challenging exercise will reinforce key principles in a fun, hands-on, team-based challenge.

Topics: Defend-the-Flag Challenge – Hands-on Experience

Mentor Events

Arlington, VA . . . . . Jan 8 - Feb 26

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training . . . . . Feb 3-8

Online Training . . . . . Apr 5-10

Online Training . . . . . Jun 15-20

SEC599: Defeating Advanced Adversaries – Purple Team Tactics and Kill Chain Defenses

GDAT
Defending Advanced Threats
giac.org/gdat

6 Day Program | 36 CPEs | Laptop Required

You Will Be Able To

- Understand how recent high-profile attacks were delivered and how they could have been stopped
- Implement security controls throughout the different phases of the Cyber Kill Chain and the MITRE ATT&CK framework to prevent, detect, and respond to attacks
- Understand how typical adversaries work and how they can be stopped (or at least detected early)
- Improve how red and blue teams work together by reinforcing the red-blue feedback loop (purple teaming) to both strengthen and harden an organization's security posture.

"SEC599 gives really good background about adversary behavior and the steps needed to detect it."

— Tarot Wake, **Halkyn Consulting Ltd**

You just got hired to help our virtual organization "SYNCTECHLABS" build out a cybersecurity capability. On your first day, your manager tells you: "We looked at some recent cybersecurity trend reports and we feel like we've lost the plot. Advanced persistent threats, ransomware, denial of service...We're not even sure where to start!"

Cyber threats are on the rise: ransomware tactics are affecting small, mid-size, and large enterprises alike, while state-sponsored adversaries are attempting to obtain access to your most precious crown jewels. SEC599: Defeating Advanced Adversaries – Purple Team Tactics & Kill Chain Defenses will arm you with the knowledge and expertise you need to overcome today's threats. Recognizing that a prevent-only strategy is not sufficient, we will introduce security controls aimed at stopping, detecting, and responding to your adversaries.

Course authors Stephen Sims and Erik Van Buggenhout (both certified as GIAC Security Experts) are hands-on practitioners who have built a deep understanding of how cyber attacks work through penetration testing and incident response. While teaching penetration testing courses, they were often asked the question: "How do I prevent or detect this type of attack?" Well, this is it! SEC599 gives students real-world examples of how to prevent attacks. The course features more than 20 labs plus a full-day Defend-the-Flag exercise during which students attempt to defend our virtual organization from different waves of attacks against its environment.

Our six-part journey will start off with an analysis of recent attacks through in-depth case studies. We will explain what types of attacks are occurring and introduce formal descriptions of adversary behavior such as the Cyber Kill Chain and the MITRE ATT&CK framework. In order to understand how attacks work, you will also compromise our virtual organization "SYNCTECHLABS" in section one exercises.

In sections two, three, four and five we will discuss how effective security controls can be implemented to prevent, detect, and respond to cyber attacks. The topics to be addressed include:

- Leveraging MITRE ATT&CK as a "common language" in the organization
- Building your own Cuckoo sandbox solution to analyze payloads
- Developing effective group policies to improve script execution (including PowerShell, Windows Script Host, VBA, HTA, etc.)
- Highlighting key bypass strategies for script controls (Unmanaged Powershell, AMSI bypasses, etc.)
- Stopping 0-day exploits using ExploitGuard and application whitelisting
- Highlighting key bypass strategies in application whitelisting (focus on AppLocker)
- Detecting and preventing malware persistence
- Leveraging the Elastic stack as a central log analysis solution
- Detecting and preventing lateral movement through Sysmon, Windows event monitoring, and group policies
- Blocking and detecting command and control through network traffic analysis
- Leveraging threat intelligence to improve your security posture

SEC599 will finish with a bang. During the Defend-the-Flag challenge in the final course section, you will be pitted against advanced adversaries in an attempt to keep your network secure. Can you protect the environment against the different waves of attacks? The adversaries aren't slowing down, so what are you waiting for?

***SEC599** is available via (subject to change):*

Live Training sans.org/events

Miami	Miami, FL	Jan 13-18
Anaheim	Anaheim, CA	Jan 20-25
Security East	**New Orleans, LA**	**Feb 3-8**
Scottsdale	Scottsdale, AZ	Feb 17-22
San Francisco Spring	San Francisco, CA	Mar 22-27
SANS 2020	**Orlando, FL**	**Apr 5-10**
Boston Spring	Boston, MA	Apr 20-25
Pen Test Austin	Austin, TX	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Open-Source Intelligence	Washington, DC	Feb 19-24

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Introduction and Reconnaissance

Our six-part journey starts with an analysis of recent attacks through in-depth case studies. We will explain what's happening in real situations and introduce the Cyber Kill Chain and MITRE ATT&CK framework as a structured approach to describing adversary tactics and techniques. We will also explain what purple teaming is, typical tools associated with it, and how it can be best organized in your organization. In order to understand how attacks work, students will also compromise our virtual organization "SYNCTECHLABS" during section one exercises.

Topics: Course Outline and Lab Setup; Adversary Emulation and the Purple Team; Reconnaissance

SECTION 2: Payload Delivery and Execution

Section 2 will cover how the attacker attempts to deliver and execute payloads in the organization. We will first cover adversary techniques (e.g., creation of malicious executables and scripts), then focus on how both payload delivery (e.g., phishing mails) and execution (e.g., double-clicking of the attachment) can be hindered. We will also introduce YARA as a common payload description language and SIGMA as a vendor-agnostic use-case description language.

Topics: Common Delivery Mechanisms; Hindering Payload Delivery; Preventing Payload Execution

SECTION 3: Exploitation, Persistence, and Command and Control

Section 3 will first explain how exploitation can be prevented or detected. We will show how security should be an integral part of the software development lifecycle and how this can help prevent the creation of vulnerable software. We will also explain how patch management fits in the overall picture.

Next, we will zoom in on exploit mitigation techniques, both at compile-time (e.g., ControlFlowGuard) and at run-time (ExploitGuard). We will provide an in-depth explanation of what the different exploit mitigation techniques (attempt to) cover and how effective they are. We'll then turn to a discussion of typical persistence strategies and how they can be detected using Autoruns and OSQuery. Finally, we will illustrate how command and control channels are being set up and what controls are available to the defender for detection and prevention.

Topics: Protecting Applications from Exploitation; Avoiding Installation; Foiling Command and Control

SECTION 4: Lateral Movement

Section 4 will focus on how adversaries move laterally throughout an environment. A key focus will be on Active Directory (AD) structures and protocols (local credential stealing, NTLMv2, Kerberosm, etc.). We will discuss common attack strategies, including Windows privilege escalation, UAC bypasses, (Over-) Pass-the-Hash, Kerberoasting, Silver Tickets, and others. We'll also cover how BloodHound can be used to develop attack paths through the AD environment. Finally, we will discuss how lateral movement can be identified in the environment and how cyber deception can be used to catch intruders red-handed!

Topics: Protecting Administrative Access; Key Attack Strategies against AD; How Can We Detect Lateral Movement?

SECTION 5: Action on Objectives, Threat Hunting, and Incident Response

Section five focuses on stopping the adversary during the final stages of the attack:

- How does the adversary obtain "domain dominance" status? This includes the use of Golden Tickets, Skeleton Keys, and directory replication attacks such as DCSync and DCShadow.
- How can data exfiltration be detected and stopped?
- How can threat intelligence aid defenders in the Cyber Kill Chain?
- How can defenders perform effective incident response?

As always, theoretical concepts will be illustrated during the different exercises performed throughout the section.

Topics: Domain Dominance; Data Exfiltration; Leveraging Threat Intelligence; Threat Hunting and Incident Response

SECTION 6: APT Defender Capstone

The course culminates in a team-based Defend-the-Flag competition. Section six is a full chapter of hands-on work applying the principles taught throughout the course. Your team will progress through multiple levels and missions designed to ensure mastery of the modern cyber security controls promoted all week long. This challenging exercise will reinforce key principles in a fun, hands-on, team-based challenge.

Note that OnDemand students will enjoy this exercise on an individual basis. As always, SANS subject-matter experts are available to support every OnDemand student's experience.

Topics: Applying Previously Covered Security Controls In-depth; Reconnaissance; Weaponization; Delivery; Exploitation; Installation; Command and Control; Action on Objectives

Who Should Attend

- Security architects and security engineers
- Red teamers and penetration testers
- Technical security managers
- Security Operations Center analysts, engineers, and managers
- Security Operations Center analysts and engineers
- Individuals looking to better understand how persistent cyber adversaries operate and how the IT environment can be improved to better prevent, detect, and respond to incidents.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Jan 13-18
Online Training. . . . . Feb 19-24
Online Training. . . . . Apr 5-10
Online Training. . . . . Jun 15-20

SEC560: **Network Penetration Testing and Ethical Hacking**

GPEN
Penetration Tester
giac.org/gpen

6 Day Program	37 CPEs	Laptop Required

You Will Be Able To

- Develop tailored scoping and rules of engagement for penetration testing projects to ensure the work is focused, well defined, and conducted in a safe manner
- Conduct detailed reconnaissance using document metadata, search engines, and other publicly available information sources to build a technical and organizational understanding of the target environment
- Utilize a scanning tool such as Nmap to conduct comprehensive network sweeps, port scans, OS fingerprinting, and version scanning to develop a map of target environments
- Choose and properly execute Nmap Scripting Engine scripts to extract detailed information from target systems
- Configure and launch a vulnerability scanner such as Nessus so that it safely discovers vulnerabilities through both authenticated and unauthenticated scans, and customize the output from such tools to represent the business risk to the organization
- Analyze the output of scanning tools to eliminate false positive reduction with tools including Netcat and Scapy
- Utilize the Windows PowerShell and Linux bash command lines during post-exploitation to plunder target systems for vital information that can further overall penetration test progress, establish pivots for deeper compromise, and help determine business risks
- Configure an exploitation tool such as Metasploit to scan, exploit, and then pivot through a target environment

Who Should Attend

- Security personnel whose job involves assessing networks and systems to find and remediate vulnerabilities
- Penetration testers
- Ethical hackers
- Defenders who want to better understand offensive methodologies, tools, and techniques
- Auditors who need to build deeper technical skills
- Red and blue team members
- Forensics specialists who want to better understand offensive tactics

As a cybersecurity professional, you have a unique responsibility to find and understand your organization's vulnerabilities, and to work diligently to mitigate them before the bad guys pounce. Are you ready? SANS SEC560, our flagship course for penetration testing, fully arms you to address this task head-on.

SEC560 IS THE MUST-HAVE COURSE FOR EVERY WELL-ROUNDED SECURITY PROFESSIONAL

With comprehensive coverage of tools, techniques, and methodologies for network penetration testing, SEC560 truly prepares you to conduct high-value penetration testing projects step by step and end to end. Every organization needs skilled information security personnel who can find vulnerabilities and mitigate their effects, and this entire course is specially designed to get you ready for that role. The course starts with proper planning, scoping and recon, then dives deep into scanning, target exploitation, password attacks, and web app manipulation, with over 30 detailed hands-on labs throughout. The course is chock full of practical, real-world tips from some of the world's best penetration testers to help you do your job safely, efficiently, and with great skill.

LEARN THE BEST WAYS TO TEST YOUR OWN SYSTEMS BEFORE THE BAD GUYS ATTACK

You'll learn how to perform detailed reconnaissance, studying a target's infrastructure by mining blogs, search engines, social networking sites, and other Internet and intranet infrastructures. Our hands-on labs will equip you to scan target networks using best-of-breed tools. We won't just cover run-of-the-mill options and configurations, we'll also go over the lesser-known but super-useful capabilities of the best pen test toolsets available today. After scanning, you'll learn dozens of methods for exploiting target systems to gain access and measure real business risk. You'll dive deep into post-exploitation, password attacks, and web apps, pivoting through the target environment to model the attacks of real-world bad guys to emphasize the importance of defense in depth.

EQUIPPING SECURITY ORGANIZATIONS WITH COMPREHENSIVE PENETRATION TESTING AND ETHICAL HACKING KNOW-HOW

SEC560 is designed to get you ready to conduct a full-scale, high-value penetration test and at the end of the course you'll do just that. After building your skills in comprehensive and challenging labs, the course culminates with a final real-world penetration test scenario. You'll conduct an end-to-end pen test, applying knowledge, tools, and principles from throughout the course as you discover and exploit vulnerabilities in a realistic sample target organization, demonstrating the skills you've gained in this course.

"SEC560 provides practical, how-to material that I can use daily in my penetration testing activities – not only technically, but also from a business perspective."

— Steve Nolan, **General Dynamics**

***SEC560** is available via (subject to change):*

Live Training sans.org/events

Austin Winter . . . . . Austin, TX . . . . . Jan 6-11	Norfolk . . . . . Norfolk, VA . . . . . Mar 16-21	**Security West** . . . . . **San Diego, CA** . . . . . **May 8-13**
Security East . . . . . **New Orleans, LA** . . . . . **Feb 3-8**	Seattle Spring . . . . . Seattle, WA . . . . . Mar 23-28	N. VA – Alexandria . . . . . Alexandria, VA . . . . . May 17-22
New York City Winter . . . New York City, NY . . . . . Feb 10-15	**SANS 2020** . . . . . **Orlando, FL** . . . . . **Apr 5-10**	San Antonio . . . . . San Antonio, TX . . . . . May 17-22
Scottsdale . . . . . Scottsdale, AZ . . . . . Feb 17-22	Boston Spring . . . . . Boston, MA . . . . . Apr 20-25	**SANSFIRE** . . . . . **Washington, DC** . . . . . **Jun 15-20**
Jacksonville . . . . . Jacksonville, FL . . . . . Feb 24-29	Baltimore Spring . . . . . Baltimore, MD . . . Apr 27 - May 2	Pittsburgh . . . . . Pittsburgh, PA . . . . . Jun 22-27

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Comprehensive Pen Test Planning, Scoping, and Recon

In this section of the course, you will develop the skills needed to conduct a best-of-breed, high-value penetration test. We will go in-depth on how to build penetration testing infrastructure that includes all the hardware, software, network infrastructure, and tools you will need to conduct great penetration tests, with specific low-cost recommendations for your arsenal. We will then cover formulating a pen test scope and rules of engagement that will set you up for success, including a role-play exercise. We'll also dig deep into the reconnaissance portion of a penetration test, covering the latest tools and techniques, including hands-on document metadata analysis to pull sensitive information about a target environment, as well as a lab using Recon-ng to plunder a target's DNS infrastructure for information such as the anti-virus tools the organization relies on.

Topics: The Mindset of the Professional Pen Tester; Building a World-Class Pen Test Infrastructure; Creating Effective Pen Test Scopes and Rules of Engagement; Detailed Recon Using the Latest Tools; Effective Pen Test Reporting to Maximize Impact; Mining Search Engine Results; Document Metadata Extraction and Analysis

SECTION 2: In-Depth Scanning

We next focus on the vital task of mapping the target environment's attack surface by creating a comprehensive inventory of machines, accounts, and potential vulnerabilities. We will look at some of the most useful scanning tools freely available today and run them in numerous hands-on labs to help hammer home the most effective way to use each tool. We will also conduct a deep dive into some of the most useful tools available to pen testers today for formulating packets: Scapy and Netcat. We finish the section covering vital techniques for false-positive reduction so you can focus your findings on meaningful results and avoid the sting of a false positive. And we will examine the best ways to conduct your scans safely and efficiently.

Topics: Tips for Awesome Scanning; Tcpdump for the Pen Tester; Nmap In-Depth; Version Scanning with Nmap; Vulnerability Scanning with Nessus; False-Positive Reduction; Packet Manipulation with Scapy; Enumerating Users; Netcat for the Pen Tester; Monitoring Services During a Scan

SECTION 3: Exploitation

In this section, we look at the many kinds of exploits that penetration testers use to compromise target machines, including client-side exploits, service-side exploits, and local privilege escalation. We'll see how these exploits are packaged in frameworks like Metasploit and its mighty Meterpreter. You'll learn in-depth how to leverage Metasploit and the Meterpreter to compromise target environments. We'll also analyze the topic of anti-virus evasion to bypass the target organization's security measures, as well as methods for pivoting through target environments, all with a focus on determining the true business risk of the target organization.

Topics: Comprehensive Metasploit Coverage with Exploits/Stagers/Stages; Strategies and Tactics for Anti-Virus Evasion; In-Depth Meterpreter Analysis, Hands-On; Implementing Port Forwarding Relays for Merciless Pivots; How to Leverage PowerShell Empire to Plunder a Target Environment

SECTION 4: Post-Exploitation and Merciless Pivoting

This section of the course zooms in on pillaging target environments and building formidable hands-on command line skills. We'll cover Windows command line skills in-depth, including PowerShell's awesome abilities for post-exploitation. We'll see how we can leverage malicious services and the incredible WMIC toolset to access and pivot through a target organization. We'll then turn our attention to password guessing attacks, discussing how to avoid account lockout, as well as numerous options for plundering password hashes from target machines including the great Mimikatz Kiwi tool. Finally, we'll look at Metasploit's fantastic features for pivoting, including the msfconsole route command.

Topics: Windows Command Line Kung Fu for Penetration Testers; PowerShell's Amazing Post-Exploitation Capabilities; Password Attack Tips; Account Lockout and Strategies for Avoiding It; Automated Password Guessing with THC-Hydra; Retrieving and Manipulating Hashes from Windows, Linux, and Other Systems; Pivoting through Target Environments; Extracting Hashes and Passwords from Memory with Mimikatz Kiwi

SECTION 5: In-Depth Password Attacks and Web App Pen Testing

In this section of the course, we'll go even deeper in exploiting one of the weakest aspects of most computing environments: passwords. You'll custom-compile John the Ripper to optimize its performance in cracking passwords. You'll look at the amazingly full-featured Cain tool, running it to crack sniffed Windows authentication messages. We'll see how Rainbow Tables really work to make password cracking much more efficient, all hands-on. And we'll cover powerful "pass-the-hash" attacks, leveraging Metasploit, the Meterpreter, and more. We then turn our attention to web application pen testing, covering the most powerful and common web app attack techniques with hands-on labs for every topic we address. We'll cover finding and exploiting cross-site scripting (XSS), cross-site request forgery (XSRF), command injection, and SQL injection flaws in applications such as online banking, blog sites, and more.

Topics: Password Cracking with John the Ripper; Sniffing and Cracking Windows Authentication Exchanges Using Cain; Using Rainbow Tables to Maximum Effectiveness; Pass-the-Hash Attacks with Metasploit and More; Finding and Exploiting Cross-Site Scripting; Utilizing Cross-Site Request Forgery Flaws; Data Plundering with SQL Injection; Leveraging SQL Injection to Perform Command Injection; Maximizing Effectiveness of Command Injection Testing

SECTION 6: Penetration Test and Capture-the-Flag Workshop

This lively session represents the culmination of the network penetration testing and ethical hacking course. You'll apply all of the skills mastered in the course so far in a full-day, hands-on workshop during which you'll conduct an actual penetration test of a sample target environment. We'll provide the scope and rules of engagement, and you'll work with a team to achieve your goal of finding out whether the target organization's Personally Identifiable Information (PII) is at risk. As a final step in preparing you for conducting penetration tests, you'll make recommendations about remediating the risks you identify.

Topics: Applying Penetration Testing and Ethical Hacking Practices End-to-End; Detailed Scanning to Find Vulnerabilities and Avenues to Entry; Exploitation to Gain Control of Target Systems; Post-Exploitation to Determine Business Risks; Merciless Pivoting; Analyzing Results

Community Events

Raleigh, NC . . . . . Jan 13-18

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Feb 3-8

Online Training. . . . . Apr 27 – May 2

Online Training. . . . . May 17-22

Online Training. . . . . Jun 15-20

SEC542: Web App Penetration Testing and Ethical Hacking

GWAPT
Web Application Penetration Tester
giac.org/gwapt

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Apply a detailed, four-step methodology to your web application penetration tests: reconnaissance, mapping, discovery, and exploitation
- Analyze the results from automated web testing tools to validate findings, determine their business impact, and eliminate false positives
- Manually discover key web application flaws
- Use Python to create testing and exploitation scripts during a penetration test
- Discover and exploit SQL Injection flaws to determine true risk to the victim organization
- Create configurations and test payloads within other web attacks
- Fuzz potential inputs for injection attacks
- Explain the impact of exploitation of web application flaws
- Analyze traffic between the client and the server application using tools such as the Zed Attack Proxy and Burp Suite to find security issues within the client-side application code
- Manually discover and exploit Cross-Site Request Forgery (CSRF) attacks
- Use the Browser Exploitation Framework (BeEF) to hook victim browsers, attack client software and the network, and evaluate the potential impact that XSS flaws have within an application
- Perform a complete web penetration test during the Capture-the-Flag exercise to bring techniques and tools together into a comprehensive test

Web applications play a vital role in every modern organization. However, if your organization doesn't properly test and secure its web apps, adversaries can compromise these applications, damage business functionality, and steal data. Unfortunately, many organizations operate under the mistaken impression that a web application security scanner will reliably discover flaws in their systems.

SEC542 helps students move beyond push-button scanning to professional, thorough, and high-value web application penetration testing.

Customers expect web applications to provide significant functionality and data access. Even beyond the importance of customer-facing web applications, internal web applications increasingly represent the most commonly used business tools within any organization. Unfortunately, there is no "patch Tuesday" for custom web applications, and major industry studies find that web application flaws play a major role in significant breaches and intrusions. Adversaries increasingly focus on these high-value targets either by directly abusing public-facing applications or by focusing on web apps as targets after an initial break-in.

Modern cyber defense requires a realistic and thorough understanding of web application security issues. Anyone can learn to sling a few web hacks, but effective web application penetration testing requires something deeper.

SEC542 enables students to assess a web application's security posture and convincingly demonstrate the impact of inadequate security that plagues most organizations.

In this course, students will come to understand major web application flaws and their exploitation. Most importantly, they'll learn a field-tested and repeatable process to consistently find these flaws and convey what they have learned to their organizations. Even technically gifted security geeks often struggle with helping organizations understand risk in terms relatable to business. Much of the art of penetration testing has less to do with learning how adversaries are breaking in than it does with convincing an organization to take the risk seriously and employ appropriate countermeasures. The goal of SEC542 is to better secure organizations through penetration testing, and not just show off hacking skills. This course will help you demonstrate the true impact of web application flaws through exploitation.

In addition to high-quality course content, SEC542 focuses heavily on in-depth, hands-on labs to ensure that students can immediately apply all they learn. The course features more than 30 formal hands-on labs and culminates in a web application pen test tournament, powered by the SANS NetWars Cyber Range. This Capture-the-Flag event on the final section brings students into teams to apply their newly acquired command of web application penetration testing techniques in a fun way that hammers home lessons learned.

"SEC542 shows a hands-on way of doing web app penetration testing – not just how to use this tool, or that tool."

— Christopher J. Stover, **Infogressive Inc.**

***SEC542** is available via (subject to change):*

Live Training sans.org/events

Miami ..... Miami, FL ..... Jan 13-18	San Francisco Spring ... San Francisco, CA ..... Mar 16-21	**Security West** ..... **San Diego, CA** ..... **May 8-13**
Security East ..... **New Orleans, LA** ..... **Feb 3-8**	**SANS 2020** ..... **Orlando, FL** ..... **Apr 5-10**	Pittsburgh ..... Pittsburgh, PA ..... Jun 22-27
New York City Winter ... New York City, NY ..... Feb 10-15	Baltimore Spring ..... Baltimore, MD ... Apr 27 - May 2	
N. VA – Reston Spring .. Reston, VA ..... Mar 2-7	Pen Test Austin ..... Austin, TX ..... Apr 27 - May 2	

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Introduction and Information Gathering

Understanding the attacker's perspective is key to successful web application penetration testing. The course begins by thoroughly examining web technology, including protocols, languages, clients and server architectures, from the attacker's perspective. We will also examine different authentication systems, including Basic, Digest, Forms and Windows Integrated authentication, and discuss how servers use them and attackers abuse them.

Topics: Overview of the Web from a Penetration Tester's Perspective; Exploring the Various Servers and Clients; Discussion of the Various Web Architectures; Discovering How Session State Works; Discussion of the Different Types of Vulnerabilities; WHOIS and DNS Reconnaissance; The HTTP Protocol; WebSocket; Secure Sockets Layer (SSL) Configurations and Weaknesses; Heartbleed Exploitation; Utilizing the Burp Suite in Web App Penetration Testing

SECTION 2: Configuration, Identity, and Authentication Testing

The second section starts the actual penetration testing process, beginning with the reconnaissance and mapping phases. Reconnaissance includes gathering publicly available information regarding the target application and organization, identifying the machines that support our target application, and building a profile of each server, including the operating system, specific software and configuration. The discussion is underscored through several practical, hands-on labs in which we conduct reconnaissance against in-class targets.

Topics: Scanning with Nmap; Discovering the Infrastructure Within the Application; Identifying the Machines and Operating Systems; Exploring Virtual Hosting and its Impact on Testing; Learning Methods to Identify Load Balancers; Software Configuration Discovery; Learning Tools to Spider a Website; Brute Forcing Unlinked Files and Directories; Discovering and Exploiting Shellshock; Web Authentication; Username Harvesting and Password Guessing; Fuzzing; Burp Intruder

SECTION 3: Injection

This section continues to explore our methodology with the discovery phase. We will build on the information started the previous section, exploring methods to find and verify vulnerabilities within the application. Students will also begin to explore the interactions between the various vulnerabilities.

Topics: Session Tracking; Authentication Bypass Flaws; Mutillidae; Command Injection; Directory Traversal; Local File Inclusion (LFI); Remote File Inclusion (RFI); SQL Injection; Blind SQL Injection; Error-Based SQL Injection; Exploiting SQL Injection; SQL Injection Tools; sqlmap

SECTION 4: XXE and XSS

On section four, students continue exploring the discovery phase of the methodology. We cover methods to discover key vulnerabilities within web applications, such as Cross-Site Scripting (XSS) and Cross-Site Request Forgery (CSRF/XSRF). Manual discovery methods are employed during hands-on labs.

Topics: XML External Entity (XXE); Cross-Site Scripting (XSS); Browser Exploitation Framework (BeEF); AJAX; XML and JSON; Document Object Model (DOM); Logic Attacks; API Attacks; Data Attacks

SECTION 5: CSRF, Logic Flaws, and Advanced Tools

On the fifth section, we launch actual exploits against real-world applications, building on the previous three steps, expanding our foothold within the application, and extending it to the network on which it resides. As penetration testers, we specifically focus on ways to leverage previously discovered vulnerabilities to gain further access, highlighting the cyclical nature of the four-step attack methodology.

Topics: Cross-Site Request Forgery (CSRF); Python for Web App Penetration Testing; WPScan; w3af; Metasploit for Web Penetration Testers; Leveraging Attacks to Gain Access to the System; How to Pivot Our Attacks Through a Web Application; Exploiting Applications to Steal Cookies; Executing Commands Through Web Application Vulnerabilities; When Tools Fail

SECTION 6: Capture the Flag

On section six, students form teams and compete in a web application penetration testing tournament. This NetWars-powered Capture-the-Flag exercise provides students an opportunity to wield their newly developed or further-honed skills to answer questions, complete missions, and exfiltrate data, applying skills gained throughout the course. The style of challenge and integrated-hint system allows students of various skill levels to both enjoy a game environment and solidify the skills learned in class.

Who Should Attend

- General security Practitioners
- Penetration testers
- Ethical hackers
- Web application developers
- Website developers and architects

Community Events

Burbank, CA. . . . . Jan 13-18
Ottawa, ON . . . . . Feb 24-29
Cincinnati, OH. . . . . Mar 30 - Apr 4

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Mar 2-7
Online Training. . . . . Apr 27 – May 2

SEC460: **Enterprise Threat and Vulnerability Assessment**

GEVA
Enterprise Vulnerability Assessor
giac.org/geva

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Perform end-to-end vulnerability assessments
- Develop customized vulnerability discovery, management, and remediation plans
- Conduct threat intelligence gathering and analysis to create a tailored cybersecurity plan that integrates various attack and vulnerability modeling frameworks
- Implement a proven testing methodology using industry-leading tactics and techniques
- Adapt information security approaches to target real-world enterprise challenges
- Configure and manage vulnerability assessment tools to limit risk added to the environment by the tester
- Operate enumeration tools like Nmap, Masscan, Recon-ng, and WMI to identify network nodes, services, configurations, and vulnerabilities that an attacker could use as an opportunity for exploitation
- Conduct infrastructure vulnerability enumeration at scale across numerous network segments, in spite of divergent network infrastructure and nonstandard configurations
- Conduct web application vulnerability enumeration in enterprise environments while solving complex challenges resulting from scale
- Perform manual discovery and validation of cybersecurity vulnerabilities that can be extended to custom and unique applications and systems
- Manage large vulnerability datasets and perform risk calculation and scoring against organization-specific risks
- Implement vulnerability triage and prioritize mitigation
- Use high-end commercial software including Acunetix WVS and Rapid7 Nexpose (InsightVM) in the classroom range

Computer exploitation is on the rise. As advanced adversaries become more numerous, more capable, and much more destructive, organizations must become more effective at mitigating their information security risks at the enterprise scale. SEC460 is the premier course focused on building technical vulnerability assessment skills and techniques, while highlighting time-tested practical approaches to ensure true value across the enterprise. The course covers threat management, introduces the core components of comprehensive vulnerability assessment, and provides the hands-on instruction necessary to produce a vigorous defensive strategy from day one. The course is focused on equipping information security personnel from mid-sized to large organizations charged with effectively and efficiently securing 10,000 or more systems.

SEC460 begins with an introduction to information security vulnerability assessment fundamentals, followed by in-depth coverage of the Vulnerability Assessment Framework. It then moves into the structural components of a dynamic and iterative information security program. Through a detailed, practical analysis of threat intelligence, modeling, and automation, students will learn the skills necessary to not only use the tools of the trade, but also to implement a transformational security vulnerability assessment program.

SEC460 will teach you how to use real industry-standard security tools for vulnerability assessment, management, and mitigation. It is the only course that teaches a holistic vulnerability assessment methodology while focusing on challenges faced in a large enterprise. You will learn on a full-scale enterprise range chock full of target machines representative of an enterprise environment, leveraging production-ready tools and a proven testing methodology.

SEC460 takes you beyond the checklist, giving you a tour of the attackers' perspective that is crucial to discovering where they will strike. Operators are more than the scanner they employ. SEC460 emphasizes this personnel-centric approach by examining the shortfalls of many vulnerability assessment programs in order to provide you with the tactics and techniques required to secure networks against even the most advanced intrusions.

We wrap up the first five sections of instruction with a discussion of triage, remediation, and reporting before putting your skills to the test on the final day against an enterprise-grade cyber range with numerous target systems for you to analyze and explore. The cyber range is a large environment of servers, end-users, and networking gear that represents many of the systems and topologies used by enterprises. By adopting an end-to-end approach to vulnerability assessment, you can be confident that your skills will provide much-needed value in securing your organization.

"SEC460 has provided me the knowledge to build a great vulnerability management/vulnerability assessment program that vendor courses couldn't provide."

— Eric Osmus, **ConocoPhillips Company**

***SEC460** is available via (subject to change):*

Live Training sans.org/events

Miami	Miami, FL	Jan 13-18
N. VA – Reston Spring	Reston, VA	Mar 2-7
San Francisco Spring	San Francisco, CA	Mar 16-21
Pen Test Austin	Austin, TX	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Methodology, Planning, and Threat Modeling

In this section of the course, students will develop the skills needed to conduct high-value vulnerability assessments with measurable impact. We will explore the elemental components of successful vulnerability assessment programs, deconstruct the logistical precursors to value-added operations, and integrate adversarial threat modeling and intelligence.

Topics: Maximizing Value from Vulnerability Assessments and Programs; Setting Up for Success at Scale: Enterprise Architecture and Strategy; Developing Transformational Vulnerability Assessment Strategies; Performing Enterprise Threat Modeling; Generating Compounding Interest from Threat Intelligence and Avoiding Information Overload; The Vulnerability Assessment Framework; Overview of Comprehensive Network Scanning; Compliance Standards and Information Security; Team Operations and Collaboration

SECTION 2: Discovery

Having mastered the structural foundations of vulnerability management, we pivot to the realm of direct, tactical application. Comprehensive reconnaissance, enumeration, and discovery techniques are the prime elements of successful vulnerability assessment. While gaining additional familiarity with hands-on enterprise operations, you will systematically probe the environment in order to discover the relevant host, service, version, and configuration details that will drive the remainder of the assessment system.

Topics: Active and Passive Reconnaissance; Identification and Enumeration with DNS; DNS Zone Speculation and Dictionary-Enabled Discovery; Port Scanning with Nmap and Zenmap; Scanning Large-Scale Environments; Commonplace Services; Scanning the Network Perimeter and Engaging the DMZ; Trade-offs: Speed, Efficiency, Accuracy, and Thoroughness; Introduction to PowerShell

Who Should Attend

- Vulnerability assessors
- IT System administrators
- Security auditors
- Compliance professionals
- Penetration testers
- Vulnerability program managers
- Security analysts
- Security architects
- Senior security engineers
- Technical security managers

SECTION 3: Enhanced Vulnerability Scanning and Automation

We begin section three by delving into the next phase of the Vulnerability Assessment Framework and charging into the most exciting topic in security testing: automation to handle scale. We start by breaking vulnerability scanning into its elemental components and gaining an understanding of vulnerability measurement that can be applied to task automation. This focus will direct us to the quantitative facets underlying cybersecurity vulnerabilities and drive our discussion of impact, risk, and triage. Each topic discussed will focus on identifying, observing, inciting, or assessing the entry points that threats leverage during network attacks.

Topics: Assigning a Confidence Value and Validating Exploitative Potential of Vulnerabilities: Enhanced Vulnerability Scanning: Risk Assessment Matrices and Rating Systems: Quantitative Analysis Techniques Applied to Vulnerability Scoring: Performing Tailored Risk Calculation to Drive Triage: General Purpose vs. Application-Specific Vulnerability Scanning: Tuning the Scanner to the Task, the Enterprise, and Tremendous Scale: Scan Policies and Compliance Auditing: Performing Vulnerability Discovery with Open-Source and Commercial Appliances: Scanning with the Nmap Scripting Engine, Nexpose/InsightVM, and Acunetix: The Windows Domain: Exchange, SharePoint, and Active Directory: Testing for Insecure Cryptographic Implementations Including SSL: Assessing VOIP Environments: Discovering Vulnerabilities in the Enterprise Backbone: Active Directory, Exchange, and SharePoint: Minimizing Supplemental Risk while Conducting Authenticated Scanning through Purposeful Application of Least Privilege: Probing for Data Link Liability to Identify Hazards in Wireless Infrastructure, Switches, and VLANs: Manual Vulnerability Discovery Automated to Attain Maximal Efficacy

SECTION 4: Vulnerability Validation, Triage, and Data Management

Over the course of this section we will tackle vulnerability validation, which is the next phase of our overarching testing methodology. Simultaneously, we will confront and address the biggest headaches common to a vulnerability assessment at scale. At large scale, vulnerability data can be overwhelming and possibly even contradictory. We will cover the specific techniques needed to wade through and better focus those data. Next, we will examine techniques for collaboration and data management with the Acheron tool for analyzing vulnerability data across an organization. Later in the section, we will apply our understanding of the vulnerability concept to evolve our PowerShell skills and take action on an enterprise scale.

Topics: Recruiting Disparate Data Sources: Patches, Hotfixes, and Configurations; Manual Vulnerability Validation Targeting Enterprise Infrastructure; Converting Disparate Datasets into a Central, Normalized, and Relational Knowledge Base; Managing Large Repositories of Vulnerability Data; Querying the Vulnerability Knowledge Base; Evaluating Vulnerability Risk in Custom and Unique Systems, including Web Applications; Triage: Assessing the Relative Importance of Vulnerabilities Against Strategic Risk

SECTION 5: Remediation and Reporting

Many well-intentioned vulnerability assessment programs begin with zeal and vitality, but after the discovery of vulnerabilities there is often a tendency to ignore the risk reality and shift back to the status quo. Over the previous course modules we focused on knowing the target environment and uncovering its weak points. Now it's time for decision and action based on an understanding of the risks the organization faces. Developing an actionable vulnerability remediation plan with time-based success targets sets the stage for continuous improvement, and that's exactly what we cover in this section of the course. Developing this plan in conjunction with the Vulnerability Assessment Report is an opportunity to galvanize the team, while enhancing the vulnerability assessment value proposition.

Topics: Domain Password Auditing: Creating and Navigating Vulnerability Prioritization Schemes in Acheron: Developing a Web of Network and Host Affiliations: Modeling Account Relationships on Active Directory Forests: Creating Effective Vulnerability Assessment Reports: Transforming Triage Listing into the Vulnerability Remediation Plan: Closure: Be a Positive Influence in the Context of the Global Information Security Crisis

SECTION 6: Vulnerability Assessment Foundry Hands-On Challenge

In celebration of your diligence, curiosity, and new vulnerability skills, we welcome you to your final hands-on challenge to hammer home your capabilities. The guided scenario in this final module is designed to test your mettle through trial and detailed work in a fun capture-the-flag-style environment. The challenge is the canvas upon which you can hone your skills and measure your maturing talents. Armed for the fight, you will doubtless rise to the challenge...and triumph! The scenario: The Ellingson Mineral Company (EMC) has engaged you to perform a vulnerability assessment of its environment. The organization is very aware of your particular set of vulnerability assessment skills, and treasures the insights it is certain you will provide to help secure the organization against its formidable adversaries, including nefarious cybercrime cartels and jealous nation-state actors. Teams will work together to help squash issues that would lead to a compromise of EMC's precious assets.

Topics: Tactical Employment of the Vulnerability Assessment Framework; Threat Modeling; Discovery; Vulnerability Scanning; Validation; Data Management and Triage

SEC573: **Automating Information Security with Python**

GPYC
Python Coder
giac.org/gpyc

6 Day Program | 36 CPEs | Laptop Required

You Will Be Able To

- Modify existing open-source tools to customize them to meet the needs of your organization
- Manipulate log file formats to make them compatible with various log collectors
- Write new tools to analyze log files and network packets to identify attackers in your environment
- Develop tools that extract otherwise inaccessible forensics artifacts from computer systems of all types
- Automate the collection of intelligence information to augment your security from online resources
- Automate the extraction of signs of compromise and other forensics data from the Windows Registry and other databases
- Write a backdoor that uses exception handling, sockets, process execution, and encryption to provide you with your initial foothold in a target environment

All security professionals, including penetration testers, forensic analysts, network defenders, security administrators, and incident responders, have one experience in common: CHANGE. Tools, technologies, and threats change constantly, but Python is a simple, user-friendly language that can help you keep pace with change, allowing you to write custom tools and automate tasks to effectively manage and respond to your unique threats.

Whether you are new to coding or have been coding for years, SEC573: Automating Information Security with Python will have you creating programs that make your job easier and your work more efficient. This self-paced course starts from the very beginning, assuming you have no prior experience with or knowledge of programming. We cover all of the essentials of the language up front. If you already know the essentials, you will find that the pyWars lab environment allows advanced developers to quickly accelerate to more advanced material in the course.

Technology, threats, and tools are constantly evolving. If we don't evolve with them, we'll become ineffective and irrelevant, unable to provide the vital defenses our organizations increasingly require. Maybe your chosen Operating System has a new feature that creates interesting forensic artifacts that would be invaluable for your investigation, if only you had a tool to access it. Often for new features and forensic artifacts, no such tool has yet been released. You could try moving your case forward without that evidence or hope that someone creates a tool before the case goes cold...or you can write a tool yourself.

Or perhaps an attacker bypassed your defenses and owned your network months ago. If existing tools were able to find the attack, you wouldn't be in this situation. You are bleeding sensitive data and the time-consuming manual process of finding and eradicating the attacker is costing you money and hurting your organization. The answer is simple if you have the skills: Write tools to automate various aspects of your defenses.

As a penetration tester, you need to evolve as quickly as the threats you are paid to emulate. What do you do when "off-the-shelf" tools and exploits fall short? If you're good, you write your own tool or modify existing capabilities to make them perform as you need them to.

SEC573 is designed to give you the skills you need for tweaking, customizing, or outright developing your own tools. We put you on the path of creating your own tools, empowering you to better automate the daily routine of today's information security professional and to achieve more value in less time. Again and again, organizations serious about security emphasize their need for skilled tool builders. There is a huge demand for people who can understand a problem and then rapidly develop prototype code to attack or defend against it. Learn Python in-depth with us to become fully weaponized.

***SEC573** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-8**
SANS 2020	**Orlando, FL**	**Apr 5-10**
Pen Test Austin	Austin, TX	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Essentials Workshop with pyWars

The course begins with a brief introduction to Python and the pyWars Capture-the-Flag game. We set the stage for students to learn at their own pace in the 100% hands-on pyWars lab environment. As more advanced students take on Python-based Capture-the-Flag challenges, students who are new to programming will start from the very beginning with Python essentials.

Topics: Syntax; Variables; Math Operators; Strings; Functions; Modules; Control Statements; Introspection

SECTION 2: Essentials Workshop with MORE pyWars

You will never learn to program by staring at PowerPoint slides. The second section continues the hands-on, lab-centric approach established in section one. This section covers data structures and more detailed programming concepts. Next, we focus on invaluable tips and tricks to make you a better Python programmer and on how to debug your code.

Topics: Lists; Loops; Tuples; Dictionaries; The Python Debugger; Coding Tips, Tricks, and Shortcuts; System Arguments; ArgParser Module

SECTION 3: Defensive Python

In this section we take on the role of a network defender with more logs to examine than there is time in the day. Attackers have penetrated the network and you will have to analyze the logs and packet captures to find them. We will discuss how to analyze network logs and packets to discover where the attackers are coming from and what they are doing. We will build scripts to empower continuous monitoring and disrupt the attackers before they exfiltrate your data. Forensicators and offensive security professionals won't be left out because reading and writing files and parsing data are also essential skills they will apply to their craft.

Topics: File Operations; Python Sets; Regular Expressions; Log Parsing; Data Analysis Tools and Techniques; Long Tail/Short Tail Analysis; Geolocation Acquisition; Blacklists and Whitelists; Packet Analysis; Packet Reassembly; Payload Extraction

SECTION 4: Forensics Python

On section four we will play the role of a forensics analyst who has to carve evidence from artifacts when no tool exists to do so. Even if you don't do forensics you will find that these skills covered on section four are foundational to every security role. We will discuss the process required to carve binary images, find appropriate data of interest in them, and extract those data. Once you have the artifact isolated, there is more analysis to be done. You will learn how to extract metadata from image files. Then we will discuss techniques for finding artifacts in other locations such as SQL databases and interacting with web pages.

Topics: Acquiring Images from Disk, Memory, and the Network; File Carving; The STRUCT Module; Raw Network Sockets and Protocols; Image Forensics and PIL; SQL Queries; HTTP Communications with Python Built-In Libraries; Web Communications with the Requests Module

SECTION 5: Offensive Python

In section five we play the role of penetration testers whose normal tricks have failed. Their attempts to establish a foothold have been stopped by modern defenses. To bypass these defenses, you will build an agent to give you access to a remote system. Similar agents can be used for incident response or systems administration, but our focus will be on offensive operations.

Topics: Network Socket Operations; Exception Handling; Process Execution; Blocking and Non-blocking Sockets; Using the Select Module for Asynchronous Operations Python Objects; Argument Packing and Unpacking

SECTION 6: Capture the Flag

In this final section, you will be placed on a team with other students. You will apply the skills you have mastered in a series of programming challenges. Participants will exercise the new skills and the code they have developed throughout the course in a series of challenges. You will solve programming challenges, exploit vulnerable systems, analyze packets, parse logs, and automate code execution on remote systems. Test your skills! Prove your might!

"SEC573 is excellent. I went from having almost no Python coding ability to being able to write functional and useful programs."

— Caleb Jaren, **Microsoft**

Who Should Attend

- Security professionals who benefit from automating routine tasks so they can focus on what's most important
- Forensic analysts who can no longer wait on someone else to develop a commercial tool to analyze artifacts
- Network defenders who sift through mountains of logs and packets to find evil-doers in their networks
- Penetration testers who are ready to advance from script kiddie to professional offensive computer operations operator
- Security professionals who want to evolve from security tool consumer to security solution provider

You Will Receive

- A USB containing a virtual machine filled with sample code and working examples
- A copy of *The Python Pocket Reference* published by O'Reilly Press
- MP3 audio files of the complete course lecture

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Feb 3-8

Online Training. . . . . Apr 27 – May 2

SEC575: **Mobile Device Security and Ethical Hacking**

GMOB
Mobile Device Security Analyst
giac.org/gmob

6 Day Program | 36 CPEs | Laptop Required

You Will Be Able To

- Use jailbreak tools for Apple iOS and Android systems
- Conduct an analysis of iOS and Android filesystem data to plunder compromised devices and extract sensitive mobile device use information
- Analyze Apple iOS and Android applications with reverse-engineering tools
- Change the functionality of Android and iOS apps to defeat anti-jailbreaking or circumvent in-app purchase requirements
- Conduct an automated security assessment of mobile applications
- Use wireless network analysis tools to identify and exploit wireless networks used by mobile devices
- Intercept and manipulate mobile device network activity
- Leverage mobile-device-specific exploit frameworks to gain unauthorized access to target devices
- Manipulate the behavior of mobile applications to bypass security restrictions

Who Should Attend

- Penetration testers
- Ethical hackers
- Auditors who need to build deeper technical skills
- Security personnel whose job involves assessing, deploying or securing mobile phones and tablets
- Network and system administrators supporting mobile phones and tablets

Imagine an attack surface that is spread across your organization and in the hands of every user. It moves from place to place regularly, stores highly sensitive and critical data, and sports numerous different wireless technologies all ripe for attack. Such a surface already exists today: mobile devices. These devices are the biggest attack surface in most organizations, yet these same organizations often don't have the skills needed to assess them.

SEC575 is designed to give you the skills you need to understand the security strengths and weaknesses in Apple iOS and Android devices. Mobile devices are no longer a convenience technology: they are an essential tool carried or worn by users worldwide, often displacing conventional computers for everyday enterprise data needs. You can see this trend in corporations, hospitals, banks, schools, and retail stores throughout the world. Users rely on mobile devices more today than ever before – we know it, and the bad guys do too. The SEC575 course examines the full gamut of these devices.

With the skills you learn in SEC575, you will be able to evaluate the security weaknesses of built-in and third-party applications. You'll learn how to bypass platform encryption and how to manipulate apps to circumvent client-side security techniques. You'll leverage automated and manual mobile application analysis tools to identify deficiencies in mobile app network traffic, file system storage, and inter-app communication channels. You'll safely work with mobile malware samples to understand the data exposure and access threats affecting Android and iOS, and you'll bypass lock screen to exploit lost or stolen devices.

Understanding and identifying vulnerabilities and threats to mobile devices is a valuable skill, but it must be paired with the ability to communicate the associated risks. Throughout the course, you'll review ways to effectively communicate threats to key stakeholders. You'll leverage tools, including Mobile App Report Cards, to characterize threats for managers and decision-makers, while also identifying sample code and libraries that developers can use to address risks for in-house applications.

In employing your newly learned skills, you'll apply a step-by-step mobile device deployment penetration test. Starting with gaining access to wireless networks to implement man-in-the-middle attacks and finishing with mobile device exploits and data harvesting, you'll examine each step of the test with hands-on exercises, detailed instructions, and tips and tricks learned from hundreds of successful penetration tests. By building these skills, you'll return to work prepared to conduct your own test, or better informed on what to look for and how to review an outsourced penetration test.

Mobile device deployments introduce new threats to organizations, including advanced malware, data leakage, and the disclosure to attackers of enterprise secrets, intellectual property, and personally identifiable information assets. Further complicating matters, there simply are not enough people with the security skills needed to identify and manage secure mobile phone and tablet deployments. By completing this course, you'll be able to differentiate yourself as having prepared to evaluate the security of mobile devices, effectively assess and identify flaws in mobile applications, and conduct a mobile device penetration test – all critical skills to protect and defend mobile device deployments.

***SEC575** is available via (subject to change):*

Live Training sans.org/events

Anaheim	Anaheim, CA	Jan 20-25
SANS 2020	**Orlando, FL**	**Apr 5-10**
Pen Test Austin	Austin, TX	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	Apr 27 – May 2

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Device Architecture and Common Mobile Threats

The first module of SEC575 quickly looks at the significant threats affecting mobile device deployments, highlighted by a hands-on exercise evaluating network traffic from a vulnerable mobile banking application. As a critical component of a secure deployment, we will examine the architectural and implementation differences and similarities between Android (including Android Pie), Apple iOS 12, and the Apple Watch and Google Wear platforms. We will also look at the specific implementation details of popular platform features such as iBeacon, AirDrop, App Verification, and more. Hands-on exercises will be used to interact with mobile devices running in a virtualized environment, including low-level access to installed application services and application data. We'll examine the tools used to evaluate mobile devices as part of establishing a lab environment for mobile device assessments, including the analysis of mobile malware affecting Android and non-jailbroken iOS devices. Finally, we will address the threats of lost and stolen devices (and opportunities for a pen tester), including techniques to bypass mobile device lock screens.

Topics: Mobile Problems and Opportunities; Mobile Device Platform Analysis; Wearable Platforms; Mobile Device Lab Analysis Tools; Mobile Device Malware Threats

SECTION 2: Mobile Platform Access and Application Analysis

With an understanding of the threats, architectural components and desired security methods, we dig deeper into iOS and Android mobile platforms focusing on sandboxing and data isolation models, and on the evaluation of mobile applications. This module is designed to help build skills in analyzing mobile device data and applications through rooting and jailbreaking Android and iOS devices and using that access to evaluate file system artifacts. We will also start to evaluate the security of mobile applications, using network capture analysis tools to identify weak network protocol use and sensitive data disclosure over the network. Finally, we'll wrap up the module with an introduction to reverse engineering of iOS and Android applications using decompilers, disassemblers, and by manual analysis techniques.

Topics: Unlocking, Rooting, and Jailbreaking Mobile Devices; Mobile Phone Data Storage and File System Architecture; Network Activity Monitoring; Static Application Analysis

SECTION 3: Mobile Application Reverse Engineering

One of the core skills you need as a mobile security analyst is the ability to evaluate the risks and threats a mobile app introduces to your organization. Through lecture and hands-on exercises in this module, with some analysis skills, you will be able to evaluate critical mobile applications to determine the type of access threats and information disclosure threats they represent. In this module we will use automated and manual application assessment tools to evaluate iOS and Android apps. We'll build upon the static application analysis skills covered in Module 2 to manipulate application components, including Android Intents and iOS URL extensions. We'll also learn and practice techniques for manipulating iOS and Android applications, such as method swizzling on iOS, and disassembly, modification, and reassembly of Android apps. The module ends with a look at a consistent system for evaluating and grading the security of mobile applications using the Application Report Card Project.

Topics: Automated Application Analysis Systems; Reverse Engineering Obfuscated Applications; Application Report Cards

SECTION 4: Penetration Testing Mobile Devices – Part 1

An essential component of developing a secure mobile device deployment is to perform or outsource a penetration test. Through ethical hacking and penetration testing, we examine the mobile devices and infrastructure from the perspective of an attacker, identifying and exploiting flaws that deliver unauthorized access to data or supporting networks. By identifying these flaws we can evaluate the mobile phone deployment risk to the organization with practical and useful risk metrics. Whether your role is to implement the penetration test, or to source and evaluate the penetration tests of others, understanding these techniques will help your organization identify and resolve vulnerabilities before they become incidents.

Topics: Manipulating Application Behavior; Using Mobile Device Remote Access Trojans; Wireless Network Probe Mapping; Weak Wireless Attacks; Enterprise Wireless Security Attacks

SECTION 5: Penetration Testing Mobile Devices – Part 2

Continuing our look at ethical hacking and penetration testing, we turn our focus to exploiting weaknesses on iOS and Android devices. We will also examine platform-specific application weaknesses and look at the growing use of web framework attacks in mobile application exploitation. Hands-on exercises are used throughout the module to practice these attacks, exploiting both vulnerable mobile applications and the supporting back-end servers.

Topics: Network Manipulation Attacks; Sidejacking Attacks; SSL/TLS Attacks; Client-Side Injection Attacks; Web Framework Attacks; Back-end Application Support Attacks

SECTION 6: Capture-the-Flag Event

In the final module of SEC575 we will pull together all the concepts and technology covered during the week in a comprehensive Capture-the-Flag event. In this hands-on exercise, you will have the option to participate in multiple roles, including designing a secure infrastructure for the deployment of mobile phones, monitoring network activity to identify attacks against mobile devices, extracting sensitive data from a compromised iPad, and attacking a variety of mobile phones and related network infrastructure components. During this mobile security event you will put into practice the skills you have learned in order to evaluate systems and defend against attackers, simulating the realistic environment you will be prepared to protect when you get back to the office.

"SEC575 provides an incredible amount of information, and the hands-on labs are awesome. It is a must-have for mobile penetration testers."

— Richard Takacs, **Integrity360**

SEC617: **Wireless Penetration Testing and Ethical Hacking**

GAWN
Assessing & Auditing Wireless Networks
giac.org/gawn

6 Day Program | 36 CPEs | Laptop Required

You Will Be Able To

- Identify and locate malicious rogue access points using free and low-cost tools
- Conduct a penetration test against low-power wireless devices to identify control system and related wireless vulnerabilities
- Identify vulnerabilities and bypass authentication mechanisms in Bluetooth networks
- Utilize wireless capture tools to extract audio conversations and network traffic from DECT wireless phones
- Implement a WPA2 Enterprise penetration test to exploit vulnerable wireless client systems for credential harvesting
- Utilize Scapy to force custom packets to manipulate wireless networks in new ways, quickly building custom attack tools to meet specific penetration test requirements
- Identify WiFi attacks using network packet captures traces and freely available analysis tools
- Identify and exploit shortcomings in the security of proximity key card systems
- Decode proprietary radio signals using Software-Defined Radio
- Mount a penetration test against numerous standards-based or proprietary wireless technologies

This course is designed for professionals seeking a comprehensive technical ability to understand, analyze, and defend the various wireless technologies that have become ubiquitous in our environments and, increasingly, key entrance points for attackers.

The authors of SEC617, as penetration testers themselves, know that many organizations overlook wireless security as an attack surface, and therefore fail to establish required defenses and monitoring, even though wireless technologies are now commonplace in executive suites, financial departments, government offices, manufacturing production lines, retail networks, medical devices, and air traffic control systems. Given the known risks of insecure wireless technologies and the attacks used against them, SEC617 was designed to help people build the vital skills needed to identify, evaluate, assess, and defend against these threats. These skills are "must-haves" for any high-performing security organization.

For many analysts, "wireless" was once synonymous with "WiFi," the ever-present networking technology, and many organizations deployed complex security systems to protect these networks. Today, wireless takes on a much broader meaning – not only encompassing the security of WiFi systems, but also the security of Bluetooth, ZigBee, Z-Wave, DECT, RFID, NFC, contactless smart cards, and even proprietary wireless systems. To effectively evaluate the security of wireless systems, your skill set needs to expand to include many different types of wireless technologies.

SEC617 will give you the skills you need to understand the security strengths and weaknesses of wireless systems. You will learn how to evaluate the ever-present cacophony of WiFi networks and identify the WiFi access points (APs) and client devices that threaten your organization. You will learn how to assess, attack, and exploit deficiencies in modern WiFi deployments using WPA2 technology, including sophisticated WPA2 Enterprise networks. You will gain a strong, practical understanding of the many weaknesses in WiFi protocols and how to apply that understanding to modern wireless systems. Along with identifying and attacking WiFi access points, you will learn to identify and exploit the behavioral differences in how client devices scan for, identify, and select APs, with deep insight into the behavior of the Windows 10, macOS, Apple iOS, and Android WiFi stacks.

A significant portion of the course focuses on Bluetooth and Bluetooth Low Energy (BLE) attacks, targeting a variety of devices, including wireless keyboards, smart light bulbs, mobile devices, audio streaming devices, and more. You will learn to assess a target Bluetooth device, identify the present (or absent) security controls, and apply a solid checklist to certify a device's security for use within your organization.

Beyond analyzing WiFi and Bluetooth security threats, analysts must also understand many other wireless technologies that are widely utilized in complex systems. SEC617 provides insight and hands-on training to help analysts identify and assess the use of ZigBee and Z-Wave wireless systems used for automation, control, and smart home systems. The course also investigates the security of cordless telephony systems in the worldwide Digital Enhanced Cordless Telephony (DECT) standard, including audio eavesdropping and recording attacks.

Radio frequency identification (RFID), near field communication (NFC), and contactless smart card systems are more popular than ever in countless applications such as point of sale systems and data center access control systems. You will learn how to assess and evaluate these deployments using hands-on exercises to exploit the same kinds of flaws discovered in mass transit smart card systems, hotel guest room access systems, and more.

In addition to standards-based wireless systems, we also dig deeper into the radio spectrum using software-defined radio (SDR) systems to scour for signals. Using SDR, you will gain new insight into how widely pervasive wireless systems are deployed. With your skills in identifying, decoding, and evaluating the data these systems transmit, you will be able to spot vulnerabilities even in custom wireless infrastructures.

***SEC617** is available via (subject to change):*

Live Training sans.org/events

St. Louis	St. Louis, MO	Mar 8-13
SANS 2020	**Orlando, FL**	**Apr 5-10**
Pen Test Austin	Austin, TX	Apr 27 - May 2
Baltimore Spring	Baltimore, MD	Apr 27 - May 2
Security West	**San Diego, CA**	**May 8-13**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: WiFi Data Collection and Analysis

The first section of the course quickly looks at wireless threats and attack surfaces and analyzes where you will likely see non-WiFi systems deployed in modern networks. We start off with a look at fundamental analysis techniques for evaluating WiFi networks, including the identification and analysis of rogue devices, and finish with a dive into remote penetration testing techniques using compromised Windows 10 and macOS devices to pivot.

Topics: Characterize the Wireless Threat; Sniffing WiFi; Rogue Access Point (AP) Analysis

SECTION 2: WiFi Attack and Exploitation Techniques

After developing skills needed to capture and evaluate WiFi activity, we start our look at exploiting WiFi, targeting AP and client devices. We cover techniques that apply to any WiFi products, from consumer to enterprise-class devices, focusing on understanding protocol-level deficiencies that will continue to be applied throughout the course on non-WiFi wireless systems as well.

Topics: Exploiting WiFi Hotspots; WiFi Client Attacks; Exploiting WEP; Denial of Service (DoS) Attacks; WiFi Fuzzing for Bug Discovery

SECTION 3: Enterprise WiFi, DECT, and ZigBee Attacks

We finish our look at WiFi attack techniques with a detailed look at assessing and exploiting WPA2 networks. Starting with WPA2 consumer networks, we investigate the flaws associated with pre-shared key networks and WiFi Protected Setup (WPS) deployments, continuing with a look at exploiting WPA2 Enterprise networks using various Extensible Authentication Protocol (EAP) methods. We continue to investigate the security of wireless networks on section 3, switching to non-WiFi analysis with a look at exploiting the worldwide Digital Enhanced Cordless Telephony (DECT) standard to capture and export audio conversations from cordless headsets and phones. We also investigate the security of ZigBee and IEEE 802.15.4 networks, looking at cryptographic flaws, key management failures, and hardware attacks.

Topics: Attacking WPA2 Pre-Shared Key Networks; Attacking WPA2 Enterprise Networks; Attacking Digital Enhanced Cordless Telephony Deployments; Attacking ZigBee Deployments

SECTION 4: Bluetooth and Software-Defined Radio Attacks

Bluetooth technology is nearly as pervasive as WiFi, with widespread adoption in smart phones, fitness trackers, wireless keyboard, smart watches, and more. In this module, we dig into the Bluetooth Classic, Enhanced Data Rate, and Low Energy protocols, including tools and techniques to evaluate target devices for vulnerabilities. Immediately following our look at Bluetooth technology, we jump into the practical application of Software-Defined Radio (SDR) technology to identify, decode, and assess proprietary wireless systems. We investigate the hardware and software available for SDR systems, and look at the tools and techniques to start exploring this exciting area of wireless security assessment.

Topics: Bluetooth Introduction and Attack Techniques; Bluetooth Low Energy Introduction and Attack Techniques; Practical Application of Software-Defined Radio (SDR)

SECTION 5: RFID, Smart Cards, and NFC Hacking

On section 5, we evaluate RFID technology in its multiple forms to identify the risks associated with privacy loss and tracking, while also building an understanding of both low-frequency and high-frequency RFID systems and NFC. We examine the security associated with contactless Point of Sale (PoS) terminals, including Apple Pay and Google Wallet, and proximity lock access systems from HID and other vendors. We also examine generalized techniques for attacking smart card systems, including critical data analysis skills needed to bypass the intended security of smart card systems used for mass transit systems, concert venues, bike rentals, and more.

Topics: RFID Overview; RFID Tracking and Privacy Attacks; Low-Frequency RFID Attacks; Exploiting Contactless RFID Smart Cards; Attacking NFC

SECTION 6: Capture-the-Flag Event

On the last section of class, we will pull together all the concepts and technology we have covered during the week in a comprehensive Capture-the-Flag event. In this hands-on exercise, you will have the option to participate in multiple roles: identifying unauthorized/rogue WiFi access points, attacking live and recorded WiFi networks, decoding proprietary wireless signals, exploiting smart card deficiencies, and more. During this wireless security event you will put into practice the skills you have learned in order to evaluate systems and defend against attackers, simulating the realistic environment you will be prepared to protect when you get back to the office.

Who Should Attend

- Ethical hackers and penetration testers
- Network security staff
- Network and system administrators
- Incident response teams
- Information security policy decision-makers
- Technical auditors
- Information security consultants
- Wireless system engineers
- Embedded wireless system developers

"I have a better understanding of the technologies and protocols in use and can now perform more accurate risk assessments."

— Shawn Pray, **Accenture**

"SEC617 is great for someone looking for a top-to-bottom rundown in wireless attacks."

— Garret Picchioni, **Salesforce**

SEC642: **Advanced Web App Penetration Testing, Ethical Hacking, and Exploitation Techniques**

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Perform advanced Local File Include (LFI)/Remote File Include (RFI), Blind SQL injection (SQLi), and Cross-Site Scripting (XSS) combined with Cross-Site Request Forger (XSRF) discovery and exploitation
- Exploit advanced vulnerabilities common to most backend language like Mass Assignments, Type Juggling, and Object Serialization
- Perform JavaScript-based injection against ExpressJS, Node.js, and NoSQL
- Understand the special testing methods for content management systems such as SharePoint and WordPress
- Identify and exploit encryption implementations within web applications and frameworks
- Discover XML Entity and XPath vulnerabilities in SOAP or REST web services and other datastores
- Use tools and techniques to work with and exploit HTTP/2 and Web Sockets
- Identify and bypass Web Application Firewalls and application filtering techniques to exploit the system

Who Should Attend

- Web and network penetration testers
- Red team members
- Vulnerability assessment personnel
- Security consultants
- Developers, QA testers
- System administrators and IT managers
- System architects

Can your web apps withstand the onslaught of modern advanced attack techniques?

Modern web applications are growing more sophisticated and complex as they utilize exciting new technologies and support ever more critical operations. Long gone are the days of basic HTML requests and responses. Even in the age of Web 2.0 and AJAX, the complexity of HTTP and modern web applications is progressing at breathtaking speed. With the demands of highly available web clusters and cloud deployments, web applications are looking to deliver more functionality in smaller packets, with a decreased strain on backend infrastructure. Welcome to an era that includes tricked-out cryptography, WebSockets, HTTP/2, and a whole lot more. Are your web application assessment and penetration testing skills ready to evaluate these impressive new technologies and make them more secure?

Are you ready to put your web apps to the test with cutting-edge skills?

This pen testing course is designed to teach you the advanced skills and techniques required to test modern web applications and next-generation technologies. The course uses a combination of lecture, real-world experiences, and hands-on exercises to teach you the techniques to test the security of tried-and-true internal enterprise web technologies, as well as cutting-edge Internet-facing applications. The final course section culminates in a Capture-the-Flag competition, where you will apply the knowledge you acquired during the previous five sections in a fun environment based on real-world technologies.

This course offers hands-on learning of advanced web app exploitation skills.

We begin by exploring advanced techniques and attacks to which all modern-day complex applications may be vulnerable. We'll learn about new web frameworks and web backends, then explore encryption as it relates to web applications, digging deep into practical cryptography used by the web, including techniques to identify the type of encryption in use within the application and methods for exploiting or abusing it. We'll look at alternative front ends to web applications and web services such as mobile applications, and examine new protocols such as HTTP/2 and WebSockets. The final portion of the class will focus on how to identify and bypass web application firewalls, filtering, and other protection techniques.

"SEC642 is quality content for senior penetration testers – a nice extension of standard WAPT courses!"

— Caleb Jaren, **Microsoft**

***SEC642** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-8**
SANS 2020	**Orlando, FL**	**Apr 5-10**
Pen Test Austin	Austin, TX	Apr 27 - May 2
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training . . . . . Apr 27 – May 2

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Advanced Attacks

As applications and their vulnerabilities become more complex, penetration testers have to be able to handle advanced targets. We'll start the course with a warm-up pen test of a small application. After our review of this exercise, we will explore some of the more advanced techniques for LFI/RFI and SQLi server-based flaws. We will then take a stab at combined XSS and XSRF attacks, where we leverage the two vulnerabilities together for even greater effect. After discovering the flaws, we will then work through various ways to exploit these flaws beyond the typical means exhibited today. These advanced techniques will help penetration testers find ways to demonstrate these vulnerabilities to their organization through advanced and custom exploitation.

Topics: Review of the Testing Methodology; Using Burp Suite in a Web Penetration Test; Exploiting Local and Remote File Inclusions; Exploring Advanced Discovery Techniques for SQL Injection and Other Server-Based Flaws; Exploring Advanced Exploitation of XSS and XSRF in a Combined Attack; Learning Advanced Exploitation Techniques

SECTION 2: Web Frameworks

We'll continue exploring advanced discovery and exploitation techniques for today's complex web applications. We'll look at vulnerabilities that could affect web applications written in any backend language, then examine how logic flaws in applications, especially in Mass Object Assignments, can have devastating effects on security. We'll also dig into assumptions made by core development teams of backend programming languages and learn how even something as simple as handling the data types in variables can be leveraged through the web with Type Juggling and Object Serialization. Next we'll explore various popular applications and frameworks and how they change the discovery techniques within a web penetration test. Part of this discussion will lead us to cutting-edge technologies like the MEAN stack, where JavaScript is leveraged from the browser, web server, and backend NoSQL storage. The final section of the class examines applications in content management systems such as SharePoint and WordPress, which have unique needs and features that make testing them both more complex and more fruitful for the tester.

Topics: Web Architectures; Web Design Patterns; Languages and Frameworks; Java and Struts; PHP-Type Juggling; Logic Flaws; Attacking Object Serialization; The MEAN Stack; Content Management Systems; SharePoint; WordPress

SECTION 3: Web Cryptography

Cryptographic weaknesses are common, yet few penetration testers have the skill to investigate, attack and exploit these flaws. When we investigate web application crypto attacks, we typically target the implementation and use of cryptography in modern web applications. Many popular web programming languages or development frameworks make encryption services available to the developer, but do not inherently protect encrypted data from being attacked, or only permit the developer to use cryptography in a weak manner. These implementation mistakes are going to be our focus in this section, as opposed to the exploitation of deficiencies in the cryptographic algorithms themselves. We will also explore the various ways applications use encryption and hashing insecurely. Students will learn techniques ranging from identifying what the encryption technique is to exploiting various flaws within the encryption or hashing.

Topics: Identifying the Cryptography Used in the Web Application; Analyzing and Attacking the Encryption Keys; Exploiting Stream Cipher IV Sollisions; Exploiting Electronic Codebook (ECB) Mode Ciphers with Block Shuffling; Exploiting Cipher Block Chaining (CBC) Mode with Bit Flipping; Vulnerabilities in PKCS#7 Padding Implementations

SECTION 4: Alternative Web Interfaces

Web applications are no longer limited to the traditional HTML-based interfaces. Web services and mobile applications have become more common and are regularly being used to attack clients and organizations. As such, it has become very important that penetration testers understand how to evaluate the security of these systems. We will examine Flash, Java, Active X, and Silverlight flaws. We will explore various techniques to discover flaws within the applications and backend systems. These techniques will make use of tools such as Burp Suite and other automated toolsets. We'll use lab exercises to explore the newer protocols of HTTP/2 and WebSockets, exploiting flaws exposed within each of them.

Topics: Intercepting Traffic to Web Services and from Mobile Applications; Flash, Java, ActiveX, and Silverlight Vulnerabilities; SOAP and REST Web Services; Penetration Testing Web Services; WebSocket Protocol Issues and Vulnerabilities; New HTTP/2 Protocol Issues and Penetration Testing

SECTION 5: Web Application Firewall and Filter Bypass

Applications today are using more security controls to help prevent attacks. These controls, such as Web Application Firewalls and filtering techniques, make it more difficult for penetration testers during their testing. The controls block many of the automated tools and simple techniques used to discover flaws. In this section we'll explore techniques used to map the control and how that control is configured to block attacks. You'll be able to map out the rule sets and determine the specifics of how the Web Application Firewall detects attacks. This mapping will then be used to determine attacks that will bypass the control. You'll use HTML5, UNICODE, and other encodings that will enable your discovery techniques to work within the protected application.

Topics: Understanding Web Application Firewalling and Filtering Techniques; Determining the Rule Sets Protecting the Application; Fingerprinting the Defense Techniques Used; Learning How HTML5 Injections Work; Using UNICODE, CTYPEs, and Data URIs to Bypass Restrictions; Bypassing a Web Application Firewall's Best-Defended Vulnerabilities, XSS and SQLi

SECTION 6: Capture the Flag

On this final course section you will be placed on a network and given the opportunity to complete an entire penetration test. The goal of this exercise is for you to explore the techniques, tools, and methodology you will have learned over the last five sections. You'll be able to use these skills against a realistic extranet and intranet. At the end of the section, you will provide a verbal report of the findings and methodology you followed to complete the test. Students will be provided with a virtual machine that contains the Samurai Web Testing Framework (SamuraiWTF). You will be able to use this both in the class and after leaving and returning to your job.

SEC660: **Advanced Penetration Testing, Exploit Writing, and Ethical Hacking**

GXPN
Exploit Researcher & Advanced Pen Tester
giac.org/gxpn

6 Day Program	46 CPEs	Laptop Required

You Will Be Able To

- Perform fuzz testing to enhance your company's SDL process
- Exploit network devices and assess network application protocols
- Escape from restricted environments on Linux and Windows
- Test cryptographic implementations
- Model the techniques used by attackers to perform 0-day vulnerability discovery and exploit development
- Develop more accurate quantitative and qualitative risk assessments through validation
- Demonstrate the needs and effects of leveraging modern exploit mitigation controls
- Reverse-engineer vulnerable code to write custom exploits

Who Should Attend

- Network and systems penetration testers
- Incident handlers
- Application developers
- IDS engineers

This course is designed as a logical progression point for those who have completed SEC560: Network Penetration Testing and Ethical Hacking, or for those with existing penetration testing experience. Students with the prerequisite knowledge to take this course will walk through dozens of real-world attacks used by the most seasoned penetration testers. The methodology of a given attack is discussed, followed by exercises in a real-world lab environment to solidify advanced concepts and allow for the immediate application of techniques in the workplace. Each section includes a two-hour evening bootcamp to allow for additional mastery of the techniques discussed and even more hands-on exercises. A sample of topics covered includes weaponizing Python for penetration testers, attacks against network access control (NAC) and VLAN manipulation, network device exploitation, breaking out of Linux and Windows restricted environments, IPv6, Linux privilege escalation and exploit-writing, testing cryptographic implementations, fuzzing, defeating modern OS controls such as ASLR and DEP, return-oriented programming (ROP), Windows exploit-writing, and much more!

Attackers are becoming more clever and their attacks more complex. In order to keep up with the latest attack methods, you need a strong desire to learn, the support of others, and the opportunity to practice and build experience. SEC660 provides attendees with in-depth knowledge of the most prominent and powerful attack vectors and an environment to perform these attacks in numerous hands-on scenarios. This course goes far beyond simple scanning for low-hanging fruit, and shows penetration testers how to model the abilities of an advanced attacker to find significant flaws in a target environment and demonstrate the business risk associated with these flaws.

SEC660 starts off by introducing the advanced penetration concept, and provides an overview to help prepare students for what lies ahead. The focus of section one is on network attacks, an area often left untouched by testers. Topics include accessing, manipulating, and exploiting the network. Attacks are performed against NAC, VLANs, OSPF, 802.1X, CDP, IPv6, VOIP, SSL, ARP, SNMP, and others. Day two starts off with a technical module on performing penetration testing against various cryptographic implementations. The rest of the section is spent on network booting attacks, escaping Linux restricted environments such as chroot, and escaping Windows restricted desktop environments. Day three jumps into an introduction of Python for penetration testing, Scapy for packet crafting, product security testing, network and application fuzzing, and code coverage techniques. Days four and five are spent exploiting programs on the Linux and Windows operating systems. You will learn to identify privileged programs, redirect the execution of code, reverse-engineer programs to locate vulnerable code, obtain code execution for administrative shell access, and defeat modern operating system controls such as ASLR, canaries, and DEP using ROP and other techniques. Local and remote exploits, as well as client-side exploitation techniques, are covered. The final course section is dedicated to numerous penetration testing challenges requiring you to solve complex problems and capture flags.

Among the biggest benefits of SEC660 is the expert-level hands-on guidance provided through the labs and the additional time allotted each evening to reinforce daytime material and master the exercises.

***SEC660** is available via (subject to change):*

Live Training sans.org/events

Norfolk	Norfolk, VA	Mar 16-21
San Francisco Spring	San Francisco, CA	Mar 22-27
SANS 2020	**Orlando, FL**	**Apr 5-10**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Network Attacks for Penetration Testers

Day one serves as an advanced network attack module, building on knowledge gained from SEC560. The focus will be on obtaining access to the network; manipulating the network to gain an attack position for eavesdropping and attacks, and for exploiting network devices; leveraging weaknesses in network infrastructure; and taking advantage of client frailty.

Topics: Bypassing Network Admission Control; Impersonating Devices with Admission Control Policy Exceptions; Exploiting EAP-MD5 Authentication; Custom Network Protocol Manipulation with Ettercap and Custom Filters; Multiple Techniques for Gaining Man-in-the-Middle Network Access; Exploiting OSPF Authentication to Inject Malicious Routing Updates; Using Evilgrade to Attack Software Updates; Overcoming SSL Transport Encryption Security with Sslstrip; Remote Cisco Router Configuration File Retrieval; IPv6 for Penetration Testers

SECTION 2: Crypto and Post-Exploitation

Day two starts by taking a tactical look at techniques penetration testers can use to investigate and exploit common cryptography mistakes. We finish the module with lab exercises that allow you to practice your new-found crypto attack skill set against reproduced real-world application vulnerabilities.

Topics: Pen Testing Cryptographic Implementations; Exploiting CBC Bit Flipping Vulnerabilities; Exploiting Hash Length Extension Vulnerabilities; PowerShell Essentials; Enterprise PowerShell; Post-Exploitation with PowerShell and Metasploit; Escaping Software Restrictions; Two-hour Evening Capture-the-Flag Exercise Using PXE, Network Attacks, and Local Privilege Escalation

SECTION 3: Python, Scapy, and Fuzzing

Day three starts with a focus on how to leverage Python as a penetration tester. It is designed to help people unfamiliar with Python start modifying scripts to add to their own functionality while helping seasoned Python scripters improve their skills. Once we leverage the Python skills in creative lab exercises, we move on to leveraging Scapy for custom network targeting and protocol manipulation. Using Scapy, we examine techniques for transmitting and receiving network traffic beyond what canned tools can accomplish, including IPv6.

Topics: Becoming Familiar with Python Types; Leveraging Python Modules for Real-World Pen Tester Tasks; Manipulating Stateful Protocols with Scapy; Using Scapy to Create a Custom Wireless Data Leakage Tool; Product Security Testing; Using Taof for Quick Protocol Mutation Fuzzing; Optimizing Your Fuzzing Time with Smart Target Selection; Automating Target Monitoring While Fuzzing with Sulley; Leveraging Microsoft Word Macros for Fuzzing .docx files; Block-Based Code Coverage Techniques Using Paimei

SECTION 4: Exploiting Linux for Penetration Testers

Day four begins by walking through memory from an exploitation perspective as well as introducing x86 assembler and linking and loading. Processor registers are directly manipulated by testers and must be intimately understood. Disassembly is a critical piece of testing and will be used throughout the remainder of the course. We will take a look at the Linux OS from an exploitation perspective and discuss the topic of privilege escalation.

Topics: Stack and Dynamic Memory Management and Allocation on the Linux OS; Disassembling a Binary and Analyzing x86 Assembly Code; Performing Symbol Resolution on the Linux OS; Identifying Vulnerable Programs; Code Execution Redirection and Memory Leaks; Return-Oriented Programming (ROP); Identifying and Analyzing Stack-Based Overflows on the Linux OS; Performing Return-to-libc (ret2libc) Attacks on the Stack; Defeating Stack Protection on the Linux OS; Defeating ASLR on the Linux OS

SECTION 5: Exploiting Windows for Penetration Testers

In section five we start with covering the OS security features (ALSR, DEP, etc.) added to the Windows OS over the years, as well as Windows-specific constructs, such as the process environment block (PEB), structured exception handling (SEH), thread information block (TIB), and the Windows API. Differences between Linux and Windows will be covered. These topics are critical in assessing Windows-based applications. We then focus on stack-based attacks against programs running on the Windows OS.

Topics: The State of Windows OS Protections on Windows 7, 8, 10, Server 2008 and 2012; Understanding Common Windows Constructs; Stack Exploitation on Windows; Defeating OS Protections Added to Windows; Creating a Metasploit Module; Advanced Stack-Smashing on Windows; Using ROP; Building ROP Chains to Defeat DEP and Bypass ASLR; Windows 7 and 8; Porting Metasploit Modules; Client-side Exploitation; Windows Shellcode

SECTION 6: Capture-the-Flag Challenge

This section will serve as a real-world challenge for students by requiring them to utilize skills they have learned throughout the course, think outside the box, and solve a range of problems from simple to complex. A web server scoring system and Capture-the-Flag engine will be provided to score students as they capture flags. More difficult challenges will be worth more points. In this offensive exercise, challenges range from local privilege escalation to remote exploitation on both Linux and Windows systems, as well as networking attacks and other challenges related to the course material.

"SEC660 is the right balance between theory and practice; it's hands-on, not too hard, but also not too easy."

— Anton Ebertzeder, **Siemens AG**

SEC760: **Advanced Exploit Development for Penetration Testers**

6 Day Program	46 CPEs	Laptop Required

You Will Be Able To

- Discover zero-day vulnerabilities in programs running on fully-patched modern operating systems
- Create exploits to take advantage of vulnerabilities through a detailed penetration testing process
- Use the advanced features of IDA Pro and write your own IDC and IDA Python scripts
- Perform remote debugging of Linux and Windows applications
- Understand and exploit Linux heap overflows
- Write Return-Oriented Shellcode
- Perform patch diffing against programs, libraries, and drivers to find patched vulnerabilities
- Perform Windows heap overflows and use-after-free attacks
- Use precision heap sprays to improve exploitability
- Perform Windows Kernel debugging up through Windows 8 64-bit
- Jump into Windows kernel exploitation

Vulnerabilities in modern operating systems such as Microsoft Windows 7/8, Server 2012, and the latest Linux distributions are often very complex and subtle. Yet these vulnerabilities could expose organizations to significant attacks, undermining their defenses when attacked by very skilled adversaries. Few security professionals have the skill set to discover let alone even understand at a fundamental level why the vulnerability exists and how to write an exploit to compromise it. Conversely, attackers must maintain this skill set regardless of the increased complexity. SEC760: Advanced Exploit Development for Penetration Testers, the SANS Institute's only 700-level course, teaches the skills required to reverse-engineer 32- and 64-bit applications, perform remote user application and kernel debugging, analyze patches for one-day exploits, and write complex exploits, such as use-after-free attacks, against modern software and operating systems.

Some of the skills you will learn in SEC760 include:

- How to write modern exploits against the Windows 7/8/10 operating systems
- How to perform complex attacks such as use-after-free, Kernel exploit techniques, one-day exploitation through patch analysis, and other advanced topics
- How to utilize a Security Development Lifecycle (SDL) or Secure SDLC, along with Threat Modeling
- How to effectively utilize various debuggers and plug-ins to improve vulnerability research and speed
- How to deal with modern exploit mitigation controls aimed at thwarting success and defeating determination

Course Author Statement

"As a perpetual student of information security, I am excited to offer SEC760: Advanced Exploit Writing for Penetration Testers. Exploit development is a hot topic as of late and will continue to increase in importance moving forward. With all of the modern exploit mitigation controls offered by operating systems such as Windows 7 and 8, the number of experts with the skills to produce working exploits is highly limited. More and more companies are looking to hire professionals with the ability to conduct a Secure-SDLC process, perform threat modeling, determine if vulnerabilities are exploitable, and carry out security research. This course was written to help you get into these highly sought-after positions and to teach you cutting-edge tricks to thoroughly evaluate a target, providing you with the skills to improve your exploit development."
— Stephen Sims

***SEC760** is available via (subject to change):*

Live Training sans.org/events

SANS 2020	**Orlando, FL**	**Apr 5-10**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Section Descriptions

SECTION 1: Threat Modeling, Reversing and Debugging with IDA

Many penetration testers, incident handlers, developers, and other related professionals lack reverse-engineering and debugging skills. These are different skills than reverse-engineering malicious software. As part of the Security Development Lifecycle (SDL) and Secure-SDLC, developers and exploit writers should have experience using IDA Pro to debug and reverse their code when finding bugs or when identifying potential risks after static code analysis or fuzzing.

Topics: Security Development Lifecycle; Threat Modeling; Why IDA Is the #1 Tool for Reverse Engineering; IDA Navigation; IDA Python and the IDA IDC; IDA Plug-ins and Extensibility; Local Application Debugging with IDA; Remote Application Debugging with IDA

SECTION 2: Advanced Linux Exploitation

The ability to progress into more advanced reversing and exploitation requires an expert-level understanding of basic software vulnerabilities, such as those covered in SEC660. Heap overflows serve as a rite of passage into modern exploitation techniques. This section is aimed at bridging this gap of knowledge in order to inspire thinking in a more abstract manner, necessary for continuing further with the course. Linux can sometimes be an easier operating system to learn these techniques, serving as a productive gateway into Windows.

Topics: Linux Heap Management, Constructs, and Environment; Navigating the Heap; Abusing Macros such as unlink() and frontlink(); Function Pointer Overwrites; Format String Exploitation; Abusing Custom Doubly-Linked Lists; Defeating Linux Exploit Mitigation Controls; Using IDA for Linux Application Exploitation; Using Format String Bugs for ASLR Bypass

SECTION 3: Patch Diffing, One-Day Exploits, and Return-Oriented Shellcode

Attackers often download patches as soon as they are distributed by vendors such as Microsoft in order to find newly patched vulnerabilities. Vulnerabilities are usually disclosed privately, or even discovered in-house, allowing the vendor to more silently patch the vulnerability. This also allows the vendor to release limited or even no details at all about a patched vulnerability. Attackers are well aware of this and quickly work to find the patched vulnerability in order to take control of unpatched systems. This technique is also used by incident handlers, IDS administrators and vendors, vulnerability and penetration testing framework companies, government entities, and others. You will use the material covered in this section to identify bugs patched by vendors and take them through to exploitation.

Topics: The Microsoft Patch Management Process and Patch Tuesday; Obtaining Patches and Patch Extraction; Binary Diffing with BinDiff, patchdiff2, turbodiff, and DarunGrim4; Visualizing Code Changes and Identifying Fixes; Reversing 32-bit and 64-bit Applications and Modules; Triggering Patched Vulnerabilities; Writing One-Day Exploits; Handling Modern Exploit Mitigation Controls; Using ROP to Compiled Shellcode on the Fly (Return-Oriented Shellcode)

SECTION 4: Windows Kernel Debugging and Exploitation

The Windows Kernel is very complex and intimidating. This course section aims to help you understand the Windows Kernel and the various exploit mitigations added into recent versions. You will perform Kernel debugging on various versions of the Windows OS, such as Windows 7 and 8, and learn to deal with its inherent complexities. Exercises will be performed to analyze vulnerabilities, look at exploitation techniques, and get a working exploit.

Topics: Understanding the Windows Kernel; Navigating the Windows Kernel; Modern Kernel Protections; Debugging the Windows 7/8 Kernels and Drivers; WinDbg; Analyzing Kernel Vulnerabilities and Kernel Vulnerability Types; Kernel Exploitation Techniques; Token Stealing and HAL Dispatch Table Overwrites

SECTION 5: Windows Heap Overflows and Client-Side Exploitation

The focus of this section is primarily on Windows browser and client-side exploitation. You will learn to analyze C++ vftable overflows, one of the most common mechanisms used to compromise a modern Windows system. Many of these vulnerabilities are discovered in the browser, so browser techniques will also be taught, including modern heap spraying to deal with Internet Explorer 8/9/10 and other browsers such as FireFox and Chrome. You will work towards writing exploits in the Use-After-Free/Dangling Pointer vulnerability class.

Topics: Windows Heap Management, Constructs, and Environment; Understanding the Low Fragmentation Heap (LFH); Browser-based and Client-side Exploitation; Remedial Heap Spraying; Understanding C++ vftable/vtable Behavior; Modern Heap Spraying to Determine Address Predictability; Use-after-free Attacks and Dangling Pointers; Using Custom Flash Objects to Bypass ASLR; Defeating ASLR, DEP, and Other Common Exploit Mitigation Controls

SECTION 6: Capture-the-Flag Challenge

Section 6 will feature a Capture-the-Flag event with different types of challenges taken from material taught throughout the week.

Who Should Attend

- Senior network and system penetration testers
- Secure application developers (C and C++)
- Reverse-engineering professionals
- Senior incident handlers
- Senior threat analysts
- Vulnerability researchers
- Security researchers

"SEC760 is the challenge I am looking for. It will be overwhelming, but well worth it."

— William Stott, **Raytheon**

"SEC760 is a kind of training we could not get anywhere else. It is not a theory, we got to implement and to exploit everything we learned."

— Jenny Kitaichit, **Intel**

FOR508: **Advanced Incident Response, Threat Hunting, and Digital Forensics**

GCFA
Forensic Analyst
giac.org/gcfa

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Learn and master the tools, techniques, and procedures necessary to effectively hunt, detect, and contain a variety of adversaries and to remediate incidents
- Detect and hunt unknown live, dormant, and custom malware in memory across multiple Windows systems in an enterprise environment
- Hunt through and perform incident response across hundreds of unique systems simultaneously using F-Response Enterprise and the SIFT Workstation
- Identify and track malware beaconing outbound to its command and control (C2) channel via memory forensics, registry analysis, and network connection residue
- Determine how the breach occurred by identifying the beachhead and spear phishing attack mechanisms
- Target advanced adversary anti-forensics techniques like hidden and time-stomped malware, along with utility-ware used to move in the network and maintain an attacker's presence
- Use memory analysis, incident response, and threat hunting tools in the SIFT Workstation to detect hidden processes, malware, attacker command lines, rootkits, network connections, and more
- Track user and attacker activity second-by-second on the system you are analyzing through in-depth timeline and super-timeline analysis
- Recover data cleared using anti-forensics techniques via Volume Shadow Copy and Restore Point analysis
- Identify lateral movement and pivots within your enterprise, showing how attackers transition from system to system without detection

ADVANCED THREATS ARE IN YOUR NETWORK – IT'S TIME TO GO HUNTING!

FOR508: Advanced Incident Response, Threat Hunting, and Digital Forensics will help you to:

- Detect how and when a breach occurred
- Identify compromised and affected systems
- Determine what attackers took or changed
- Contain and remediate incidents
- Develop key sources of threat intelligence
- Hunt down additional breaches using knowledge of the adversary

DAY 0: A 3-letter government agency contacts you to say an advanced threat group is targeting organizations like yours, and that your organization is likely a target. They won't tell how they know, but they suspect that there are already several breached systems within your enterprise. An advanced persistent threat, aka an APT, is likely involved. This is the most sophisticated threat that you are likely to face in your efforts to defend your systems and data, and these adversaries may have been actively rummaging through your network undetected for months or even years.

This is a hypothetical situation, but the chances are very high that hidden threats already exist inside your organization's networks. Organizations can't afford to believe that their security measures are perfect and impenetrable, no matter how thorough their security precautions might be. Prevention systems alone are insufficient to counter focused human adversaries who know how to get around most security and monitoring tools.

The key is to constantly look for attacks that get past security systems, and to catch intrusions in progress, rather than after attackers have completed their objectives and done significant damage to the organization. For the incident responder, this process is known as "threat hunting," which uses known adversary behaviors to proactively examine the network and endpoints in order to identify new data breaches.

Threat hunting and Incident response tactics and procedures have evolved rapidly over the past several years. Your team can no longer afford to use antiquated incident response and threat hunting techniques that fail to properly identify compromised systems, provide ineffective containment of the breach, and ultimately fail to rapidly remediate the incident. Incident response and threat hunting teams are the keys to identifying and observing malware indicators and patterns of activity in order to generate accurate threat intelligence that can be used to detect current and future intrusions

GATHER YOUR INCIDENT RESPONSE TEAM – IT'S TIME TO GO HUNTING!

"FOR508 analyzes Advanced Persistent Threat samples that are affecting our industry today. This training can't get any better!"

— Neel Mehta, **Chevron**

***FOR508** is available via (subject to change):*

Live Training sans.org/events

Austin Winter	Austin, TX	Jan 6-11
San Francisco East Bay	Emeryville, CA	Jan 27 - Feb 1
Security East	**New Orleans, LA**	**Feb 3-8**
New York City Winter	New York City, NY	Feb 10-15
St. Louis	St. Louis, MO	Mar 8-13
Norfolk	Norfolk, VA	Mar 16-21
Seattle Spring	Seattle, WA	Mar 23-28
SANS 2020	**Orlando, FL**	**Apr 5-10**
Bethesda	Bethesda, MD	Apr 14-19
Security West	**San Diego, CA**	**May 8-13**
San Antonio	San Antonio, TX	May 17-22
Atlanta Spring	Atlanta, GA	May 26-31
New Orleans	New Orleans, LA	Jun 8-13
Las Vegas Spring	Las Vegas, NV	Jun 8-13
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Cyber Threat Intelligence	Washington, DC	Jan 22-27

Section Descriptions

Course Preview available at: **sans.org/demo**

SECTION 1: Advanced Incident Response and Threat Hunting

Incident responders and threat hunters should be armed with the latest tools, memory analysis techniques, and enterprise methodologies to identify, track, and contain advanced adversaries and to remediate incidents. Incident response and threat hunting analysts must be able to scale their analysis across thousands of systems in their enterprise. This section examines the six-step incident response methodology as it applies to incident response for advanced threat groups. We will show the importance of developing cyber threat intelligence to impact the adversaries' "kill chain" and demonstrate live response techniques and tactics that can be applied to a single system and across the entire enterprise.

Topics: Real Incident Response Tactics; Threat Hunting; Threat Hunting in the Enterprise; Incident Response and Hunting across Endpoints; Malware Defense Evasion and Identification; Malware Persistence Identification; Investigating WMI-Based Attacks

SECTION 2: Intrusion Analysis

Cyber defenders have a wide variety of tools and artifacts available to identify, hunt, and track adversary activity in a network. Each attacker action leaves a corresponding artifact, and understanding what is left behind as footprints can be critical to both red and blue team members. Attacks follow a predictable pattern, and we focus our detective efforts on immutable portions of that pattern. As an example, at some point attackers will need to run code to accomplish their objectives. We can identify this activity via application execution artifacts. Attackers will also need one or more accounts to run code. Consequently, account auditing is a powerful means of identifying malicious actions. Attackers also need a means to move throughout the network, so we look for artifacts left by the relatively small number of ways there are to accomplish this part of their mission. In this section, we cover common attacker tradecraft and discuss the various data sources and forensic tools you can use to identify malicious activity in the enterprise.

Topics: Stealing and Utilization of Legitimate Credentials; Advanced Evidence of Execution Detection; Lateral Movement Adversary Tactics, Techniques, and Procedures (TTPs); Log Analysis for Incident Responders and Hunters

Who Should Attend

- Incident response team members
- Threat hunters
- Security Operations Center analysts
- Experienced digital forensic analysts
- Information security professionals
- Federal agents and law enforcement personnel
- Red team members, penetration testers, and exploit developers
- SANS FOR500 and SEC504 graduates

SECTION 3: Memory Forensics in Incident Response and Threat Hunting

Now a critical component of many incident response and threat hunting teams that regularly detect advanced adversaries in their organization, memory forensics has come a long way in just a few years. Memory forensics can be extraordinarily effective at finding evidence of worms, rootkits, PowerShell, and advanced malware used by APT attackers. In fact, some attacks may be nearly impossible to unravel without memory analysis. Memory analysis was traditionally the domain of Windows internals experts, but the recent development of new tools and techniques makes it accessible today to all investigators, incident responders, and threat hunters. Better tools, interfaces and detection heuristics have greatly leveled the playing field. Understanding attack patterns in memory is a core analyst skill applicable across a wide range of endpoint detection and response products. This extremely popular section will cover many of the most powerful memory analysis capabilities available and give you a solid foundation of advanced memory forensic skills to super-charge investigations, regardless of the toolset employed.

Topics: Remote and Enterprise Incident Response; Triage and Enpoint Detection and Reponse; Memory Acquisition; Memory Forensics Analysis Process for Response and Hunting; Memory Forensics Examinations; Memory Analysis Tools

SECTION 4: Timeline Analysis

Learn advanced incident response and hunting techniques uncovered via timeline analysis directly from the authors who pioneered timeline analysis tradecraft. Temporal data are located everywhere on a computer system. Filesystem modified/access/creation/change times, log files, network data, registry data, and Internet history files all contain time data that can be correlated into critical analysis to successfully solve cases. Pioneered by Rob Lee in 2001, timeline analysis has become a critical incident response, hunting, and forensics technique. New timeline analysis frameworks provide the means to conduct simultaneous examinations of a multitude of time-based artifacts. The analysis that once took days now takes minutes. This section will step you through the two primary methods of building and analyzing timelines created during advanced incident response, threat hunting, and forensic cases. Exercises will show analysts how to create a timeline and also how to introduce the key methods to help you use those timelines effectively in your cases.

Topics: Timeline Analysis Overview; Memory Analysis Timeline Creation; Filesystem Timeline Creation and Analysis; Super Timeline Creation and Analysis

SECTION 5: Incident Response & Hunting Across the Enterprise – Advanced Adversary and Anti-Forensics Detection

Over the years, we have observed that many incident responders and threat hunters have a challenging time finding threats without pre-built indicators of compromise or threat intelligence gathered before a breach. This is especially true in APT adversary intrusions. This advanced session will demonstrate techniques used by first responders to identify malware or forensic artifacts when very little information exists about their capabilities or hidden locations. We will discuss techniques to help funnel possibilities down to the candidates most likely to be evil malware trying to hide on the system.

Topics: Cyber Threat Intelligence; Malware and Anti-Forensic Detection; Anti-Forensic Detection Methodologies; Identifying Compromised Hosts without Active Malware

SECTION 6: The APT Threat Group Incident Response Challenge

This incredibly rich and realistic enterprise intrusion exercise is based on a real-world advanced persistent threat (APT) group. It brings together techniques learned earlier in the week and tests your newly acquired skills in a case that simulates an attack by an advanced adversary. The challenge brings it all together using a real intrusion into a complete Windows enterprise environment. You will be asked to uncover how the systems were compromised in the initial intrusion, find other systems the adversary moved to laterally, and identify intellectual property stolen via data exfiltration. You will walk out of the course with hands-on experience investigating realistic attacks, curated by a cadre of instructors with decades of experience fighting advanced threats from attackers ranging from nation-states to financial crime syndicates and hactivist groups.

Topics: Identification and Scoping; Containment and Threat Intelligence Gathering; Remediation and Recovery

Community Events

Scottsdale, AZ . . . . . Feb 24-29

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training . . . . . Feb 3-8

Online Training . . . . . Apr 14-19

Online Training . . . . . May 8-13

FOR572: Advanced Network Forensics: Threat Hunting, Analysis, and Incident Response

GNFA
Network Forensic Analyst
giac.org/gnfa

6 Day Program | 36 CPEs | Laptop Required

You Will Be Able To

- Extract files from network packet captures and proxy cache files, allowing for follow-on malware analysis or definitive data loss determination
- Use historical NetFlow data to identify relevant past network occurrences, allowing for accurate incident scoping
- Reverse-engineer custom network protocols to identify an attacker's command-and-control abilities and actions
- Decrypt captured SSL traffic to identify attackers' actions and what data they extracted from the victim
- Use data from typical network protocols to increase the fidelity of the investigation's findings
- Identify opportunities to collect additional evidence based on the existing systems and platforms within a network architecture
- Examine traffic using common network protocols to identify patterns of activity or specific actions that warrant further investigation
- Incorporate log data into a comprehensive analytic process, filling knowledge gaps that may be far in the past
- Learn how attackers leverage man-in-the-middle tools to intercept seemingly secure communications
- Examine proprietary network protocols to determine what actions occurred on the endpoint systems
- Analyze wireless network traffic to find evidence of malicious activity
- Learn how to modify configuration on typical network devices such as firewalls and intrusion detection systems to increase the intelligence value of their logs and alerts during an investigation

Take your system-based forensic knowledge onto the wire. Incorporate network evidence into your investigations, provide better findings, and get the job done faster.

It is exceedingly rare to work any forensic investigation that doesn't have a network component. Endpoint forensics will always be a critical and foundational skill for this career, but overlooking a perpetrator's network communications is akin to ignoring security camera footage of a crime as it was committed. Whether you handle an intrusion incident, data theft case, or employee misuse scenario, or are engaged in proactive adversary discovery, the network often provides an unparalleled view of the incident. Its evidence can provide the proof necessary to show intent, uncover attackers that have been active for months or longer, or even prove useful in definitively proving a crime actually occurred.

FOR572 was designed to cover the most critical skills needed for the increased focus on network communications and artifacts in today's investigative work, including numerous use cases. Many investigative teams are incorporating proactive threat hunting into their skills. This involves using existing evidence along with newly-acquired threat intelligence to uncover evidence of previously-unidentified incidents. Other teams focus on post-incident investigations and reporting. Still others engage with an adversary in real time, seeking to contain and eradicate the attacker from the victim's environment. In these situations and more, the artifacts left behind from attackers' communications can provide an invaluable view into their intent, capabilities, successes, and failures.

In FOR572, we focus on the knowledge necessary to examine and characterize communications that have occurred in the past or continue to occur. Even if the most skilled remote attacker compromised a system with an undetectable exploit, the system still has to communicate over the network. Without command-and-control and data extraction channels, the value of a compromised computer system drops to almost zero. Put another way: Bad guys are talking – we'll teach you to listen.

This course covers the tools, technology, and processes required to integrate network evidence sources into your investigations, with a focus on efficiency and effectiveness. You will leave this week with a well-stocked toolbox and the knowledge to use it on your first day back on the job. We will cover the full spectrum of network evidence, including high-level NetFlow analysis, low-level pcap-based dissection, ancillary network log examination, and more. We cover how to leverage existing infrastructure devices that may contain months or years of valuable evidence as well as how to place new collection platforms while an incident is under way.

FOR572 is truly an advanced course – we hit the ground running on day one. Bring your entire bag of skills: forensic techniques and methodologies, full-stake networking knowledge (from the wire all the way up to user-facing services), Linux shell utilities, and everything in between. They will all benefit you throughout the course material as you fight crime.

UNRAVEL INCIDENTS...ONE BYTE (OR PACKET) AT A TIME.

***FOR572** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-8**
Scottsdale	Scottsdale, AZ	Feb 17-22
Dallas	Dallas, TX	Mar 9-14
SANS 2020	**Orlando, FL**	**Apr 5-10**
Security West	**San Diego, CA**	**May 8-13**
Las Vegas Spring	Las Vegas, NV	Jun 8-13
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Cyber Threat Intelligence . . . . . Washington, DC . . . . . Jan 22-27

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Off the Disk and Onto the Wire

Although many fundamental network forensic concepts align with those of any other digital forensic investigation, the network presents many nuances that require special attention. Today you will learn how to apply what you already know about digital forensics and incident response to network-based evidence. You will also become acclimated to the basic tools of the trade.

Topics: Web Proxy Server Examination; Foundational Network Forensics Tools: tcpdump and Wireshark; Network Evidence Acquisition; Network Architectural Challenges and Opportunities

SECTION 2: Core Protocols & Log Aggregation/ Analysis

There are countless network protocols that may be in use in a production network environment. We will cover those that are most likely to benefit the forensicator in typical casework, as well as several that help demonstrate analysis methods useful when facing new, undocumented, or proprietary protocols. By learning the "typical" behaviors of these protocols, we can more readily identify anomalies that may suggest misuse of the protocol for nefarious purposes. These protocol artifacts and anomalies can be profiled through direct traffic analysis as well as through the log evidence created by systems that have control or visibility of that traffic. While this affords the investigator with vast opportunities to analyze the network traffic, efficient analysis of large quantities of source data generally requires tools and methods designed to scale.

Topics: Hypertext Transfer Protocol (HTTP): Protocol and Logs; Domain Name Service (DNS): Protocol and Logs; Firewall, Intrusion Detection System, and Network Security Monitoring Logs; Logging Protocol and Aggregation; Elastic Stack and the SOF-ELK Platform

SECTION 3: NetFlow and File Access Protocols

Network connection logging, commonly called NetFlow, may be the single most valuable source of evidence in network investigations. Many organizations have extensive archives of flow data due to its minimal storage requirements. Since NetFlow does not capture any content of the transmission, many legal issues with long-term retention are mitigated. Even without content, NetFlow provides an excellent means of guiding an investigation and characterizing an adversary's activities from pre-attack through operations. Whether within a victim's environment or for data exfiltration, adversaries must move their quarry around through the use of various file access protocols. By knowing some of the more common file access and transfer protocols, a forensicator can quickly identify an attacker's theft actions.

Topics: NetFlow Collection and Analysis; Open-Source Flow Tools; File Transfer Protocol (FTP); Microsoft Protocols

SECTION 4: Commercial Tools, Wireless, and Full-Packet Hunting

Commercial tools are a mainstay in the network forensicator's toolkit. We'll explore the various roles that commercial tools generally fill, as well as how they can be best integrated into an investigative workflow. With the runaway adoption of wireless networking, investigators must also be prepared to address the unique challenges this technology brings to the table. However, regardless of the protocol being examined or the budget used to perform the analysis, having a means of exploring full-packet capture is a necessity, and having a toolkit to perform this at scale is critical.

Topics: Simple Mail Transfer Protocol (SMTP); Commercial Network Forensics; Wireless Network Forensics; Automated Tools and Libraries; Full-Packet Hunting with Moloch

SECTION 5: Encryption, Protocol Reversing, OPSEC, and Intel

Advancements in common technology have made it easier to be a bad guy and harder for us to track them. Strong encryption methods are readily available and custom protocols are easy to develop and employ. Despite this, there are still weaknesses even in the most advanced adversaries' methods. As we learn what the attackers have deliberately hidden from us, we must operate carefully to avoid tipping our hats regarding the investigative progress – otherwise the attacker can quickly pivot, nullifying our progress.

Topics: Encoding, Encryption, and SSL/TLS; Meddler-in-the-Middle; Network Protocol Reverse Engineering; Investigation OPSEC and Threat Intel

SECTION 6: Network Forensics Capstone Challenge

This section will combine all of what you have learned prior to and during this week. In groups, you will examine network evidence from a real-world compromise by an advanced attacker. Each group will independently analyze data, form and develop hypotheses, and present findings. No evidence from endpoint systems is available – only the network and its infrastructure.

Topics: Network Forensic Case

Who Should Attend

- Incident response team members and forensicators
- Hunt team members
- Law enforcement officers, federal agents, and detectives
- Information security managers
- Network defenders
- IT professionals
- Network engineers
- Anyone interested in computer network intrusions and investigations
- Security Operations Center personnel and information security practitioners

"I love how this course is very well organized, and how the step-by-step walk-through of the lab allows even someone new to network forensics to get started right away."

— Paul Kim, **PWC**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Mar 9-14

Online Training. . . . . May 8-13

FOR500: **Windows Forensic Analysis**

GCFE
Forensic Examiner
giac.org/gcfe

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Perform proper Windows forensic analysis by applying key techniques focusing on Windows 7/8/10
- Use full-scale forensic tools and analysis methods to detail nearly every action a suspect accomplished on a Windows system, including who placed an artifact on the system and how, program execution, file/folder opening, geo-location, browser history, profile USB device usage, and more
- Uncover the exact time a specific user last executed a program through Registry and Windows artifact analysis, and understand how this information can be used to prove intent in cases such as intellectual property theft, hacker-breached systems, and traditional crimes
- Determine the number of times files have been opened by a suspect through browser forensics, shortcut file analysis (LNK), e-mail analysis, and Windows Registry parsing
- Identify keywords searched by a specific user on a Windows system in order to pinpoint the files and information the suspect was interested in finding and accomplish detailed damage assessments
- Use Windows shellbags analysis tools to articulate every folder and directory that a user opened up while browsing local, removable, and network drives
- Determine each time a unique and specific USB device was attached to the Windows system, the files and folders that were accessed on it, and who plugged it in by parsing key Windows artifacts such as the Registry and log files
- Use event log analysis techniques to determine when and how users logged into a Windows system, whether via a remote session, at the keyboard, or simply by unlocking a screensaver

MASTER WINDOWS FORENSICS – YOU CAN'T PROTECT WHAT YOU DON'T KNOW ABOUT

FOR500: Windows Forensic Analysis will teach you to:

- Conduct in-depth forensic analysis of Windows operating systems and media exploitation focusing on Windows 7, Windows 8/8.1, Windows 10, and Windows Server 2008/2012/2016
- Identify artifact and evidence locations to answer critical questions, including application execution, file access, data theft, external device usage, cloud services, geolocation, file download, anti-forensics, and detailed system usage
- Focus your capabilities on analysis instead of on how to use a particular tool
- Extract critical answers and build an in-house forensic capability via a variety of free, open-source, and commercial tools provided within the SANS Windows SIFT Workstation

All organizations must prepare for cyber-crime occurring on their computer systems and within their networks. Demand has never been greater for analysts who can investigate crimes such as fraud, insider threats, industrial espionage, employee misuse, and computer intrusions. Government agencies increasingly require trained media exploitation specialists to recover vital intelligence from Windows systems. To help solve these cases, SANS is training a new cadre of the world's best digital forensic professionals, incident responders, and media exploitation experts capable of piecing together what happened on computer systems second by second.

FOR500: Windows Forensic Analysis focuses on building in-depth digital forensics knowledge of Microsoft Windows operating systems. You can't protect what you don't know about, and understanding forensic capabilities and artifacts is a core component of information security. You will learn how to recover, analyze, and authenticate forensic data on Windows systems, track particular user activity on your network, and organize findings for use in incident response, internal investigations, and civil/criminal litigation. You will be able to use your new skills to validate security tools, enhance vulnerability assessments, identify insider threats, track hackers, and improve security policies. Whether you know it or not, Windows is silently recording an unbelievable amount of data about you and your users. FOR500 teaches you how to mine this mountain of data.

Proper analysis requires real data for students to examine. The completely updated FOR500 course trains digital forensic analysts through a series of new hands-on laboratory exercises that incorporate evidence found on the latest Microsoft technologies (Windows 7, Windows 8/8.1, Windows 10, Office and Office365, Cloud Storage, SharePoint, Exchange, Outlook). Students leave the course armed with the latest tools and techniques and prepared to investigate even the most complicated systems they might encounter. Nothing is left out – attendees learn to analyze everything from legacy Windows 7 systems to just-discovered Windows 10 artifacts.

"I have gained so much insight taking this course and can't wait to apply these skills!"

— Dylan Ong, **Stroz Friedberg**

***FOR500** is available via (subject to change):*

Live Training sans.org/events

Miami ..... Miami, FL ..... Jan 13-18	San Francisco Spring ... San Francisco, CA ..... Mar 16-21	Chicago Spring ..... Chicago, IL ..... Jun 1-6
Security East ..... New Orleans, LA ..... Feb 3-8	**SANS 2020 ..... Orlando, FL ..... Apr 5-10**	**SANSFIRE ..... Washington, DC ..... Jun 15-20**
Scottsdale ..... Scottsdale, AZ ..... Feb 17-22	Baltimore Spring ..... Baltimore, MD ... Apr 27 - May 2	Pittsburgh ..... Pittsburgh, PA ..... Jun 22-27
N. VA – Reston Spring .. Reston, VA ..... Mar 2-7	**Security West ..... San Diego, CA ..... May 8-13**	
Dallas ..... Dallas, TX ..... Mar 9-14	N. VA – Alexandria ..... Alexandria, VA ..... May 17-22	

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Windows Digital Forensics and Advanced Data Triage

The Windows forensics course starts with an examination of digital forensics in today's interconnected environments and discusses challenges associated with mobile devices, tablets, cloud storage, and modern Windows operating systems. We will discuss how modern hard drives, such as Solid State Devices (SSD), can affect the digital forensics acquisition process and how analysts need to adapt to overcome the introduction of these new technologies.

Topics: Windows Operating System Components; Core Forensic Principles; Live Response and Triage-Based Acquisition Techniques; Acquisition Review with Write Blocker; Advanced Acquisition Challenges; Windows Image Mounting and Examination; NTFS File System Overview; Document and File Metadata; File Carving; Custom Carving Signatures; Memory, Pagefile, and Unallocated Space Analysis

SECTION 2: Core Windows Forensics Part 1 – Windows Registry Forensics and Analysis

Our journey continues with the Windows Registry, where the digital forensic investigator will learn how to discover critical user and system information pertinent to almost any investigation. Each examiner will learn how to navigate and examine the Registry to obtain user-profile data and system data. The course teaches forensic investigators how to prove that a specific user performed key word searches, ran specific programs, opened and saved files, perused folders, and used removable devices. Throughout the section, investigators will use their skills in a real hands-on case, exploring and analyzing the evidence.

Topics: Registry Basics; Profile Users and Groups; Core System Information; User Forensic Data; Tools Utilized

SECTION 3: Core Windows Forensics Part 2 – USB Devices and Shell Items

Being able to show the first and last time a file or folder was opened is a critical analysis skill. Utilizing shortcut (LNK), jump list, and Shellbag databases through the examination of Shell Items, we can quickly pinpoint which file or folder was opened and when. The knowledge obtained by examining Shell Items, is crucial in tracking user activity in intellectual property theft cases internally or in tracking hackers. Removable storage device investigations are often an essential part of performing digital forensics. We will show you how to perform in-depth USB device examinations on Windows 7, 8/8.1, and 10. You will learn how to determine when a storage device was first and last plugged in, its vendor/make/model, and even the unique serial number of the device used.

Topics: Shell Item Forensics; USB and Bring Your Own Device (BYOD) Forensic Examinations

SECTION 4: Core Windows Forensics Part 3 – Email, Key Additional Artifacts, and Event Logs

Depending on the type of investigation and authorization, a wealth of evidence can be unearthed through the analysis of email files. Recovered email can bring excellent corroborating information to an investigation, and its informality often provides very incriminating evidence. It is common for users to have an email that exists locally on their workstation, on their company email server, in a private cloud, and in multiple webmail accounts. Windows event log analysis has solved more cases than possibly any other type of analysis. Understanding the locations and content of these files is crucial to the success of any investigator. Many researchers overlook these records because they do not have adequate knowledge or tools to get the job done efficiently. This section arms each investigator with the core knowledge and capability to maintain this crucial skill for many years to come.

Topics: Email Forensics; Forensicating Additional Windows OS Artifacts; Windows Event Log Analysis

SECTION 5: Core Windows Forensics Part 4 – Web Browser Forensics: Firefox, Internet Explorer, and Chrome

With the increasing use of the web and the shift toward web-based applications and cloud computing, browser forensic analysis has become a critical skill. During this section, the investigator will comprehensively explore web browser evidence created during the use of Internet Explorer, Edge, Firefox, and Google Chrome. The analyst will learn how to examine every significant artifact stored by the browser and how to analyze some of the more obscure (and powerful) browser artifacts, such as session restore, tracking cookies, zoom levels, predictive site prefetching, and private browsing remnants.

Topics: Browser Forensics: History, Cache, Searches, Downloads, Understanding Browser Timestamps, Internet Explorer; Edge; Firefox; Chrome; Examining of Browser Artifacts; Tools Used

SECTION 6: Windows Forensic Challenge

This complex case will involve an investigation into one of the most recent versions of the Windows Operating System. The evidence is real and provides the most realistic training opportunity currently available. Solving the case will require that students use all of the skills gained from each of the previous sections.

Topics: Digital Forensic Case; Windows 10 Forensic Challenge

Who Should Attend

- Information security professionals
- Incident response team members
- Law enforcement officers, federal agents, and detectives
- Media exploitation analysts
- Anyone interested in a deep understanding of Windows forensics

"Anyone involved in digital investigations needs to take this class! It covers or touches upon almost every aspect of Windows forensic investigations in a very short period of time."

— Cy Bleistine, **NJSP**

Community Events

San Francisco, CA. . . . . Jan 27 - Feb 1

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Jan 13-18

Online Training. . . . . Mar 9-14

Online Training. . . . . May 8-13

FOR498: **Battlefield Forensics & Data Acquisition** NEW

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Learn and master the tools, techniques, and procedures necessary to effectively locate, identify, and collect data no matter where they are stored
- Handle and process a scene properly to maintain evidentiary integrity
- Perform data acquisition from at-rest storage, including both spinning media and solid-state storage
- Identify the numerous places that data for an investigation might exist
- Perform Battlefield Forensics by going from evidence seizure to actionable intelligence in 90 minutes or less
- Assist in preparing the documentation necessary to communicate with online entities such as Google, Facebook, Microsoft, etc.
- Understand the concepts and usage of large-volume storage technologies, including JBOD, RAID storage, NAS devices, and other large-scale, network addressable storage
- Identify and collect user data within large corporate environments where they are accessed using SMB
- Gather volatile data such as a computer system's RAM
- Recover and properly preserve digital evidence on cellular and other portable devices
- Address the proper collection and preservation of data on devices such as Microsoft Surface/Surface Pro, where hard-drive removal is not an option
- Address the proper collection and preservation of data on Apple devices such as MacBook, MacBook Air, and MacBook Pro, where hard-drive removal is not an option
- Properly collect and effectively target email from Exchange servers, avoiding the old-school method of full acquisition and subsequent onerous data culling
- Properly collect data from SharePoint repositories
- Access and acquire online mail stores such as Gmail, Hotmail, and Yahoo Mail accounts

THE CLOCK IS TICKING. YOU NEED TO PRIORITIZE THE MOST VALUABLE EVIDENCE FOR PROCESSING. LET US SHOW YOU HOW!

FOR498: Battlefield Forensics & Acquisition will help you to:

- Acquire data effectively from:
  - PCs, Microsoft Surface, and Tablet PCs
  - Apple Devices, and Mac, and Macbooks
  - RAM and memory
  - Smartphones and portable mobile devices
  - Cloud storage and services
  - Network storage repositories
- Produce actionable intelligence in 90 minutes or less

The first step in any investigation is the gathering of evidence. Digital forensic investigations are no different. The evidence used in this type of investigation is data, and these data can live in many varied formats and locations. You must be able to first identify the data that you might need, determine where those data reside, and, finally, formulate a plan and procedures for collecting those data. With digital forensic acquisitions, you will typically have only one chance to collect data properly. If you manage the acquisition incorrectly, you run the risk of not only damaging the investigation, but more importantly, destroying the very data that could have been used as evidence.

With the wide range of storage media in the marketplace today, any kind of standardized methodology for all media is simply untenable. Many mistakes are being made in digital evidence collection, and this can cause the guilty to go free and, more importantly, the innocent to be incarcerated. The disposition of millions and millions of dollars can rest within the bits and bytes that you are tasked with properly collecting and interpreting. An examiner can no longer rely on "dead box" imaging of a single hard drive. In today's cyber sphere, many people utilize a desktop, laptop, tablet, and cellular phone within the course of a normal day. Compounding this issue is the expanding use of cloud storage and providers, and the proper collection of data from all these domains can become quite overwhelming.

This in-depth digital acquisition and data handling course will provide first responders and investigators alike with the advanced skills necessary to properly respond to, identify, collect, and preserve data from a wide range of storage devices and repositories, ensuring that the integrity of the evidence is beyond reproach. Constantly updated, FOR498 addresses today's need for widespread knowledge and understanding of the challenges and techniques that investigators require when addressing real-world cases.

Numerous hands-on labs throughout the course will give first responders, investigators, and digital forensics teams practical experience needed when performing digital acquisition from hard drives, memory sticks, cellular phones, network storage areas, and everything in between. During a digital forensics response and investigation, an organization needs the most skilled responders possible, lest the investigation end before it has begun. FOR498: Battlefield Forensics & Acquisition will train you and your team to identify, collect, preserve and respond to data no matter where those data hide or reside.

***FOR498** is available via (subject to change):*

Live Training sans.org/events

Minneapolis . . . . . Minneapolis, MN . . . . . Apr 14-19

SANSFIRE . . . . . **Washington, DC** . . . . . **Jun 15-20**

Summit Events

Cyber Threat Intelligence . . . . . Washington, DC . . . . . Jan 22-27

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Section Descriptions

SECTION 1: Evidence File Quick Wins and Dealing with Smartphones

Investigators will often be responding in high-stress environments where many different entities are critically scrutinizing the collection process. Personnel need to be properly trained and equipped to work in less than optimal surroundings, and be confident that they have managed the scene, identified all necessary data, collected the data in a properly defensible manner, and maintained their integrity. One of the most common scenarios that can cause headaches is receiving an evidence file (usually an E01), and being expected to provide answers immediately. The common approach is to mount the image and then start running carving and other tools against it. These automated tasks can take many hours (and sometimes days) just by themselves! Portable devices bring their own set of challenges to the table. These devices are more ubiquitous than computers. Seldom is the case today that does not include a cellular device. Unfortunately, there is no standard for the cellular operating systems. Even within brands, there can be vastly different data storage. Today will introduce the student to several devices and the tools that will acquire them.

SECTION 2: Evidence Acquisition and Collection

Investigators and first responders should be armed with the latest tools, digital container access techniques, and enterprise methodologies to identify, access, and preserve evidence across a vast range of devices and repositories. Personnel must also be able to scale their identification and collection across thousands of systems in their enterprise. Enterprise and cloud storage collection techniques are now a requirement to track activity that has been intentionally and unintentionally spread across many devices. Responding to these many systems cannot be accomplished using the standard "pull the hard drive" forensic examination methodology. Such an approach will cause frustration and result in lost opportunities due to the time it takes to forensically image entire hard drives. Furthermore, investigators need actionable intelligence as quickly and responsibly as possible. This section lays the foundation for evidence collection, from initial arrival on a scene to the fundamentals of understanding data at rest and properly identifying devices, interfaces, and tools that will be necessary to affect a successful collection. This course section will explore the myriad of acquisition hardware and software, not to mention adapters and identification, so we can make the best decisions about the data.

Who Should Attend

- Federal agents and law enforcement personnel
- First responders
- Digital forensic analysts
- Information security professionals
- Incident response team members
- Media exploitation analysts
- Department of Defense and intelligence community professionals
- Anyone interested in an understanding of the proper preservation of systems

"This course showed some useful info that I wasn't aware of previously, i.e., RAID acquisition, tool usage, and data recovery."

— Nina Turner, **Travelers**

SECTION 3: Quick Win Forensics

Given that 99% of the necessary evidence typically will exist in 1-2% of the data acquired, it is easy to see how a great deal of time can be wasted following the normal procedures in today's digital forensics world. Instead, let's focus on this 1-2% and perform a very rapid triage collection that can be used to start our investigation sooner! Far too often, computers are seized in an "on" state, and immediately powered down because, "that is how we've always done it." With today's computers this means you are throwing away (essentially destroying) many gigabytes of data. The RAM in a computer holds an incredibly important treasure trove of data, from keystrokes to network connections, running services, and, quite importantly, passwords and decryption keys. With the vastly increasing spread of file-less malware, in many cases the only place that evidence will exist is in memory. Another often-overlooked factor is full disk encryption. In cases like this, "live" acquisition will be your only hope.

SECTION 4: Non-Traditional and Cloud Acquisition

When we think about acquisition, it usually involves opening the side of the computer, removing the hard drive, connecting to a write blocker or imaging equipment, and completing the task. While this is not an inaccurate assessment, it does not address a great deal of the access and acquisition questions surrounding so much data today. If full disk imaging is necessary, then it is certainly easier and quicker to do it directly from the storage itself. But what happens with devices such as iPads, Surface Books, and other such equipment, where it is glue and not screws that hold them together? Volume Shadow Copies also contain a wealth of historic data that are of great use to investigators. Knowing how to access and collect data from these shadow copies is critical in cases involving the Windows operating system. Battlefield forensics is considered the bleeding edge of digital forensics. It requires in-depth knowledge of where the most valuable data reside on the computer and how to get those data as fast as possible. An effective battlefield forensicator needs to be extracting actionable intelligence in 90 minutes or less, but the clock does not start when the forensic imaging is done. Rather. it starts from the moment you lay your hands on the device. Learn how to identify and access data in non-traditional storage areas. In today's world so much data live off site, and there are very few methods in place to access and properly acquire those data. In this section, we will identify these locations, including SharePoint, Exchange, webmail, network locations, cloud storage, and social media, not to mention Dropbox, Google Drive, and the Internet of Things. This also includes RAID storage and how to best collect these devices regardless of configuration.

SECTION 5: Apple Acquisition, Internet of Things, and Online Attribution

There are very few tools and techniques available when it comes to acquisition of Apple products, as compared to Windows. The tools that exist can be quite expensive, and free tools are simply few and far between. In this section, we will explore the fundamentals of acquiring data from Apple devices. We will acquire memory and identify systems that are running CoreStorage technology and full disk encryption. We will also visit the challenges posed by APFS. Many of the Apple systems are closed systems, in that you simply cannot remove the hard drive, as it is soldered directly to the motherboard. The uniqueness of the data storage demands alternative methods of acquisition. In this course section, you'll learn how to access and forensically image iPads, MacBooks, and other HFS+ devices, working at the command line. You have traced an artifact back to an IP, email, or web address. Now what? We will learn the best methods for determining attribution, from proper collection to legal documentation. Not to be left out, the Internet of Things is pervasive. It is controlling our fridges, thermostats, security cameras, and door locks. It is listening passively and waiting patiently for an instruction to perform. Today you will learn how these devices communicate, and more importantly, who is controlling them.

SECTION 6: Beyond the Forensic Tools: The Deeper Dive

The usefulness of file and stream carving cannot be overstated. Some data simply do not live in the defined file space that can be readily accessed by a viewer. From partially overwritten to deleted data, we will explore techniques you can employ when traditional tools fail. Data carving is a skill that is increasingly important. Once the reference to a file is destroyed, how can the data still be recovered? File carving tools will assist in this, but examiners must understand the limitations of their tools. Without the proper pieces of the original file, a carver is useless. At some point, you will be faced with non-functioning media. Learn about the inner workings of hard drives, and what you can (and cannot) do to revive them to a point where you can then create your forensic image. We will also be looking at the "best of breed" data recovery tools, from those that are free to those that cost many thousands of dollars.

FOR518: **Mac and iOS Forensic Analysis and Incident Response**

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Parse the HFS+ file system by hand, using only a cheat sheet and a hex editor
- Determine the importance of each file system domain
- Conduct temporal analysis of a system by correlating data files and log analysis
- Profile individuals' usage of the system, including how often they used it, what applications they frequented, and their personal system preferences
- Determine remote or local data backups, disk images, or other attached devices
- Find encrypted containers and FileVault volumes, understand keychain data, and crack Mac passwords
- Analyze and understand Mac metadata and their importance in the Spotlight database, Time Machine, and Extended Attributes
- Develop a thorough knowledge of the Safari Web Browser and Apple Mail applications
- Identify communication with other users and systems through iChat, Messages, FaceTime, Remote Login, Screen Sharing, and AirDrop
- Conduct an intrusion analysis of a Mac for signs of compromise or malware infection
- Acquire and analyze memory from Mac systems
- Acquire iOS and analyze devices in-depth

FORENSICATE DIFFERENTLY!

Digital forensic and incident response investigators have traditionally dealt with Windows machines, but what if they find themselves in front of a new Apple Mac or iDevice? The increasing popularity of Apple devices can be seen everywhere, from coffee shops to corporate boardrooms. Dealing with these devices as an investigator is no longer a niche skill – every analyst must have the core skills necessary to investigate the Apple devices they encounter.

Times and trends change and forensic investigators and analysts need to change with them. The new FOR518: Mac Forensic Analysis course provides the tools and techniques necessary to take on any Mac case without hesitation. The intense, hands-on forensic analysis skills taught in the course will enable Windows-based investigators to broaden their analysis capabilities and have the confidence and knowledge to comfortably analyze any Mac or iOS system.

This course will teach you:

- Mac and iOS Fundamentals: How to analyze and parse the Hierarchical File System (HFS+) and Apple File System (APFS) by hand and recognize the specific domains of the logical file system and Mac-specific file types.
- User Activity: How to understand and profile users through their data files and preference configurations.
- Advanced Intrusion Analysis and Correlation: How to determine how a system has been used or compromised by using the system and user data files in correlation with system log files.
- Apple Technologies: How to understand and analyze many Mac and iOS-specific technologies, including Time Machine, Spotlight, iCloud, Document Versions, FileVault, Continuity, and FaceTime.

FOR518: Mac and iOS Forensic Analysis and Incident Response aims to train a well-rounded investigator by diving deep into forensic and intrusion analysis of Mac and iOS. The course focuses on topics such as the HFS+ and APFS file systems, Mac-specific data files, tracking of user activity, system configuration, analysis and correlation of Mac logs, Mac applications, and Mac-exclusive technologies. A computer forensic analyst who completes this course will have the skills needed to take on a Mac or iOS forensics case.

"This course provides good, clear training on Mac OS/iOS and how they relate/differ in several aspects. It's a must for anyone carrying out forensic analysis today."

— Iain Spence, **MOD**

***FOR518** is available via (subject to change):*

Live Training sans.org/events

San Francisco Spring	San Francisco, CA	Mar 22-27
SANS 2020	**Orlando, FL**	**Apr 5-10**
Security West	**San Diego, CA**	**May 8-13**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	May 8-13

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Mac and iOS Essentials

This section introduces the student to Mac and iOS essentials such as acquisition, timestamps, logical file system, and disk structure. Acquisition fundamentals are the same with Mac and iOS devices, but there are a few tips and tricks that can be used to successfully and easily collect Mac and iOS systems for analysis. Students comfortable with Windows forensic analysis can easily learn the slight differences on a Mac system – the data are the same, only the format differs.

Topics: Apple Essentials; Mac Essentials and Acquisition; Disks & Partitions; iOS Essentials and iOS Acquisition

SECTION 2: File Systems & System Triage

The building blocks of Mac and iOS forensics start with a thorough understanding of the HFS+. Utilizing a hex editor, students will learn the basic principles of the primary file system implemented on MacOS systems. The students will then use that information to look at a variety of great artifacts that use the file system and that are different from other operating systems students have seen in the past. Rounding out the day, students will review Mac and iOS triage data.

Topics: File System; Extended Attributes; File System Events Store Database; Spotlight; Mac and iOS Triage; Most Recently Used (MRU)

SECTION 3: User Data, System Configuration, and Log Analysis

This section contains a wide array of information that can be used to profile and understand how individuals use their computers. The logical Mac file system is made up of four domains: User, Local, System, and Network. The User Domain contains most of the user-related items of forensic interest. This domain consists of user preferences and configurations. The System and Local Domains contain system-specific information such as application installation, system settings and preferences, and system logs. This section details basic system information, GUI preferences, and system application data. A basic analysis of system logs can give a good understanding of how a system was used or abused. Timeline analysis tells the story of how the system was used. Each entry in a log file has a specific meaning and may be able to tell how the user interacted with the computer. The log entries can be correlated with other data found on the system to create an in-depth timeline that can be used to solve cases quickly and efficiently. Analysis tools and techniques will be used to correlate the data and help the student put the story back together in a coherent and meaningful way.

Topics: User Data and System Configuration; Log Parsing and Analysis; Timeline Analysis and Data Correlation

SECTION 4: Application Data Analysis

In addition to all the configuration and preference information found in the User Domain, the user can interact with a variety of native Apple applications, including the Internet, email, communication, photos, locational data, etc. These data can provide analysts with the who, what, where, why, and how for any investigation. This section will explore the various databases and other files where data are being stored. The student will be able to parse this information by hand without the help of a commercial tool parser.

Topics: Application Permissions; Native Application Fundamentals; Safari Browser; Apple Mail; Communication; Calendar and Reminders; Contacts; Notes; Photos; Maps; Location Data; Apple Watch; Third-Party Apps; Apple Pay, Wallet, Passes

SECTION 5: Advanced Analysis Topics

Mac systems implement some technologies that are available only to those with Mac and iOS devices. These include data backup with Time Machine, Document Versions, and iCloud; and disk encryption with FileVault. Other advanced topics include data hidden in encrypted containers, live response, Mac intrusion and malware analysis, and Mac memory analysis.

Topics: Live Response; Time Machine; OS X Malware and Intrusion Analysis; iCloud; Versions; Memory Acquisitions and Analysis; Password Cracking and Encrypted Containers

SECTION 6: Mac Forensics & Incident Response Challenge

Students will put their new Mac forensics skills to the test by running through a real-life scenario with team members.

Topics: In-Depth File System Examination; File System Timeline Analysis; Advanced Computer Forensics Methodology; Mac Memory Analysis; File System Data Analysis; Metadata Analysis; Recovering Key Mac Files; Volume and Disk Image Analysis; Analysis of Mac Technologies including Time Machine, Spotlight, and FileVault; Advanced Log Analysis and Correlation; iDevice Analysis and iOS Artifacts

Who Should Attend

- Experienced digital forensic analysts who want to solidify and expand their understanding of file system forensics and advanced Mac analysis
- Law enforcement officers, federal agents, and detectives who want to master advanced computer forensics and expand their investigative skill set
- Media exploitation analysts who need to know where to find the critical data they need from a Mac system
- Incident response team members who are responding to complex security incidents and/or intrusions from sophisticated adversaries and need to know what to do when examining a compromised system
- Information security professionals who want to become knowledgeable with Mac OS X and iOS system internals
- SANS FOR500, FOR508, FOR526, FOR585, and FOR610 alumni looking to round out their forensic skills

"We have a primarily Mac OS environment and I don't think I could find a tenth of this information through my own research."

— Kevin Neely, **Pure Storage**

FOR526: **Advanced Memory Forensics & Threat Detection**

6 Day Program	45 CPEs	Laptop Required

What You Will Receive

- SIFT Workstation 3
  This course extensively uses the SIFT Workstation 3 to teach incident responders and forensic analysts how to respond to and investigate sophisticated attacks. SIFT contains hundreds of free and open-source tools, easily matching any modern forensic and incident response commercial tool suite.
  - Ubuntu LTS base
  - 64 bit-based system
  - Better memory utilization
  - Auto-DFIR package update and customizations
  - Latest forensic tools and techniques
  - VMware Appliance ready to tackle forensics
  - Cross-compatibility between Linux and Windows
  - Expanded filesystem support (NTFS, HFS, EXFAT, and more)
- Windows 8.1 Workstation with license
  - 64 bit-based system
  - A licensed virtual machine loaded with the latest forensic tools
  - VMware Appliance ready to tackle forensics
- 32 GB Course USB 3.0
  - USB loaded with memory captures, SIFT Workstation 3, tools, and documentation
- SANS Memory Forensics Exercise Workbook
  - Exercise book is over 200 pages long with detailed step-by-step instructions and examples to help you become a master incident responder
- SANS DFIR cheat sheets to help use the tools
- MP3 audio files of the complete course lecture

MALWARE CAN HIDE, BUT IT MUST RUN

Digital Forensics and Incident Response (DFIR) professionals need Windows memory forensics training to be at the top of their game. Investigators who do not look at volatile memory are leaving evidence at the crime scene. RAM content holds evidence of user actions, as well as evil processes and furtive behaviors implemented by malicious code. It is this evidence that often proves to be the smoking gun that unravels the story of what happened on a system.

FOR526: Advanced Memory Forensics & Threat Detection provides the critical skills necessary for digital forensics examiners and incident responders to successfully perform live system memory triage and analyze captured memory images. The course uses the most effective freeware and open-source tools in the industry today and provides an in-depth understanding of how these tools work. FOR526 is a critical course for any serious DFIR investigator who wants to tackle advanced forensics, trusted insider, and incident response cases.

In today's forensics cases, it is just as critical to understand memory structures as it is to understand disk and registry structures. Having in-depth knowledge of Windows memory internals allows the examiner to access target data specific to the needs of the case at hand. For those investigating platforms other than Windows, this course also introduces OSX and Linux memory forensics acquisition and analysis using hands-on lab exercises.

There is an arms race between analysts and attackers. Modern malware and post-exploitation modules increasingly employ self-defense techniques that include more sophisticated rootkit and anti-memory analysis mechanisms that destroy or subvert volatile data. Examiners must have a deeper understanding of memory internals in order to discern the intentions of attackers or rogue trusted insiders. FOR526 draws on best practices and recommendations from experts in the field to guide DFIR professionals through acquisition, validation, and memory analysis with real-world and malware-laden memory images.

FOR526: Advanced Memory Forensics & Threat Detection will teach you:

- Proper Memory Acquisition: Demonstrate targeted memory capture ensuring data integrity and overcoming obstacles to acquisition/anti-acquisition behaviors
- How to Find Evil in Memory: Detect rogue, hidden, and injected processes, kernel-level rootkits, Dynamic Link Libraries (DLL) hijacking, process hollowing, and sophisticated persistence mechanisms
- Effective Step-by-Step Memory Analysis Techniques: Use process timelining, high-low level analysis, and walking the Virtual Address Descriptors (VAD) tree to spot anomalous behavior
- Best Practice Techniques: Learn when to implement triage, live system analysis, and alternative acquisition techniques and how to devise custom parsing scripts for targeted memory analysis

***FOR526** is available via (subject to change):*

Live Training sans.org/events

SANS 2020	**Orlando, FL**	**Apr 5-10**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Cyber Threat Intelligence	Washington, DC	Jan 22-27

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	Jun 15-20

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Foundations in Memory Analysis and Acquisition

Simply put, memory analysis has become a required skill for all incident responders and digital forensics examiners. Regardless of the type of investigation, system memory and its contents often expose the first piece of the evidential thread that, when pulled, unravels the whole picture of what happened on the target system. Where is the malware? How did the machine get infected? Where did the attacker move laterally? Or what did the disgruntled employee do on the system? What lies in physical memory can provide answers to all of these questions and more.

Topics: Why Memory Forensics?; Investigative Methodologies; The Ubuntu SIFT and Windows 10 Workstations; The Volatility Framework; System Architectures; Triage versus Full Memory Acquisition; Physical Memory Acquisition

SECTION 2: Unstructured Analysis and Process Exploration

Structured memory analysis using tools that identify and interpret operating system structures is certainly powerful. However, many remnants of previously allocated memory remain available for analysis, and they cannot be parsed through structure identification. What tools are best for processing fragmented data? Unstructured analysis tools! They neither know nor care about operating system structures. Instead, they examine data, extracting findings using pattern matching. You will learn how to use Bulk Extractor to parse memory images and extract investigative leads such as email addresses, network packets, and more.

Topics: Unstructured Memory Analysis; Page File Analysis; Exploring Process Structures; List Walking and Scanning; Pool Memory; Exploring Process Relationships; Exploring DLLs; Kernel Objects

SECTION 3: Investigating the User via Memory Artifacts

An incident responder (IR) is often asked to triage a system because of a network intrusion detection system alert. The Security Operations Center makes the call and requires more information due to outbound network traffic from an endpoint and the IR team is asked to respond. In this section, we cover how to enumerate active and terminated TCP connections – selecting the right plugin for the job based on the OS version.

Topics: Network Connections; Virtual Address Descriptors; Detecting Injected Code; Analyzing the Registry via Memory Analysis; User Artifacts in Memory

SECTION 4: Internal Memory Structures

Section 4 focuses on introducing some internal memory structures (such as drivers), Windows memory table structures, and extraction techniques for portable executables. As we come to the final steps in our investigative methodology, "Spotting Rootkit Behaviors" and "Extracting Suspicious Binaries," it is important to emphasize again the rootkit paradox. The more malicious code attempts to hide itself, the more abnormal and seemingly suspicious it appears. We will use this concept to evaluate some of the most common structures in Windows memory for hooking, the IDTs and SSDTs.

Topics: Interrupt Descriptor Tables; System Service Descriptor Tables; Drivers; Direct Kernel Object Manipulation; Module Extraction; Hibernation Files; Crash Dump Files

SECTION 5: Memory Analysis on Platforms Other than Windows

Windows systems may be the most prevalent platform encountered by forensic examiners today, but most enterprises are not homogeneous. Forensic examiners and incident responders are best served by having the skills to analyze the memory of multiple platforms, including Linux and Mac—that is, platforms other than Windows.

Topics: Linux Memory Acquisition and Analysis; Mac Memory Acquisition and Analysis

SECTION 6: Memory Analysis Challenges

This final course section provides students with a direct memory forensics challenge that makes use of the DFIR NetWars Tournament platform. Your memory analysis skills are put to the test with a variety of hands-on scenarios involving hibernation files, Crash Dump files, and raw memory images, reinforcing techniques covered in the first five sections of the course. These challenges strengthen students' ability to respond to typical and atypical memory forensics challenges from all types of cases, from investigating the user to isolating the malware. By applying the techniques learned earlier in the course, students consolidate their knowledge and can shore up skill areas where they feel they need additional practice.

Topics: Malware and Rootkit Behavior Detection; Persistence Mechanism Identification; Code Injection Analysis; User Activity Reconstruction; Linux Memory Image Parsing; Mac OSX Memory Image Parsing; Windows Hibernation File Conversion and Analysis; Windows Crash Dump Analysis (Using Windows Debugger)

Who Should Attend

- Incident response team members
- Experienced digital forensic analysts
- Red team members, penetration testers, and exploit developers
- Law enforcement officers, federal agents, and detectives
- SANS FOR508 and SEC504 graduates
- Forensics investigators

"FOR526 is the best training I've had in years. I'm learning many new tools and methodologies and using them in labs immediately."

— Josh Burbank, **Northrop Grumman**

"This training is a must for learning the foundations of memory forensics and becoming efficient at it. Highly recommended."

— Hugo Gabignon, **Amazon**

FOR578: **Cyber Threat Intelligence**

GCTI
Cyber Threat Intelligence
giac.org/gcti

5 Day Program | 30 CPEs | Laptop Required

Who Should Attend

- Security practitioners
- Incident response team members
- Threat hunters
- Security Operations Center personnel and information security practitioners
- Digital forensic analysts and malware analysts
- Federal agents and law enforcement officials
- Technical managers
- SANS alumni looking to take their analytical skills to the next level

"This course provides great value as it focuses on collection of data and modeling and how to use frameworks to build out capabilities."

— Aaron Bostwick, **General Atomics**

Every security practitioner should attend FOR578: Cyber Threat Intelligence course. This course is unlike any other technical training you have experienced. It focuses on structured analysis in order to establish a solid foundation for any security skillset and to amplify existing skills. The course will help practitioners from across the security spectrum to:

- Develop analysis skills to better comprehend, synthesize, and leverage complex scenarios
- Identify and create intelligence requirements through practices such as threat modeling
- Understand and develop skills in tactical, operational, and strategic-level threat intelligence
- Generate threat intelligence to detect, respond to, and defeat focused and targeted threats
- Learn the different sources to collect adversary data and how to exploit and pivot off of it
- Validate information received externally to minimize the costs of bad intelligence
- Create Indicators of Compromise (IOCs) in formats such as YARA, OpenIOC, and STIX
- Move security maturity past IOCs into understanding and countering the behavioral tradecraft of threats
- Establish structured analytical techniques to be successful in any security role

It is common for security practitioners to call themselves analysts. But how many of us have taken structured analysis training instead of simply attending technical training? Both are important, but very rarely do analysts focus on training on analytical ways of thinking. This course exposes analysts to new mindsets, methodologies, and techniques that will complement their existing knowledge as well as establish new best practices for their security teams. Proper analysis skills are key to the complex world that defenders are exposed to on a daily basis.

The analysis of an adversary's intent, opportunity, and capability to do harm is known as cyber threat intelligence. Intelligence is not a data feed, nor is it something that comes from a tool. Intelligence is actionable information that answers a key knowledge gap, pain point, or requirement of an organization. This collection, classification, and exploitation of knowledge about adversaries gives defenders an upper hand against adversaries and forces defenders to learn and evolve with each subsequent intrusion they face.

Cyber threat intelligence thus represents a force multiplier for organizations looking to establish or update their response and detection programs to deal with increasingly sophisticated threats. Malware is an adversary's tool, but the real threat is the human one, and cyber threat intelligence focuses on countering those flexible and persistent human threats with empowered and trained human defenders.

Knowledge about the adversary is core to all security teams. The red team needs to understand adversaries' methods in order to emulate their tradecraft. The Security Operations Center needs to know how to prioritize intrusions and quickly deal with those that need immediate attention. The incident response team needs actionable information on how to quickly scope and respond to targeted intrusions. The vulnerability management group needs to understand which vulnerabilities matter most for prioritization and the risk that each one presents. The threat hunting team needs to understand adversary behaviors to search out new threats.

In other words, cyber threat intelligence informs all security practices that deal with adversaries. FOR578: Cyber Threat Intelligence will equip you, your security team, and your organization with the tactical, operational, and strategic-level cyber threat intelligence skills and tradecraft required to better understand the evolving threat landscape and to accurately and effectively counter those threats.

***FOR578** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-7**
St. Louis	St. Louis, MO	Mar 8-12
SANS 2020	**Orlando, FL**	**Apr 5-9**
N. VA – Alexandria	Alexandria, VA	May 17-21
SANSFIRE	**Washington, DC**	**Jun 15-19**

Summit Events

Cyber Threat Intelligence	Washington, DC	Jan 22-26
Open-Source Intelligence	Washington, DC	Feb 19-23

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Cyber Threat Intelligence and Requirements

Cyber threat intelligence is a rapidly growing field. However, intelligence was a profession long before the word "cyber" entered the lexicon. Understanding the key points regarding intelligence terminology, tradecraft, and impact is vital to understanding and using cyber threat intelligence. This section introduces students to the most important concepts of intelligence, analysis tradecraft, and levels of threat intelligence, and the value they can add to organizations. It also focuses on getting your intelligence program off to the right start with planning, direction, and the generation of intelligence requirements. As with all sections, the day includes immersive hands-on labs to ensure that students have the ability to turn theory into practice.

Topics: Case Study: Carbanak, The Great Bank Robbery; Understanding Intelligence; Understanding Cyber Threat Intelligence; Threat Intelligence Consumption; Positioning the Team to Generate Intelligence; Planning and Direction (Developing Requirements)

SECTION 2: The Fundamental Skill Set: Intrusion Analysis

Intrusion analysis is at the heart of threat intelligence. It is a fundamental skill set for any security practitioner who wants to use a more complete approach to addressing security. Two of the most commonly used models for assessing adversary intrusions are the "kill chain" and the "Diamond Model." These models serve as a framework and structured scheme for analyzing intrusions and extracting patterns such as adversary behaviors and malicious indicators. In this section students will participate in and be walked through multi-phase intrusions from initial notification of adversary activity to the completion of analysis of the event. The section also highlights the importance of this process in terms of structuring and defining adversary campaigns.

Topics: Primary Collection Source: Intrusion Analysis; Kill Chain Courses of Action; Kill Chain Deep Dive; Handling Multiple Kill Chains; Collection Source: Malware

SECTION 3: Collection Sources

Cyber Threat Intelligence analysts must be able to interrogate and fully understand their collection sources. Analysts do not have to be malware reverse engineers, as an example, but they must at least understand that work and know what data can be sought. This section continues from the previous one in identifying key collection sources for analysts. There is also a lot of available information on what is commonly referred to as open-source intelligence (OSINT). In this course section students will learn to seek and exploit information from Domains, External Datasets, Transport Layer Security/Secure Sockets Layer (TLS/SSL) Certificates, and more while also structuring the data to be exploited for purposes of sharing internally and externally.

Topics: Case Study: Axiom; Collection Source: Domains; Case Study: GlassRAT; Collection Source: External Datasets; Collection Source: TLS Certificates; Case Study: Trickbots; Exploitation: Storing and Structuring Data

SECTION 4: Analysis and Dissemination of Intelligence

Many organizations seek to share intelligence but often fail to understand its value, its limitations, and the right formats to choose for each audience. Additionally, indicators and information shared without analysis are not intelligence. Structured analytical techniques such as the Analysis of Competing Hypotheses can help add considerable value to intelligence before it is disseminated. This section will focus on identifying both open-source and professional tools that are available for students as well as on sharing standards for each level of cyber threat intelligence both internally and externally. Students will learn about YARA and generate YARA rules to help incident responders, security operations personnel, and malware analysts. Students will gain hands-on experience with STIX and understand the CybOX and TAXII frameworks for sharing information between organizations. Finally, the section will focus on building the singular intrusions into campaigns and being able to communicate about those campaigns.

Topics: Analysis: Exploring Hypotheses; Analysis: Building Campaigns; Dissemination: Tactical; Case Study: Sony Attack; Dissemination: Operational

SECTION 5: Higher-Order Analysis and Attribution

A core component of intelligence analysis at any level is the ability to defeat biases and analyze information. The skills required to think critically are exceptionally important and can have an organization-wide or national-level impact. In this course section, students will learn about logical fallacies and cognitive biases as well as how to defeat them. They will also learn about nation-state attribution, including when it can be of value and when it is merely a distraction. Students will also learn about nation-state-level attribution from previously identified campaigns and take away a more holistic view of the cyber threat intelligence industry to date. The class will finish with a discussion on consuming threat intelligence and actionable takeaways for students to make significant changes in their organizations once they complete the course.

Topics: Logical Fallacies and Cognitive Biases; Dissemination: Strategic Case Study: Stuxnet; Fine-Tuning Analysis; Case Study: Sofacy; Attribution

"This course gives a very smart and structured approach to Cyber Threat Intelligence, something that the global community has been lacking to date."

— John Geary, **Citigroup**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . May 17-21

FOR585: **Smartphone Forensic Analysis In-Depth**

GASF
Advanced Smartphone Forensics
giac.org/gasf

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Select the most effective forensic tools, techniques, and procedures for critical analysis of smartphone data
- Reconstruct events surrounding a crime using information from smartphones, including timeline development and link analysis (e.g., who communicated with whom, where, and when)
- Understand how smartphone file systems store data, how they differ, and how the evidence will be stored on each device
- Interpret file systems on smartphones and locate information that is not generally accessible to users
- Identify how the evidence got onto the mobile device – we'll teach you how to know if the user created the data, which will help you avoid the critical mistake of reporting false evidence obtained from tools
- Incorporate manual decoding techniques to recover deleted data stored on smartphones and mobile devices
- Tie a user to a smartphone at a specific date/time and at various locations
- Recover hidden or obfuscated communication from applications on smartphones
- Decrypt or decode application data that are not parsed by your forensic tools
- Detect smartphones compromised by malware and spyware using forensic methods
- Decompile and analyze mobile malware using open-source tools
- Handle encryption on smartphones and bypass, crack, and/or decode lock codes manually recovered from smartphones, including cracking iOS backup files that were encrypted with iTunes

FOR585: Smartphone Forensic Analysis In-Depth will help you understand:

- Where key evidence is located on a smartphone
- How the data got onto the smartphone
- How to recover deleted mobile device data that forensic tools miss
- How to decode evidence stored in third-party applications
- How to detect, decompile, and analyze mobile malware and spyware
- Advanced acquisition terminology and free techniques to gain access to data on smartphones
- How to handle locked or encrypted devices, applications, and containers

SMARTPHONES HAVE MINDS OF THEIR OWN. DON'T MAKE THE MISTAKE OF REPORTING SYSTEM EVIDENCE, SUGGESTIONS, OR APPLICATION ASSOCIATIONS AS USER ACTIVITY. IT'S TIME TO GET SMARTER!

A smartphone lands on your desk and you are tasked with determining if the user was at a specific location at a specific date and time. You rely on your forensic tools to dump and parse the data. The tools show location information tying the device to the place of interest. Are you ready to prove the user was at that location? Do you know how to take this further to place the subject at the location of interest at that specific date and time? Tread carefully, because the user may not have done what the tools are showing!

Mobile devices are often a key factor in criminal cases, intrusions, IP theft, security threats, accident reconstruction, and more. Understanding how to leverage the data from the device in a correct manner can make or break your case and your future as an expert. FOR585: Smartphone Forensic Analysis In-Depth will teach you those skills.

Every time the smartphone thinks or makes a suggestion, the data are saved. It's easy to get mixed up in what the forensic tools are reporting. Smartphone forensics is more than pressing the find evidence button and getting answers. Your team cannot afford to rely solely on the tools in your lab. You have to understand how to use them correctly to guide your investigation, instead of just letting the tool report what it believes happened on the device. It is impossible for commercial tools to parse everything from smartphones and understand how the data were put on the device. Examination and interpretation of the data is your job and this course will provide you and your organization with the capability to find and extract the correct evidence from smartphones with confidence.

This in-depth smartphone forensic course provides examiners and investigators with advanced skills to detect, decode, decrypt, and correctly interpret evidence recovered from mobile devices. The course features 27 hands-on labs, a forensic challenge, and a bonus take-home case that allow students to analyze different datasets from smart devices and leverage the best forensic tools, methods, and custom scripts to learn how smartphone data hide and can be easily misinterpreted by forensic tools. Each lab is designed to teach you a lesson that can be applied to other smartphones. You will gain experience with the different data formats on multiple platforms and learn how the data are stored and encoded on each type of smart device. The labs will open your eyes to what you are missing by relying 100% on your forensic tools.

Smartphone technologies are constantly changing, and most forensic professionals are unfamiliar with the data formats for each technology. Take your skills to the next level: it's time for the good guys to get smarter and for the bad guys to know that their smartphone activity can and will be used against them!

SMARTPHONE DATA CAN'T HIDE FOREVER – IT'S TIME TO OUTSMART THE MOBILE DEVICE!

***FOR585** is available via (subject to change):*

Live Training sans.org/events

Anaheim	Anaheim, CA	Jan 20-25
Security East	**New Orleans, LA**	**Feb 3-8**
N. VA – Reston Spring	Reston, VA	Mar 2-7
Seattle Spring	Seattle, WA	Mar 23-28
SANS 2020	**Orlando, FL**	**Apr 5-10**
Security West	**San Diego, CA**	**May 8-13**
SANSFIRE	**Washington, DC**	**Jun 15-20**

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Smartphone Overview, Misfit Devices, SQLite Introduction, and Android Forensics Overview

Although smartphone forensic concepts are similar to those of digital forensics, smartphone file system structures differ and require specialized decoding skills to correctly interpret the data acquired from the device. On this first course section, students will apply what they know to smartphone forensic handling, device capabilities, acquisition methods, misfit devices, SQLite database examination, and query development. They'll also gain an overview of Android devices and manually crack locked Androids. Students will become familiar with the forensic tools required to complete comprehensive examinations of smartphone data structures. We realize that not everyone examines BlackBerry and knock-off devices, which is why we offer "choose your own adventure" labs, meaning that students can select the labs most relevant to them. BlackBerry 10 smartphones are designed to protect user privacy, but techniques taught in this course section will enable the investigator to go beyond what the tools decode and manually recover data residing in database files of BlackBerry 10 device file systems. Knock-off devices are another outlier than can be parsed and decoded once you become familiar with the file system structures.

Topics: The SIFT Workstation; Introduction to Smartphones; Smartphone Handling; Forensic Acquisition Concepts of Smartphones; Smartphone Components; Smartphone Forensic Tool Overview; Blackberry 10 Forensics, Introduction to SQLite; Android Forensic Overview; Handling Locked Android Devices

SECTION 2: Android Forensics

Android devices are among the most widely used smartphones in the world, which means they will surely be part of an investigation that will come across your desk. Unfortunately, gaining access to these devices isn't as easy as it used to be. Android devices contain substantial amounts of data that can be decoded and interpreted into useful information. However, without honing the appropriate skills to bypass locked Androids and correctly interpret the data stored on them, you will be unprepared for the rapidly evolving world of smartphone forensics. Android backups can be created for forensic analysis or by a user. Smartphone examiners need to understand the file structures and how to parse these data. Additionally, Android and Google cloud data store tons of valuable information. You will find Google artifacts from iOS users as well.

Topics: Android Acquisition Considerations; Android File System Structures; Android Evidentiary Locations; Traces of User Activity on Android Devices; Android Backup Files; Google Cloud Data and Extractions

Who Should Attend

- Experienced digital forensic analysts
- Media exploitation analysts
- Information security professionals
- Incident response teams
- Law enforcement officers, federal agents, and detectives
- Accident reconstruction investigators
- IT auditors
- Graduates of SANS SEC575, SEC563, FOR500, FOR508, FOR572, FOR526, FOR610, or FOR518 who want to take their skills to the next level

"Really useful to know the differences in the tools used and how to explore and analyze the data in a safe environment."

— Nageen Mirza, **Deloitte**

SECTION 3: iOS Device Forensics

Apple iOS devices contain substantial amounts of data (including deleted records) that can be decoded and interpreted into useful information. Proper handling and parsing skills are needed for bypassing locked iOS devices and correctly interpreting the data. Without iOS instruction, you will be unprepared to deal with the iOS device that will likely be a major component in a forensic investigation.

Topics: iOS Forensic Overview and Acquisition; iOS File System Structures; iOS Evidentiary Locations; Handling Locked iOS Devices; Traces of User Activity on iOS Devices

SECTION 4: iOS Backups, Malware and Spyware Forensics, and Detecting Evidence Destruction

iOS backups are extremely common and are found in the cloud and on hard drives. Users create backups, and we often find that our best data can be derived from creating an iOS backup for forensic investigation. This section will cover methodologies to extract backups and cloud data and analyze the artifacts for each. Malware affects a plethora of smartphone devices. We will examine various types of malware, how it exists on smartphones, and how to identify and analyze it. Most commercial smartphone tools help you identify malware, but none of them will allow you to tear down the malware to the level we cover in class. Up to five labs will be conducted in this section alone! The section ends with the students challenging themselves using tools and methods learned throughout the week to recover user data from a wiped smartphone.

Topics: iOS Backup File Forensics; Locked iOS Backup Files; iCloud Data Extraction and Analysis; Malware and Spyware Forensics; Detecting Evidence Destruction

SECTION 5: Third-Party Application Analysis

This section starts with third-party applications across all smartphones and is designed to teach students how to leverage third-party application data and preference files to support an investigation. The rest of the section focuses heavily on secure chat applications, recovery of deleted application data and attachments, mobile browser artifacts, and knock-off phone forensics. The skills learned in this section will provide you with advanced methods for decoding data stored in third-party applications across all smartphones. We will show you what the commercial tools miss and teach you how to recover these artifacts yourself.

Topics: Third-Party Applications Overview; Third-Party Application Artifacts; Messaging Applications and Recovering Attachments; Mobile Browsers; Secure Chat Applications

SECTION 6: Smartphone Forensics Capstone Exercise

This final course section will test all that you have learned during the course. Working in small groups, students will examine three smartphone devices and solve a scenario relating to a real-world smartphone forensic investigation. Each group will independently analyze the three smartphones, manually decode data, answer specific questions, form an investigation hypothesis, develop a report, and present findings.

Topics: Identification and Scoping; Forensic Examination; Forensic Reconstruction

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Mar 2-7

FOR610: **Reverse-Engineering Malware: Malware Analysis Tools and Techniques**

GREM
Reverse Engineering Malware
giac.org/grem

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Build an isolated, controlled laboratory environment for analyzing code and behavior of malicious programs
- Employ network and system-monitoring tools to examine how malware interacts with the file system, registry, network, and other processes in a Windows environment
- Uncover and analyze malicious JavaScript and other components of web pages, which are often used by exploit kits for drive-by attacks
- Control relevant aspects of the malicious program's behavior through network traffic interception and code patching to perform effective malware analysis
- Use a disassembler and a debugger to examine the inner workings of malicious Windows executables
- Bypass a variety of packers and other defensive mechanisms designed by malware authors to misdirect, confuse and otherwise slow down the analyst
- Recognize and understand common assembly-level patterns in malicious code, such as DLL injection and anti-analysis measures
- Assess the threat associated with malicious documents, such as PDF and Microsoft Office files
- Derive Indicators of Compromise (IOCs) from malicious executables to strengthen incident response and threat intelligence efforts

Who Should Attend

- Individuals who have dealt with incidents involving malware and want to learn how to understand key aspects of malicious programs
- Technologists who have informally experimented with aspects of malware analysis and are looking to formalize and expand their expertise in this area
- Forensic investigators and IT practitioners looking to expand their skill sets and learn how to play a pivotal role in the incident response process

Learn to turn malware inside out! This popular course explores malware analysis tools and techniques in depth. FOR610 training has helped forensic investigators, incident responders, security engineers, and IT administrators acquire the practical skills to examine malicious programs that target and infect Windows systems.

Understanding the capabilities of malware is critical to an organization's ability to derive threat intelligence, respond to information security incidents, and fortify defenses. This course builds a strong foundation for reverse-engineering malicious software using a variety of system and network monitoring utilities, a disassembler, a debugger, and many other freely available tools.

The course begins by establishing the foundation for analyzing malware in a way that dramatically expands upon the findings of automated analysis tools. You will learn how to set up a flexible laboratory to examine the inner workings of malicious software, and how to use the lab to uncover characteristics of real-world malware samples. You will also learn how to redirect and intercept network traffic in the lab to explore the specimen's capabilities by interacting with the malicious program.

The course continues by discussing essential assembly language concepts relevant to reverse engineering. You will learn to examine malicious code with the help of a disassembler and a debugger in order to understand its key components and execution flow. In addition, you will learn to identify common malware characteristics by looking at suspicious Windows API patterns employed by malicious programs.

Next, you will dive into the world of malware that thrives in the web ecosystem, exploring methods for assessing suspicious websites and de-obfuscating malicious JavaScript to understand the nature of the attack. You will also learn how to analyze malicious Microsoft Office, RTF, and PDF files. Such documents act as a common infection vector as a part of mainstream and targeted attacks. You will also learn how to examine "file-less" malware and malicious PowerShell scripts.

Malware is often obfuscated to hinder analysis efforts, so the course will equip you with the skills to unpack executable files. You will learn how to dump such programs from memory with the help of a debugger and additional specialized tools, and how to rebuild the files' structure to bypass the packer's protection. You will also learn how to examine malware that exhibits rootkit functionality to conceal its presence on the system, employing code analysis and memory forensics approaches to examining these characteristics.

FOR610 malware analysis training also teaches how to handle malicious software that attempts to safeguard itself from analysis. You will learn how to recognize and bypass common self-defensive measures, including code injection, sandbox evasion, flow misdirection, and other measures.

The course culminates with a series of Capture-the-Flag challenges designed to reinforce the techniques learned in class and provide additional opportunities to learn practical, hands-on malware analysis skills in a fun setting.

Hands-on workshop exercises are a critical aspect of this course. They enable you to apply malware analysis techniques by examining malicious software in a controlled and systemic manner. When performing the exercises, you will study the supplied specimens' behavioral patterns and examine key portions of their code. To support these activities, you will receive pre-built Windows and Linux virtual machines that include tools for examining and interacting with malware.

***FOR610** is available via (subject to change):*

Live Training sans.org/events

N. VA – Fairfax	Fairfax, VA	Feb 10-15
SANS 2020	**Orlando, FL**	**Apr 5-10**
Security West	**San Diego, CA**	**May 8-13**
San Antonio	San Antonio, TX	May 17-22
SANSFIRE	**Washington, DC**	**Jun 15-20**

Summit Events

Cyber Threat Intelligence	Washington, DC	Jan 22-27

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	May 8-13

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Malware Analysis Fundamentals

Section one lays the groundwork for malware analysis by presenting the key tools and techniques useful for examining malicious programs. You will learn how to save time by exploring Windows malware in two phases. Behavioral analysis focuses on the program's interactions with its environment, such as the registry, the network, and the file system. Code analysis focuses on the specimen's code and makes use of a disassembler and debugger tools such as IDA Pro and OllyDbg. You will learn how to set up a flexible laboratory to perform such analysis in a controlled manner, and set up such a lab on your laptop using the supplied Windows and Linux (REMnux) virtual machines. You will then learn how to use the key analysis tools by examining a malware sample in your lab—with guidance and explanations from the instructor—to reinforce the concepts discussed throughout the day.

Topics: Assembling a Toolkit for Effective Malware Analysis; Examining Static Properties of Suspicious Programs; Performing Behavioral Analysis of Malicious Windows Executables; Performing Static and Dynamic Code Analysis of Malicious Windows Executables; Interacting with Malware in a Lab to Derive Additional Behavioral Characteristics

SECTION 2: Reversing Malicious Code

Section two focuses on examining malicious Windows executables at the assembly level. You will discover approaches for studying inner workings of a specimen by looking at it through a disassembler and, at times, with the help of a debugger. The section begins with an overview of key code-reversing concepts and presents a primer on essential x86 Intel assembly concepts, such as instructions, function calls, variables, and jumps. You will also learn how to examine common assembly constructs, such as functions, loops, and conditional statements. The material will then build on this foundation and expand your understanding to incorporate 64-bit malware, given its growing popularity. Throughout the discussion, you will learn to recognize common characteristics at a code level, including HTTP command and control, keylogging, and command execution.

Topics: Understanding Core x86 Assembly Concepts to Perform Malicious Code Analysis; Identifying Key Assembly Logic Structures with a Disassembler; Following Program Control Flow to Understand Decision Points During Execution; Recognizing Common Malware Characteristics at the Windows API Level (Registry Manipulation, Keylogging, HTTP Communications, Droppers); Extending Assembly Knowledge to Include x64 Code Analysis

SECTION 3: Malicious Web and Document Files

Section three focuses on examining malicious web pages and documents, which adversaries can use to directly perform malicious actions on the infected system and launch attacks that lead to the installation of malicious executable files. The section begins by discussing how to examine suspicious websites that might host client-side exploits. Next, you will learn how to de-obfuscate malicious scripts with the help of script debuggers and interpreters, examine Microsoft Office macros, and assess the threats associated with PDF and RTF files using several techniques.

Topics: Interacting with Malicious Websites to Assess the Nature of Their Threats; De-obfuscating Malicious JavaScript Using Debuggers and Interpreters; Analyzing Suspicious PDF Files; Examining Malicious Microsoft Office Documents, Including Files with Macros; Analyzing Malicious RTF Document Files

SECTION 4: In-Depth Malware Analysis

Section four builds on the approaches to behavioral and code analysis introduced earlier in the course, exploring techniques for uncovering additional aspects of the functionality of malicious programs. The section begins by discussing how to handle packed malware. We will examine ways to identify packers and strip away their protection with the help of a debugger and other utilities. We will also walk through the analysis of malware that employs multiple technologies to conceal its true nature, including the use of registry, obfuscated JavaScript and PowerShell scripts, and shellcode. Finally, we will learn how malware implements Usermode rootkit functionality to perform code injection and API hooking, examining this functionality from both code and memory forensics perspectives.

Topics: Recognizing Packed Malware; Getting Started with Unpacking; Using Debuggers for Dumping Packed Malware from Memory; Analyzing Multi-Technology and Fileless Malware; Code Injection and API Hooking; Using Memory Forensics for Malware Analysis

SECTION 5: Examining Self-Defending Malware

Section five takes a close look at the techniques malware authors commonly employ to protect malicious software from being examined. You will learn how to recognize and bypass anti-analysis measures designed to slow you down or misdirect you. In the process, you will gain more experience performing static and dynamic analysis of malware that is able to unpack or inject itself into other processes. You will also expand your understanding of how malware authors safeguard the data that they embed inside malicious executables. As with the other topics covered throughout the course, you will be able to experiment with such techniques during hands-on exercises.

Topics: How Malware Detects Debuggers and Protects Embedded Data; Unpacking Malicious Software that Employs Process Hollowing; Bypassing the Attempts by Malware to Detect and Evade the Analysis Toolkit; Handling Code Misdirection Techniques, including SEH and TLS Callbacks; Unpacking Malicious Executable by Anticipating the Packer's Actions

SECTION 6: Malware Analysis Tournament

Section six assigns students to the role of a malware analyst working as a member of an incident response or forensics team. Students are presented with a variety of hands-on challenges involving real-world malware in the context of a fun tournament. These challenges further a student's ability to respond to typical malware-reversing tasks in an instructor-led lab environment and offer additional learning opportunities. Moreover, the challenges are designed to reinforce skills covered in the first five sections of the course, making use of the hugely popular DFIR NetWars tournament platform. By applying the techniques learned earlier in the course, students solidify their knowledge and can shore up skill areas where they feel they need additional practice. Students who score the highest in the malware analysis challenge will be awarded the coveted SANS Lethal Forensicator coin.

Topics: Behavioral Malware Analysis; Dynamic Malware Analysis (Using a Debugger); Static Malware Analysis (Using a Disassembler); JavaScript De-obfuscation; PDF Document Analysis; Office Document Analysis; Memory Analysis

"The theory of this course in combination with the labs is a great introduction to the possibilities and approaches one can take when fighting malware."

— Max de Bruijn, **Fox-IT**

MGT512: **Security Leadership Essentials for Managers**

GSLC
Security Leadership
giac.org/gslc

5 Day Program	30 CPEs	Laptop Required

You Will Be Able To

- Become an effective information security manager
- Get up to speed quickly on information security issues and terminology
- Establish a minimum standard of security knowledge, skills, and abilities
- Speak the same language as technical security professionals

Who Should Attend

- Security Managers
  - Newly appointed information security officers
  - Recently promoted security leaders who want to build a security foundation for leading and building teams
- Security Professionals
  - Technically skilled security administrators who have recently been given leadership responsibilities
- Managers
  - Managers who want to understand what technical people are telling them
  - Managers who need an understanding of security from a management perspective

Course Author Statement

"I have found that technical professionals who are taking on management responsibility need to learn how to convey security concepts in ways that non-technical people can understand. At the same time, managers who are new to security need to learn more about the different domains of cybersecurity. In both cases, there is a need to learn about the work of managing security. That is why this course focuses on the big picture of securing the enterprise, from governance all the way to the technical security topics that serve as the foundation for any security manager. Ultimately, the goal of the course is to ensure that you, the advancing manager, can make informed choices to improve security at your organization."

— Frank Kim

Security managers need both technical knowledge and management skills to gain the respect of technical team members, understand what technical staff are actually doing, and appropriately plan and manage security projects and initiatives. This is a big and important job that requires an understanding of a wide array of security topics.

This course empowers you to become an effective security manager and get up to speed quickly on information security issues and terminology. You won't just learn about security, you will learn how to manage security.

To accomplish this goal, MGT512 covers a wide range of security topics across the entire security stack. Data, network, host, application, and user controls are covered in conjunction with key management topics that address the overall security lifecycle. This also includes governance and technical controls focused on protecting, detecting, and responding to security issues.

This approach prepares you to:

- Make sense of different cybersecurity frameworks
- Understand and analyze risk
- Understand the pros and cons of different reporting relationships
- Manage technical personnel
- Build a vulnerability management program
- Inject security into modern DevOps workflows
- Strategically leverage a SIEM
- Change behavior and build a security-aware culture
- Effectively manage security projects
- Enable modern security architectures and the cloud

MGT512 uses case studies, group discussions, team-based exercises, and in-class games to help students absorb both technical and management topics.

"SANS prepared me for the [GSLC] certification and provided valuable information that I can use on the job immediately. Networking with peers and SANS@NIght provided extra value that's not normally available at other training sessions."

— Rick Derks, **FCS Financial**

***MGT512** is available via (subject to change):*

Live Training sans.org/events

Austin Winter ..... Austin, TX ..... Jan 6-10	Norfolk ..... Norfolk, VA ..... Mar 16-20	San Antonio ..... San Antonio, TX ..... May 17-21
N. VA – Fairfax ..... Fairfax, VA ..... Feb 10-14	**SANS 2020** ..... **Orlando, FL** ..... **Apr 5-9**	Las Vegas Spring ..... Las Vegas, NV ..... Jun 8-12
San Diego ..... San Diego, CA ..... Feb 17-21	Baltimore Spring ..... Baltimore, MD ..... Apr 27 - May 1	**SANSFIRE** ..... **Washington, DC** ..... **Jun 15-19**
St. Louis ..... St. Louis, MO ..... Mar 8-12	**Security West** ..... **San Diego, CA** ..... **May 8-12**	

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Building Your Program

The course starts with a tour of the information and topics that effective security managers and leaders must know to function in the modern security environment. This includes an understanding of the different types of cybersecurity frameworks available to structure your security team and program. Risk is central to effective information security management, and key risk concepts are discussed to lay the foundation for effective risk assessment and management. Security policy is a key tool that security managers use to manage risk. We'll cover approaches to policy to help you plan and manage your policy process. Finally, security functions, reporting relationships, and roles and responsibilities are discussed to give the advancing manager a view into effective security team and program structure.

Topics: Security Frameworks; Understanding Risk; Security Policy; Program Structure

SECTION 2: Protecting Data and Networks

Section 2 provides foundational knowledge to protect data and networks. This includes building an understanding of cryptography concepts, encryption algorithms, and applications of cryptography. Since encrypting data alone is not sufficient, the distinction between privacy and security is discussed to give managers a primer on key privacy concepts. Finally, a thorough discussion of network security is modeled around the various layers of the network stack. This allows managers to gain a deeper understanding of what their teams are talking about, what vendors are selling, and where various issues and protections lay within the seven layers of the network model.

Topics: Data Protection; Privacy Primer; Network Security

SECTION 3: Protecting and Patching Systems

Section 3 is focused on protecting and patching systems. This includes coverage of host security that encompasses endpoint and server security along with malware and attack examples. Modern infrastructure as code approaches and tools are also discussed as ways to automate consistent deployment of standard configurations. Managers must also be knowledgeable about software development processes, issues, and application vulnerabilities. Coverage includes an overview of the secure SDLC, OWASP Top Ten, and leading-edge development processes built on DevOps. Managers must also understand physical security controls that, when not implemented appropriately, can cause technical security controls to fail or be bypassed. All of these issues and corresponding vulnerabilities must be appropriately managed. This leads to a discussion on building a vulnerability management program and the associated process for successfully finding and fixing vulnerabilities.

Topics: Host Security; Application Security; Physical Security; Vulnerability Management

SECTION 4: Leading Modern Security Initiatives

Section 4 covers what managers need to know about leading modern security initiatives. Security awareness is a huge component of any security program that is focused on driving activities that lead to changes in human behavior and creating a more risk-aware and security-aware culture. For any project or initiative, security leaders must also be able to drive effective project execution. Having a well-grounded understanding of the project management process makes it easier to move these projects forward. The cloud is a major initiative that many organizations are either tackling now or planning to undertake. To get ready for these initiatives, an overview of Amazon Web Services (AWS) is provided to serve as a reference, along with a discussion of key cloud security issues based on the Cloud Security Alliance guidance. The cloud, the rise of mobile devices, and other factors are highlighting weaknesses in traditional, perimeter-oriented security architectures. This leads to a discussion of the Zero Trust Model. To execute such new initiatives security leaders must also develop negotiation skills and the ability to manage highly technical team members.

Topics: Security Awareness: Maturity Model: Human Risks: Project Management: Projects, Programs, Portfolios: Project Management Process: Cloud Security: Cloud Security Alliance (CSA) Guidance: Amazon Web Services (AWS) Overview: Moving to the Cloud: Modern Security Architecture: Zero Trust Model: User, Device, and Application Authentication and Access: Management Methods: Negotiations Primer: Managing Technical People

SECTION 5: Detecting and Responding to Attacks

Section 5 is focused on detection and response capabilities. This includes gaining appropriate visibility via logging, monitoring, and thinking strategically about a Security Information and Event Management (SIEM) system. These logs are a core component of any Security Operations Center (SOC). The key functions of a SOC are discussed along with how to design, build, operate, and mature security operations for your organization. The incident response process is discussed in relation to identifying, containing, eradicating, and recovering from security incidents. This leads into a discussion of longer-term disaster recovery and business continuity planning. Finally, the course ends with a war game that simulates an actual incident. This tabletop simulation contains a number of injects or points at which students are presented with additional information to which they can respond. After dealing with the incident itself, the simulation concludes with a game focused on choosing appropriate security controls to mitigate future incidents.

Topics: Logging and Monitoring; Security Operations Center; Incident Response; Contingency Planning; War Game

"MGT512 is valuable because it is relevant/current to the security landscape from my management vantage point."

— Michael Bradley, **Prudential Financial**

Community Events

Seattle, WA . . . . . Jan 20-24

Portland, OR . . . . . Mar 2-6

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

SEC566: Implementing and Auditing the Critical Security Controls – In-Depth

GCCC
Critical Controls
giac.org/gccc

5 Day Program | 30 CPEs | Laptop Required

You Will Be Able To

- Apply a security framework based on actual threats that is measurable, scalable, and reliable in stopping known attacks and protecting organizations' important information and systems
- Understand the importance of each control, how it is compromised if ignored, and explain the defensive goals that result in quick wins and increased visibility of networks and systems
- Identify and utilize tools that implement controls through automation
- Learn how to create a scoring tool for measuring the effectiveness of each control
- Employ specific metrics to establish a baseline and measure the effectiveness of security controls
- Understand how the Critical Controls map to standards such as NIST 800-53, ISO 27002, the Australian Top 35, and more
- Audit each of the Critical Security Controls, with specific, proven templates, checklists, and scripts provided to facilitate the audit process

Cybersecurity attacks are increasing and evolving so rapidly that it is more difficult than ever to prevent and defend against them. Does your organization have an effective method in place to detect, thwart, and monitor external and internal threats to prevent security breaches? This course helps you master specific, proven techniques and tools needed to implement and audit the Critical Security Controls as documented by the Center for Internet Security (CIS).

As threats evolve, an organization's security should too. To enable your organization to stay on top of this ever-changing threat scenario, SANS has designed a comprehensive course that teaches students the Critical Security Controls, a prioritized, risk-based approach to security. Designed by private and public sector experts from around the world, the Controls are the best way to block known attacks and mitigate damage from successful attacks. They have been adopted by the U.S. Department of Homeland Security, state governments, universities, and numerous private firms.

The Controls are specific guidelines that CISOs, CIOs, IGs, systems administrators, and information security personnel can use to manage and measure the effectiveness of their defenses. They are designed to complement existing standards, frameworks, and compliance schemes by prioritizing the most critical threat and highest payoff defenses, while providing a common baseline for action against risks that we all face.

The Controls are an effective security framework because they are based on actual attacks launched regularly against networks. Priority is given to Controls that (1) mitigate known attacks (2) address a wide variety of attacks, and (3) identify and stop attackers early in the compromise cycle. The British government's Center for the Protection of National Infrastructure describes the Controls as the "baseline of high-priority information security measures and controls that can be applied across an organisation in order to improve its cyber defense."

SANS's in-depth, hands-on training will teach you how to master the specific techniques and tools needed to implement and audit the Critical Controls. It will help security practitioners understand not only how to stop a threat, but why the threat exists, and how to ensure that security measures deployed today will be effective against the next generation of threats.

The course shows security professionals how to implement the Controls in an existing network through cost-effective automation. For auditors, CIOs, and risk officers, the course is the best way to understand how you will measure whether the Controls are effectively implemented.

"SEC566 provides great tools, explanation, and insight!"

— Ryan LeVan, **Trex Company, Inc.**

***SEC566** is available via (subject to change):*

Live Training sans.org/events

New York City Winter	New York City, NY	Feb 10-14
SANS 2020	**Orlando, FL**	**Apr 5-9**
Baltimore Spring	Baltimore, MD	Apr 27 - May 1
Security West	**San Diego, CA**	**May 8-12**
SANSFIRE	**Washington, DC**	**Jun 15-19**

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Introduction and Overview of the 20 Critical Controls

Section 1 will introduce you to all of the Critical Controls, laying the foundation for the rest of the class. For each Control, we will follow the same outline covering the following information:

- Overview of the Control
- How It Is Compromised
- Defensive Goals
- Quick Wins
- Visibility & Attribution
- Configuration & Hygiene
- Advanced Controls
- Overview of Evaluating the Control
- Core Evaluation Test(s)
- Testing/Reporting Metrics
- Steps for Root Cause Analysis of Failures
- Audit/Evaluation Methodologies
- Evaluation Tools
- Exercise to Illustrate Implementation or Steps for Auditing a Control

In addition, Critical Controls 1 and 2 will be covered in depth.

Topics: Critical Control 1: Inventory of Authorized and Unauthorized Devices; Critical Control 2: Inventory of Authorized and Unauthorized Software

SECTION 2: Critical Controls 3, 4, 5, and 6

Topics: Critical Control 3: Secure Configurations for Hardware and Software on Laptops, Workstations, and Servers; Critical Control 4: Continuous Vulnerability Assessment and Remediation; Critical Control 5: Controlled Use of Administrative Privileges; Critical Control 6: Maintenance, Monitoring, and Analysis of Audit Logs

SECTION 3: Critical Controls 7, 8, 9, 10, and 11

Topics: Critical Control 7: Email and Web Browser Protections; Critical Control 8: Malware Defenses; Critical Control 9: Limitation and Control of Network Ports, Protocols, and Services; Critical Control 10: Data Recovery Capability (validated manually); Critical Control 11: Secure Configurations for Network Devices such as Firewalls, Routers, and Switches

SECTION 4: Critical Controls 12, 13, 14, and 15

Topics: Critical Control 12: Boundary Defense; Critical Control 13: Data Protection; Critical Control 14: Controlled Access Based on the Need to Know; Critical Control 15: Wireless Device Control

SECTION 5: Critical Controls 16, 17, 18, 19, and 20

Topics: Critical Control 16: Account Monitoring and Control; Critical Control 17: Security Skills Assessment and Appropriate Training to Fill Gaps (validated manually); Critical Control 18: Application Software Security; Critical Control 19: Incident Response and Management (validated manually); Critical Control 20: Penetration Tests and Red Team Exercises (validated manually)

Who Should Attend

- Information assurance auditors
- System implementers or administrators
- Network security engineers
- IT administrators
- Department of Defense personnel and contractors
- Staff and clients of federal agencies
- Private sector organizations looking to improve information assurance processes and secure their systems
- Security vendors and consulting groups looking to stay current with frameworks for information assurance
- Alumni of SEC/AUD440, SEC401, SEC501, SANS Audit classes, and MGT512

"The training helps me understand why the Controls are necessary for securing systems at my organization."

— Brandon McWilliams, **SRP**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Apr 5-9

Online Training. . . . . May 8-12

MGT414: SANS Training Program for CISSP® Certification

GISP
Information Security Professional
giac.org/gisp

6	46	Laptop
Day Program	CPEs	Not Needed

You Will Be Able To

- Understand the eight domains of knowledge that are covered on the CISSP® exam
- Analyze questions on the exam and be able to select the correct answer
- Apply the knowledge and testing skills learned in class to pass the CISSP® exam
- Understand and explain all of the concepts covered in the eight domains of knowledge
- Apply the skills learned across the eight domains to solve security problems when you return to work

"This training was a comprehensive overview of all topics covered in the CISSP® exam. All in attendance were there for a common goal, including the instructor. It was easy to follow, and the real-world examples given were priceless."

— Ron Pinnock,
Navy Exchange Service Command

SANS MGT414: SANS Training Program for CISSP® Certification is an accelerated review course that is specifically designed to prepare students to successfully pass the CISSP® exam.

MGT414 focuses solely on the eight domains of knowledge as determined by (ISC)² that form a critical part of the CISSP® exam. Each domain of knowledge is dissected into its critical components, and those components are then discussed in terms of their relationship with one another and with other areas of information security.

After completing the course students will have:

- Detailed coverage of the eight domains of knowledge
- The analytical skills required to pass the CISSP® exam
- The technical skills required to understand each question
- The foundational information needed to become a Certified Information Systems Security Professional (CISSP®)

External Product Notice:

The CISSP® exam itself is not hosted by SANS. You will need to make separate arrangements to take the CISSP® exam. Please note as well that the GISP exam offered by GIAC is NOT the same as the CISSP® exam offered by (ISC)².

Course Authors' Statement

"The CISSP® certification has been around for nearly 25 years. The exam is designed to test your understanding of the Common Body of Knowledge, which may be thought of as the universal language of information security professionals. It is often said to be a mile wide and two inches deep. The CISSP® exam covers a lot of theoretical information that is critical for a security professional to understand. However, this material can be dry, and since most students do not see the direct applicability to their jobs, they find it boring. The goal of this course is to bring the eight domains of knowledge of the CISSP® to life. The practical workings of this information can be discovered by explaining important topics with stories, examples, and case studies. We challenge you to attend the SANS CISSP® training course and find the exciting aspect of the eight domains of knowledge!"
—Eric Conrad and Seth Misenar

***MGT414** is available via (subject to change):*

Live Training sans.org/events

Miami ... Miami, FL ... Jan 13-18	Seattle Spring ... Seattle, WA ... Mar 23-28	**Security West** ... **San Diego, CA** ... **May 8-13**
Las Vegas ... Las Vegas, NV ... Jan 27 - Feb 1	Philadelphia ... Philadelphia, PA ... Mar 30 - Apr 4	San Antonio ... San Antonio, TX ... May 17-22
Security East ... **New Orleans, LA** ... **Feb 3-8**	**SANS 2020** ... **Orlando, FL** ... **Apr 5-10**	Atlanta Spring ... Atlanta, GA ... May 26-31
Dallas ... Dallas, TX ... Mar 9-14	Boston Spring ... Boston, MA ... Apr 20-25	**SANSFIRE** ... **Washington, DC** ... **Jun 15-20**
San Francisco Spring ... San Francisco, CA ... Mar 16-21	Baltimore Spring ... Baltimore, MD ... Apr 27 - May 2	

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Introduction; Security and Risk Management

In the first section of training for the CISSP® exam, MGT414 introduces the specific requirements needed to obtain certification. The exam update will be discussed in detail. We will cover the general security principles needed to understand the eight domains of knowledge, with specific examples for each domain. The first of the eight domains, Security and Risk Management, is discussed using real-world scenarios to illustrate the critical points.

Topics: Overview of CISSP® Certification; Introductory Material; Overview of the Eight Domains; Domain 1: Security and Risk Management

SECTION 2: Asset Security and Security Engineering – Part 1

Understanding asset security is critical to building a solid information security program. The Asset Security domain, the initial focus of today's course section, describes data classification programs, including those used by both governments and the military as well as the private sector. We will also discuss ownership ranging from business/mission owners to data and system owners. We will examine data retention and destruction in detail, including secure methods for purging data from electronic media. We then turn to the first part of the Security Engineering domain, including new topics for the 2019 exam such as the Internet of Things, Trusted Platform Modules, Cloud Security, and much more.

Topics: Domain 2: Asset Security; Domain 3: Security Engineering (Part 1)

SECTION 3: Security Engineering – Part 2; Communication and Network Security

This course section continues the discussion of the Security Engineering domain, including a deep dive into cryptography. The focus is on real-world implementation of core cryptographic concepts, including the three types of cryptography: symmetric, asymmetric, and hashing. Salts are discussed, as well as rainbow tables. We will round out Domain 3 with a look at physical security before turning to Domain 4, Communication and Network Security. The discussion will cover a range of protocols and technologies, from the Open Systems Interconnection (OSI) model to storage area networks.

Topics: Domain 3: Security Engineering (Part 2); Domain 4: Communication and Network Security

SECTION 4: Identity and Access Management

Controlling access to data and systems is one of the primary objectives of information security. Domain 5, Identity and Access Management, strikes at the heart of access control by focusing on identification, authentication, and authorization of accounts. Password-based authentication represents a continued weakness, so Domain 5 stresses multi-factor authentication, biometrics, and secure credential management. The CISSP® exam underscores the increased role of external users and service providers, and mastery of Domain 5 requires an understanding of federated identity, SSO, SAML, and third-party identity and authorization services like Oauth and OpenID.

Topics: Domain 5: Identity and Access Management

SECTION 5: Security Assessment and Testing; Security Operations

This course section covers Domain 6 (Security Assessment) and Domain 7 (Security Operations). Security Assessment covers types of security tests, testing strategies, and security processes. Security Operations covers investigatory issues, including eDiscovery, logging and monitoring, and provisioning. We will discuss cutting-edge technologies such as the cloud, and we'll wrap up section five with a deep dive into disaster recovery.

Topics: Domain 6: Security Assessment; Domain 7: Security Operations

SECTION 6: Software Development Security

Domain 8 (Software Development Security) describes the requirements for secure software. Security should be "baked in" as part of network design from day one, since it is always less effective when it is added later to a poor design. We will discuss classic development models, including waterfall and spiral methodologies. We will then turn to more modern models, including agile software development methodologies. New content for the CISSP® exam update will be discussed, including DevOps. We will wrap up this course section by discussing security vulnerabilities, secure coding strategies, and testing methodologies.

Topics: Domain 8: Software Development Security

Who Should Attend

- Security professionals who are interested in understanding the concepts covered on the CISSP® exam as determined by (ISC)²
- Managers who want to understand the critical areas of information security
- System, security, and network administrators who want to understand the pragmatic applications of the CISSP® eight domains
- Security professionals and managers looking for practical ways the eight domains of knowledge can be applied to their current job

"Great discussions and examples that provide a clear understanding and relate material to examples."

— Kelley ONeil, **Wells Fargo**

Community Events

Anaheim, CA . . . . . Mar 30 - Apr 4

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Jun 15-20

MGT514: **Security Strategic Planning, Policy, and Leadership**

GSTRT
Strategic Planning, Policy & Leadership
giac.org/gstrt

5	30	Laptop
Day Program	CPEs	Not Needed

You Will Be Able To

- Develop security strategic plans that incorporate business and organizational drivers
- Develop and assess information security policy
- Use management and leadership techniques to motivate and inspire your teams

"This course provided a full scope of leadership and security that can immediately be applied to your job."

— Jerry Butler, **NAVSEA OOI**

As security professionals we have seen the landscape change. Cybersecurity is now more vital and relevant to the growth of your organization than ever before. As a result, information security teams have more visibility, more budget, and more opportunity. However, with this increased responsibility comes more scrutiny.

This course gives you tools to become a security business leader who can build and execute strategic plans that resonate with other business executives, create effective information security policy, and develop management and leadership skills to better lead, inspire, and motivate your teams.

- Develop Strategic Plans
  Strategic planning is hard for IT and IT security professionals because we spend so much time responding and reacting. We almost never do strategic planning until we get promoted to a senior position and then we are not equipped with the skills we need to run with the pack. MGT514 will teach you how to develop strategic plans that resonate with other IT and business leaders.
- Create Effective Information Security Policy
  Policy is a manager's opportunity to express expectations for the workforce, set the boundaries of acceptable behavior, and empower people to do what they ought to be doing. It is easy to get wrong. Have you ever seen a policy and your response was, "No way, I am not going to do that!" Policy must be aligned with an organization's culture. We will break down the steps to policy development so that you have the ability to design and assess policy to successfully guide your organization.
- Develop Management and Leadership Skills
  Leadership is a skill that must be learned, exercised and developed to better ensure organizational success. Strong leadership is brought about primarily through selfless devotion to the organization and staff, tireless effort in setting the example, and the vision to see and effectively use available resources toward the end goal.

  Effective leadership entails persuading team members to accomplish their objectives, removing the obstacles preventing them from doing it, and maintaining the well-being of the team in support of the organization's mission. MGT514 will teach you to use management tools and frameworks to better lead, inspire, and motivate your teams.

How the Course Works

MGT514 uses case studies from Harvard Business School, case scenarios, team-based exercises, and discussions that put students in real-world situations. You will be able to use these same activities with your own team members at work.

The next generation of security leadership must bridge the gap between security staff and senior leadership by strategically planning how to build and run effective security programs. After taking this course you will have the fundamental skills to create strategic plans that protect your company, enable key innovations, and facilitate working effectively with your business partners.

***MGT514** is available via (subject to change):*

Live Training sans.org/events

Miami ... Miami, FL ... Jan 13-17	San Francisco Spring ... San Francisco, CA ... Mar 22-26	**Security West** ... **San Diego, CA** ... **May 8-12**
Security East ... **New Orleans, LA** ... **Feb 3-7**	**SANS 2020** ... **Orlando, FL** ... **Apr 5-9**	Nashville Spring ... Nashville, TN ... May 26-30
New York City Winter ... New York City, NY ... Feb 10-14	Bethesda ... Bethesda, MD ... Apr 14-18	Chicago Spring ... Chicago, IL ... Jun 1-5
Scottsdale ... Scottsdale, AZ ... Feb 17-21	Minneapolis ... Minneapolis, MN ... Apr 14-18	**SANSFIRE** ... **Washington, DC** ... **Jun 15-19**
N. VA – Reston Spring ... Reston, VA ... Mar 2-6	Pen Test Austin ... Austin, TX ... Apr 27 - May 1	

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Strategic Planning Foundations

Creating security-strategic plans requires a fundamental understanding of the business, and a deep understanding of the threat landscape.

Topics: Vision and Mission Statements; Stakeholder Management; PEST Analysis; Porter's Five Forces; Threat Actors; Asset Analysis; Threat Analysis

SECTION 2: Strategic Roadmap Development

With a firm understanding of business drivers as well as the threats facing the organization, you will develop a plan to analyze the current situation, identify the target situation, perform gap analysis, and develop a prioritized roadmap. In other words, you will be able to determine (1) what you do today, (2) what you should be doing in the future, (3) what you don't do, and (4) what you should do first. With this plan in place you will learn how to build and execute your plan by developing a business case, defining metrics for success, and effectively marketing your security program.

Topics: Historical Analysis; Values and Culture; SWOT Analysis; Vision and Innovation; Security Framework; Gap Analysis; Roadmap Development; Business Case Development; Metrics and Dashboards; Marketing and Executive Communications

SECTION 3: Security Policy Development and Assessment

Policy is one of the key tools that security leaders have to influence and guide the organization. Security managers must understand how to review, write, assess, and support security policy and procedures. Using an instructional delivery methodology that balances lecture, exercises, and in-class discussion, this course section will teach the techniques to create successful policy that employees will read and follow, and that will be accepted by business units. Students will learn key elements of policy, including positive and negative tone, consistency of policy bullets, how to balance the level of specificity to the problem at hand, the role of policy, awareness and training, and the SMART approach to policy development and assessment.

Topics: Purpose of Policy; Policy Gap Analysis; Policy Development; Policy Review; Awareness and Training

SECTION 4: Leadership and Management Competencies

This course section will teach the critical skills you need to lead, motivate, and inspire your teams to achieve your organization's goals. By establishing a minimum standard for the knowledge, skills, and abilities required to develop leadership, you will understand how to motivate employees, and how to develop from a manager into a leader.

Topics: Leadership Building Blocks; Creating and Developing Teams; Coaching and Mentoring; Customer Service Focus; Conflict Resolution; Effective Communication; Leading Through Change; Relationship Building; Motivation and Self-Direction; Teamwork; Leadership Development

SECTION 5: Strategic Planning Workshop

Using case studies, students will work through real-world scenarios by applying the skills and knowledge learned throughout the course. The case studies are taken directly from Harvard Business School, which pioneered the case study method. The case studies focus specifically on information security management and leadership competencies. The Strategic Planning Workshop serves as a capstone exercise for the course, enabling students to synthesize and apply concepts, management tools, and methodologies learned in class.

Topics: Creating a Security Plan for the CEO; Understanding Business Priorities; Enabling Business Innovation; Working with BYOD; Effective Communication; Stakeholder Management

Who Should Attend

- CISOs
- Information security officers
- Security directors
- Security managers
- Aspiring security leaders
- Other security personnel who have team lead or management responsibilities

"This course provides invaluable info with specific guidance on how to perform leadership tasks, and it also provides links to useful info... Outstanding."

— Jeff Haynes, **NELO**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

MGT516: **Managing Security Vulnerabilities: Enterprise and Cloud** NEW

5 Day Program	30 CPEs	Laptop Required

You Will Be Able To

- Create, implement, or improve your vulnerability management program
- Establish a secure and defensible enterprise and cloud computing environment
- Build an accurate and useful inventory of IT assets in the enterprise and cloud
- Identify existing vulnerabilities and understand the severity level of each
- Prioritize vulnerabilities for treatment
- Effectively report and communicate vulnerability data within your organization
- Engage treatment teams and make vulnerability management fun

"An understanding of vulnerability management and cloud security is becoming not only valuable but a necessity to keep one's organization secure in this constantly changing and dynamic environment."

— Kae David, EY

Vulnerabilities are everywhere. There are new reports of weaknesses within our systems and software every time we turn around. Directly related to this is an increase in the quantity and severity of successful attacks against these weaknesses.

Managing vulnerabilities in any size organization is challenging. Enterprise environments add scale and diversity that overwhelm many IT security and operations organizations. Add in the cloud and the increasing speed with which all organizations must deliver systems, applications, and features to both their internal and external customers, and security may seem unachievable.

This course highlights why many organizations are still struggling with vulnerability management today and shows students how to solve these challenges. How do we manage assets successfully and analyze and prioritize vulnerabilities? What reports are most effective? How do we deal with vulnerabilities in our applications, and how do we treat them? We'll examine how the answers to these questions change as we move to the cloud or implement a private cloud or DevOps within our organizations. How do we make vulnerability management fun and get everyone to engage in the process? These are just some of the important topics we will cover in this course.

The primary goal of this course is to help you succeed where many are failing and to present solutions to the problems many are experiencing or will experience. Whether your vulnerability management program is well established or just starting, this course will help you mature your program and think differently about vulnerability management.

By understanding common issues and the solutions to them, you will be better prepared to meet the challenges you are facing or will face, and to determine what works best for your organization. Through class discussions and other exercises, you will learn specific analysis and reporting techniques so that you will be able to discuss the problems you and your peers are facing and how to solve those problems.

The course is based on the Prepare, Identify, Analyze, Communicate, and Treat (PIACT) Model:

- Prepare: Define, build, and continuously improve the program
- Identify: Identify vulnerabilities present in our operating environments
- Analyze: Analyze and prioritize identified vulnerabilities and other program metrics to provide meaningful assistance and guidance to stakeholders and program participants
- Communicate: Present the findings from analysis appropriately and efficiently for each stakeholder group
- Treat: Implement, test, and monitor solutions to vulnerabilities, vulnerability groups, and broader issues identified by the program

Knowing that our environments are adopting cloud services and becoming more tightly integrated with them, we'll look at both cloud and non-cloud environments simultaneously throughout the course, highlighting the tools, processes, and procedures that can be leveraged in each environment and presenting new and emerging trends.

A capstone exercise on the final course section of MGT516 features a business scenario that includes both enterprise and cloud-based environments. The exercise allows students to analyze and discuss how best to implement and maintain a vulnerability management program and leverage some of the information they have learned throughout the course. The group solutions are then reviewed in class so participants can learn what others outside their group have determined would best help the organization in the scenario succeed.

***MGT516** is available via (subject to change):*

Live Training sans.org/events

Security East ..... **New Orleans, LA** ..... **Feb 3-7**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Section Descriptions

SECTION 1: Overview and Identify

Section 1 begins with a discussion of how to make vulnerability management fun and improve engagement within your organization. Then, we dive into the cloud and discuss how cloud design and architecture can impact vulnerability management. We discuss how to discover and manage assets and what context is critical to the success of the program. Finally, we begin our discussion of how to find or identify vulnerabilities in our environments.

Topics: Course Introduction and Overview; Cloud Overview; Cloud Design and Architecture; Asset Management; Finding Vulnerabilities

SECTION 2: Identify and Analyze

Section 2 wraps up our discussion on how to identify vulnerabilities and then moves into how to deal with all of the results. We will go over a variety of analysis and prioritization techniques that can be used to more effectively and efficiently deal with the data that are generated during identification.

Topics: Finding Vulnerabilities; Analyzing Vulnerabilities; Introduction to Solution Grouping

SECTION 3: Communicate and Treat

Section 3 begins with how to communicate vulnerabilities, including what metrics are common or useful, and how to generate meaningful reports. We'll examine communication strategies and the different types of meetings that can facilitate communication and program participation. Then, we dive into how to treat vulnerabilities by discussing how change and patch management programs can impact vulnerability management.

Topics: Communication; Treatment

SECTION 4: Treatment, Buy-in, and Program

Section 4 discusses the treat phase of the PIACT model. Successful treatment of vulnerabilities should be the primary goal of vulnerability management. Throughout the section we will discuss the common operational processes that are used to treat vulnerabilities. We will also look at some of the technology solutions available to assist with some of these processes, and discuss different and emerging operating models that may impact our treatment methodology.

Topics: Treatment; Buy-in; Program

SECTION 5: Managing Vulnerabilities: Capstone Lab Exercise

Section 5 begins with a review of a scenario that triggers the group capstone exercise. The section is broken up into various sections and scenarios that stem from the main case study, which enables students to delve into various aspects of the PIACT model. A review of findings and conclusions will follow each section of the exercise, allowing each team to present its findings to the other teams and to engage in class discussions on the topics covered. The instructor will also present a potential solution for the scenarios discussed.

Who Should Attend

- CISOs
- Information security managers, officers, and directors
- Information security architects, analysts, and consultants
- Aspiring information security leaders
- Risk management professionals
- Business continuity and disaster recovery planners and staff members
- IT managers and auditors
- IT project managers
- IT/system administration/network administration professionals
- Operations managers
- Cloud service managers and administrators
- Cloud service security and risk managers
- Cloud service integrators, developers, and brokers
- IT security professionals managing vulnerabilities in the enterprise or cloud
- Government IT professional who manage vulnerabilities in the enterprise or cloud (FedRAMP)
- Security or IT professionals who have team-lead or management responsibilities
- Security or IT professionals who use or are planning to use cloud services

"Great course, great content. MGT516 is essential for both well-established and developing vulnerability management teams."

— Robert Adams, **CBC**

MGT525: IT Project Management, Effective Communication, and PMP® Exam Prep

GCPM
Project Manager
giac.org/gcpm

6 Day Program	36 CPEs	Laptop Not Needed

You Will Be Able To

- Recognize the top failure mechanisms related to IT and InfoSec projects, so that your projects can avoid common pitfalls
- Create a project charter that defines the project sponsor and stakeholder involvement
- Document project requirements and create a requirements traceability matrix to track changes throughout the project life cycle
- Clearly define the scope of a project in terms of cost, schedule and technical deliverables
- Create a work breakdown structure defining work packages, project deliverables and acceptance criteria
- Develop a detailed project schedule, including critical path tasks and milestones
- Develop a detailed project budget, including cost baselines and tracking mechanisms
- Develop planned and earned value metrics for your project deliverables and automate reporting functions
- Effectively manage conflict situations and build communication skills with your project team
- Document project risks in terms of probability and impact, and assign triggers and risk response responsibilities
- Create project earned value baselines and project schedule and cost forecasts

This course is offered by the SANS Institute as a PMI® Registered Education Provider (R.E.P.). R.E.P.s provide the training necessary to earn and maintain the Project Management Professional (PMP)® and other professional credentials. PMP® is a registered trademark of Project Management Institute, Inc.

This course has recently been updated to fully prepare you for changes in the 2020 PMP® exam. During this class you will learn how to improve your project planning methodology and project task scheduling to get the most out of your critical IT resources. We will utilize project case studies that highlight information technology services as deliverables. MGT525 follows the basic project management structure from the *PMBOK® Guide – Sixth Edition* and also provides specific techniques for success with information assurance initiatives. Throughout the week, we will cover all aspects of IT project management from initiating and planning projects through managing cost, time, and quality while your project is active, and to completing, closing, and documenting as your project finishes. A copy of the *PMBOK® Guide – Sixth Edition* is provided to all participants. You can reference the *PMBOK® Guide* and use your course material along with the knowledge you gain in class to prepare for the updated 2020 Project Management Professional (PMP)® Exam and the GIAC Certified Project Manager Exam.

The project management process is broken down into core process groups that can be applied across multiple areas of any project, in any industry. Although our primary focus is the application to the InfoSec industry, our approach is transferable to any projects that create and maintain services as well as general product development. We cover in-depth how cost, time, quality, and risks affect the services we provide to others. We will also address practical human resource management as well as effective communication and conflict resolution. You will learn specific tools to bridge the communications gap between managers and technical staff.

Course Author Statement

"Managing projects to completion, with an alert eye on quality, cost, and time, is something most of us need to do on an ongoing basis. In this course, we break down project management into its fundamental components and galvanize your understanding of the key concepts with an emphasis on practical application and execution of service-based IT and InfoSec projects. Since project managers spend the vast majority of their time communicating with others, throughout the week we focus on traits and techniques that enable effective technical communication. As people are the most critical asset in the project management process, effective and thorough communication is essential."
— Jeff Frisk

***MGT525** is available via (subject to change):*

Live Training sans.org/events

Scottsdale . . . . . Scottsdale, AZ . . . . . Feb 17-22
SANS 2020 . . . . . **Orlando, FL** . . . . . **Apr 5-10**

Private Training

This course is also available through Private Training.

Section Descriptions

SECTION 1: Project Management Structure and Framework

This course section offers insight and specific techniques that both beginner and experienced project managers can utilize. The structure and framework section lays out the basic architecture and organization of project management. We will cover the common project management group processes, the difference between projects and operations, project life cycles, and managing project stakeholders.

Topics: Definition of Terms and Process Concepts; Group Processes; Project Life Cycle; Types of Organizations; PDCA Cycle

SECTION 2: Project Charter and Scope Management

During section two, we will go over techniques used to develop the project charter and formally initiate a project. The scope portion defines the important input parameters of project management and gives you the tools to ensure that your project is well defined from the outset. We cover tools and techniques that will help you define your project's deliverables and develop milestones to gauge performance and manage change requests.

Topics: Formally Initiating Projects; Project Charters; Project Scope Development; Work Breakdown Structures; Scope Verification and Control

SECTION 3: Schedule and Cost Management

Our third section details the schedule and cost aspects of managing a project. We will cover the importance of correctly defining project activities, project activity sequence, and resource constraints. We will use milestones to set project timelines and task dependencies along with learning methods of resource allocation and scheduling. We introduce the difference between resource and product-related costs and go into detail on estimating, budgeting, and controlling costs. You will learn techniques for estimating project cost and rates as well as budgeting and the process for developing a project cost baseline.

Topics: Process Flow; Task Lead and Lag Dependencies; Resource Breakdown Structures; Task Duration Estimating; Critical Path Scheduling; Cost Estimating Tools; Cost vs. Quality; Cost Baselining; Earned Value Analysis and Forecasting

SECTION 4: Communications and Project Resources

During section four, we move into project and human resource management and building effective communications skills. People are the most valuable asset of any project and we cover methods for identifying, acquiring, developing and managing your project team. Performance appraisal tools are offered as well as conflict management techniques. You will learn management methods to help keep people motivated and provide great leadership. The effective communication portion of the section covers identifying and developing key interpersonal skills. We cover organizational communication and the different levels of communication as well as common communication barriers and tools to overcome these barriers.

Topics: Acquiring and Developing Your Project Team; Organizational Dependencies and Charts; Roles and Responsibilities; Team Building; Conflict Management; Interpersonal Communication Skills; Communication Models and Effective Listening

SECTION 5: Quality and Risk Management

In section five you will become familiar with quality planning, assurance, and control methodologies, as well as learn the cost-of-quality concept and its parameters. We define quality metrics and cover tools for establishing and benchmarking quality control programs. We go into quality assurance and auditing as well as how to understand and use quality control charts. The risk section goes over known versus unknown risks and how to identify, assess, and categorize risk. We use quantitative risk analysis and modeling techniques so that you can fully understand how specific risks affect your project. You will learn ways to plan for and mitigate risk by reducing your exposure as well as how to take advantage of risks that could have a positive effect on your project.

Topics: Cost of Quality; Quality Metrics; Continual Process Improvement; Quality Baselines; Quality Control; Change Control; Risk Identification; Risk Assessment; Time and Cost Risks; Risk Probability and Impact Matrices; Risk Modeling and Response

SECTION 6: Procurement, Stakeholder Management, and Project Integration

We close out the week with the procurement aspects of project and stakeholder management, and then integrate all of the concepts presented into a solid, broad-reaching approach. We cover different types of contracts and then the make-versus-buy decision process. We go over ways to initiate strong requests for quotations (RFQ) and develop evaluation criteria, then qualify and select the best partners for your project. Stakeholder communication and management strategies are reinforced. The final session integrates everything we have learned by bringing all the topics together with the common process groups. Using a detailed project management methodology, we learn how to finalize the project management plan and then execute and monitor the progress of your project to ensure success.

Topics: Contract Types; Make vs. Buy Analysis; Vendor Weighting Systems; Contract Negotiations; Stakeholder Communication and Stakeholder Management Strategies; Project Execution; Monitoring Your Project's Progress; Finalizing Deliverables; Forecasting and Integrated Change Control

Who Should Attend

- Individuals interested in preparing for the Project Management Professional (PMP)® Exam
- Security professionals who are interested in understanding the concepts of IT project management
- Managers who want to understand the critical areas of making projects successful
- Individuals working with time, cost, quality, and risk-sensitive projects and applications
- Anyone who would like to utilize effective communication techniques and proven methods to relate better to people
- Anyone in a key or lead engineering/design position who works regularly with project management staff

"MGT525 offers tools and techniques that will directly improve the planning, execution, and closing of your projects."

— Michael Long, **ARCYBER**

"As a cybersecurity architect, the skills I learned in MGT525 have made a great impact on my professional growth and continued success."

— Alex Waitkus, **Securicon, LLC**

AUD507: **Auditing & Monitoring Networks, Perimeters, and Systems**

GSNA
Systems and Networking Auditor
giac.org/gsna

6 Day Program | 36 CPEs | Laptop Required

You Will Be Able To

- Understand the different types of controls (e.g., technical vs. non-technical) essential to perform a successful audit
- Conduct a proper risk assessment of a network to identify vulnerabilities and prioritize what will be audited
- Establish a well-secured baseline for computers and networks, constituting a standard against which one can conduct audits
- Perform a network and perimeter audit using a seven-step process
- Audit firewalls to validate that rules/settings are working as designed, blocking traffic as required
- Utilize vulnerability assessment tools effectively to provide management with the continuous remediation information necessary to make informed decisions about risk and resources
- Audit web application configuration, authentication, and session management to identify vulnerabilities attackers can exploit
- Utilize scripting to build a system to baseline and automatically audit Active Directory and all systems in a Windows domain

One of the most significant obstacles facing many auditors today is how exactly to go about auditing the security of an enterprise. What systems really matter? How should the firewall and routers be configured? What settings should be checked on the various systems under scrutiny? Is there a set of processes that can be put into place to allow an auditor to focus on the business processes rather than the security settings? How do we turn this into a continuous monitoring process? All of these questions and more will be answered by the material covered in this course.

This course is specifically organized to provide a risk-driven method for tackling the enormous task of designing an enterprise security validation program. After covering a variety of high-level audit issues and general audit best practices, the students will have the opportunity to dive deep into the technical how-to for determining the key controls that can be used to provide a level of assurance to an organization. Tips on how to repeatedly verify these controls and techniques for automatic compliance validation are taken from real-world examples.

One of the struggles that IT auditors face today is helping management understand the relationship between the technical controls and the risks to the business that these controls address. In this course these threats and vulnerabilities are explained based on validated information from real-world situations. The instructor will take the time to explain how this can be used to raise the awareness of management and others within the organization to build an understanding of why these controls specifically and auditing in general are important. From these threats and vulnerabilities, we will explain how to build the ongoing compliance monitoring systems and automatically validate defenses through instrumentation and automation of audit checklists.

You'll be able to use what you learn immediately. Five of the six sections in the course will help you produce your own checklist, or provide you with a general checklist that can be customized for your audit practice. Each of these sections includes hands-on exercises with a variety of tools discussed during the lecture sections so that you will leave knowing how to verify each and every control described in the class. Each of the six hands-on sections gives you the chance to perform a thorough technical audit of the technology being considered by applying the checklists provided in class to sample audit problems in a virtualized environment.

A great audit is more than marks on a checklist; it is the understanding of what the underlying controls are, what the best practices are, and why. Sign up for this course and gain the mix of theoretical, hands-on, and practical knowledge to conduct a great audit.

"AUD507 provides insight on different aspects related to system configurations and associated risks."

— Yosra Al-Basha, **Yemen LNG Co.**

***AUD507** is available via (subject to change):*

Live Training sans.org/events

SANS 2020 . . . . . **Orlando, FL** . . . . . **Apr 5-10**

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Apr 5-10

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Effective Audit Management, Risk Assessment, and Virtualization Auditing

Section one provides the "on-ramp" for the highly technical audit tools and techniques used later in the week. After laying the foundation for the role and function of an auditor in the information security field, this day's material provides practical, repeatable and useful risk assessment methods that are particularly effective for measuring the security of enterprise systems, identifying control gaps and risks, and enabling us to recommend additional controls to address the risk. We finish off the day with coverage of the security risks and associated audit techniques for virtualization hosts, cloud services and container systems.

Topics: Auditor's Role as it Relates to Policy Creation, Policy Conformance, and Incident Handling; Basic Auditing and Assessing Strategies; Risk Assessment; The Six-Step Audit Process; Virtualization & Cloud Computing

SECTION 2: Effective Network and Perimeter Auditing/Monitoring

Section two focuses on securing the enterprise network. The days are gone when a good firewall at the edge of the network is all we really need. In fact, in many enterprises, the network has no real "edge." Auditors should encourage their organizations to focus on security within the network with the same diligence as they use at the perimeter.

Topics: Capturing and Analyzing Network Traffic; Analyzing and Validating Device Configurations; Testing Public Services; Network Mapping and Continuous Monitoring

SECTION 3: Web Application Auditing

Web applications seem to stay at the top of the list of security challenges faced by enterprises today. The organization needs an engaging and cutting-edge web presence, but the very technologies which allow the creation of compelling and data-rich websites also make it very challenging to provide proper security for the enterprise and its customers. Unlike other enterprise systems, our web applications are freely shared with the world and exposed to the potential for constant attack.

Topics: Why Web Applications Are a Major Problem; Understanding HTTP, HTML, and Related Technologies; Related Technologies; The Burp Proxy; OWASP Top 10 List; OWASP Top 10 Proactive Controls; Server Configuration; Secure Development Practices; Authentication; Session Handling; Data Handling; Logging and Monitoring

SECTION 4: Advanced Windows Auditing and Monitoring

The majority of systems encountered on most enterprise audits are running Microsoft Windows in some version or another. The centralized management available to administrators has made Windows a popular enterprise operating system. The sheer volume of settings and configurable controls, coupled with the large number of systems often in use, makes auditing Windows servers and workstations a huge undertaking. During section four, we teach students how to audit Windows systems and Active Directory domains at scale.

Topics: Windows Support and End of Life; PowerShell Command Essentials; PowerShell Scripting; Windows Management Instrumentation (WMI); PowerShell, DSQuery and LDAP; Password Management and Auditing; User Right Assignments; System Security Settings; File and Share Permissions; Registry Permissions and Settings; Windows Logging; Continuous Monitoring for Windows

SECTION 5: Advanced UNIX Auditing and Monitoring

While many enterprises today use Microsoft Windows for their endpoint systems, Linux and other Unix variants are well-established as servers, security appliances and in many other roles. Given the nature of the work these Unix variants do, it is critical to ensure their security. Add to that the fact that mass centralized administration is less likely to occur with these systems, and auditing at scale becomes even more important. Section five uses Debian and CentOS Linux as the example operating systems.

Topics: Accreditation and Snowflakes; Linux Basics; Command Line Tools and Scripting; Scripting; System Information; File Permissions; File Integrity; Services; Patching; Users, Groups and Privilege Management; Logging and Monitoring; System Audit Tools; Continuous Monitoring

SECTION 6: Audit the Flag Capstone Exercise

Section six is a full-day capstone exercise which allows students to test and refine the skills learned throughout the week. Using an online "capture the flag" (CTF) engine, students are challenged to audit a simulated enterprise environment by answering a series of questions about the enterprise network, working through various technologies explored during the course. At the conclusion of the section, students are asked to identify the most serious findings within the enterprise environment and to suggest possible root causes and potential mitigations.

Topics: Technologies included in the capstone exercise include Network Devices, Servers, Applications, and Workstations

Who Should Attend

- Auditors seeking to identify key controls in IT systems
- Audit professionals looking for technical details on auditing
- Managers responsible for overseeing the work of an audit or security team
- Security professionals newly tasked with audit responsibilities
- System and network administrators looking to better understand what an auditor is trying to achieve, how auditors think, and how to better prepare for an audit
- System and network administrators seeking to create strong change control management and detection systems for the enterprise
- Anyone looking to implement effective continuous monitoring processes within the enterprise

"The course is excellent as it covers most of the technical auditing techniques and tools used for auditing."

— Saeed, ADNOC-Dist

LEG523: **Law of Data Security and Investigations**

GLEG
Law of Data Security & Investigation
giac.org/gleg

5 Day Program | 30 CPEs | Laptop Not Needed

You Will Be Able To

- Work better with other professionals at your organization who make decisions about the law of data security and investigations
- Exercise better judgment on how to comply with technology regulations, both in the United States and in other countries
- Evaluate the role and meaning of contracts for technology, including services, software and outsourcing
- Help your organization better explain its conduct to the public and to legal authorities
- Anticipate technology law risks before they get out of control
- Implement practical steps to cope with technology law risk
- Better explain to executives what your organization should do to comply with information security and privacy law
- Better evaluate technologies, such as digital signatures, to comply with the law and serve as evidence
- Make better use of electronic contracting techniques to get the best terms and conditions
- Exercise critical thinking to understand the practical implications of technology laws and industry standards (such as the Payment Card Industry Data Security Standard)

One of the most significant obstacles facing many auditors today is how exactly to go about auditing the security of an enterprise. What systems really matter? How should the firewall and routers be configured? What settings should be checked on the various systems under scrutiny? Is there a set of processes that can be put into place to allow an auditor to focus on the business processes rather than the security settings? How do we turn this into a continuous monitoring process? All of these questions and more will be answered by the material covered in this course.

This course is specifically organized to provide a risk-driven method for tackling the enormous task of designing an enterprise security validation program. After covering a variety of high-level audit issues and general audit best practices, the students will have the opportunity to dive deep into the technical how-to for determining the key controls that can be used to provide a level of assurance to an organization. Tips on how to repeatedly verify these controls and techniques for automatic compliance validation are taken from real-world examples.

One of the struggles that IT auditors face today is helping management understand the relationship between the technical controls and the risks to the business that these controls address. In this course these threats and vulnerabilities are explained based on validated information from real-world situations. The instructor will take the time to explain how this can be used to raise the awareness of management and others within the organization to build an understanding of why these controls specifically and auditing in general are important. From these threats and vulnerabilities, we will explain how to build the ongoing compliance monitoring systems and automatically validate defenses through instrumentation and automation of audit checklists.

You'll be able to use what you learn immediately. Five of the six sections in the course will help you produce your own checklist, or provide you with a general checklist that can be customized for your audit practice. Each of these sections includes hands-on exercises with a variety of tools discussed during the lecture sections so that you will leave knowing how to verify each and every control described in the class. Each of the six hands-on sections gives you the chance to perform a thorough technical audit of the technology being considered by applying the checklists provided in class to sample audit problems in a virtualized environment.

A great audit is more than marks on a checklist; it is the understanding of what the underlying controls are, what the best practices are, and why. Sign up for this course and gain the mix of theoretical, hands-on, and practical knowledge to conduct a great audit.

***LEG523** is available via (subject to change):*

Live Training sans.org/events

SANS 2020	**Orlando, FL**	**Apr 5-9**
SANSFIRE	**Washington, DC**	**Jun 15-19**

Community Events

Scottsdale, AZ	Feb 24-29

Private Training

This course is also available through Private Training.

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Fundamentals of Data Security Law and Policy

Section one is an introduction to cyber and data protection law. It serves as the foundation for discussions during the rest of the course. We will survey the general legal issues that must be addressed in establishing best information security practices, then canvass the many new laws on data security and evaluate cybersecurity as a field of growing legal controversy. The course section will cover computer crime and intellectual property laws when a network is compromised, as well as emerging topics such as honeypots. We will look at the impact of future technologies on law and investigations in order to help students factor in legal concerns when they draft enterprise data security policies. For example, students will debate what the words of an enterprise policy would mean in a courtroom. This course section also dives deep into the legal question of what constitutes a "breach of data security" for such purposes as notifying others about it. The course day includes a case study on the drafting of policy to comply with the Payment Card Industry Data Security Standard (PCI). Students will learn how to choose words more carefully and accurately when responding to cybersecurity questionnaires from regulators, cyber insurers, and corporate customers.

SECTION 2: E-Records, E-Discovery, and Business Law

Cybersecurity and digital forensic professionals constantly deal with records and evidence, so they need a practical understanding of e-discovery and policies on the retention and destruction of data. Section two of the course places great emphasis on the law of evidence and records management. It teaches the necessity to apply a "legal hold" or "litigation hold" on records when controversy emerges. It helps technical and legal professionals learn to speak the same language as they assess how to find records and possibly disclose them in litigation or investigations. The course is chock full of actual court case studies dealing with privacy, computer records, digital evidence, electronic contracts, regulatory investigations, and liability for shortfalls in security. The purpose of the case studies is to draw practical lessons that students can take back to their jobs and apply immediately.

SECTION 3: Contracting for Data Security and Other Technology

Section 3 focuses on the essentials of contract law sensitive to the current requirements for security. Compliance with many of the new data security laws requires contracts. Because IT pulls together the products and services of many vendors, consultants, and outsourcers, enterprises need appropriate contracts to comply with Gramm-Leach-Bliley, HIPAA, GDPR, PCI-DSS, data breach notice laws, and other regulations.

SECTION 4: The Law of Data Compliance: How to Conduct Investigations

Information security professionals and cyber investigators operate in a world of ambiguity, rapid change, and legal uncertainty. To address these challenges, this course section presents methods to analyze a situation and then act in a way that is ethical, defensible, and reduces risk. Lessons will be invaluable to the effective and credible execution of any kind of investigation, be it internal, government, consultant related, a security incident, or any other. The lessons also include methods and justifications for maintaining the confidentiality of an investigation. Section four surveys white-collar fraud and other misbehaviors with an emphasis on the role of technology in the commission, discovery, and prevention of that fraud. It teaches cyber managers and auditors practical and case-study-driven lessons about the monitoring of employees and employee privacy.

SECTION 5: Applying Law to Emerging Dangers: Cyber Defense

Knowing some rules of law is not the same as knowing how to deal strategically with real-world legal problems. Section five is organized around extended case studies in security law: break-ins, investigations, piracy, extortion, rootkits, phishing, botnets, espionage, and defamation. The studies lay out the chronology of events and critique what the good guys did right and what they did wrong. The goal is to learn to apply principles and skills to address incidents in your day-to-day work.

Who Should Attend

- Investigators
- Security and IT professionals
- Lawyers
- Paralegals
- Auditors
- Accountants
- Technology managers
- Vendors
- Compliance officers
- Law enforcement personnel
- Privacy officers
- Penetration testers
- Cyber incident and emergency responders from around the world (including the private sector, law enforcement, national guard, civil defense and similar agencies)

"I wish I'd taken LEG523 four years ago, so that our policy and governance could have been enhanced sooner."

— Tom Siu, **Case Western Reserve University**

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Apr 5-9

SEC540: **Cloud Security and DevOps Automation**

GCSA
Cloud Security Automation
giac.org/gcsa

5 Day Program	30 CPEs	Laptop Required

You Will Be Able To

- Understand the core principles and patterns behind DevOps
- Map where security controls and checks can be added in Continuous Delivery and Continuous Deployment
- Integrate security into production operations
- Create a plan for introducing – or improving – security in a DevOps environment
- Move your DevOps workflows to the cloud
- Consume cloud services to secure cloud applications
- Map and implement a Continuous Delivery/Deployment pipeline

"SEC540 opened my eyes to a new way of thinking about operations and security unlike anything since SEC401: Security Essentials Bootcamp Style."

— Todd Anderson, **OBE**

SEC540 provides development, operations, and security professionals with a methodology to build and deliver secure infrastructure and software using DevOps and cloud services. Students will explore how the principles, practices, and tools of DevOps can improve the reliability, integrity, and security of on-premise and cloud-hosted applications.

Starting with on-premise deployments, the first two sections of the course examine the Secure DevOps methodology and its implementation using lessons from successful DevOps security programs. Students will gain hands-on experience using popular open-source tools such as Puppet, Jenkins, GitLab, Vault, Grafana, and Docker to automate Configuration Management ("infrastructure as Code"), Continuous Integration (CI), Continuous Delivery (CD), containerization, micro-segmentation, automated compliance ("Compliance as Code"), and Continuous Monitoring. The lab environment starts with a CI/CD pipeline that automatically builds, tests, and deploys infrastructure and applications. Leveraging the Secure DevOps toolchain, students perform a series of labs injecting security into the CI/CD pipeline using a variety of security tools, patterns, and techniques.

After laying the DevSecOps foundation, the final three sections move DevOps workloads to the cloud, build secure cloud infrastructure, and deliver secure software. DEV540 provides in-depth analysis of the Amazon Web Services (AWS) toolchain, while lightly covering comparable services in Microsoft Azure. Using the CI/CD toolchain, students build a cloud infrastructure that can host containerized applications and microservices. Hands-on exercises analyze and fix cloud infrastructure and application vulnerabilities using security services and tools such as API Gateway, Identity and Access Management (IAM), CloudFront Signing, Security Token Service (STS), Key Management Service (KMS), managed WAF services, serverless functions, CloudFormation, AWS Security Benchmark, and much more.

Course Authors' Statement

"DevOps and the cloud are radically changing the way that organizations design, build, deploy, and operate online systems. Leaders like Amazon, Etsy, and Netflix are able to deploy hundreds or even thousands of changes every day, continuously learning, improving, and growing—and leaving their competitors far behind. Now DevOps and the cloud are making their way from Internet 'Unicorns' and cloud providers into enterprises.

"Traditional approaches to security can't come close to keeping up with this rate of accelerated change. Engineering and operations teams that have broken down the 'walls of confusion' in their organizations are increasingly leveraging new kinds of automation, including Infrastructure as Code, Continuous Delivery and Continuous Deployment, microservices, containers, and cloud service platforms. The question is: can security take advantage of the tools and automation to better secure its systems?

"Security must be reinvented in a DevOps and cloud world."

— Ben Allen, Jim Bird, Eric Johnson, and Frank Kim

***SEC540** is available via (subject to change):*

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 3-7**
N. VA – Fairfax	Fairfax, VA	Feb 10-14
Dallas	Dallas, TX	Mar 9-13
San Francisco Spring	San Francisco, CA	Mar 22-26
SANS 2020	**Orlando, FL**	**Apr 5-9**
Security West	**San Diego, CA**	**May 8-12**
Nashville Spring	Nashville, TN	May 26-30
SANSFIRE	**Washington, DC**	**Jun 15-19**

Community Events

Detroit, MI	Mar 16-20

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Introduction to Secure DevOps

The first section is an introduction to DevOps practices, principles and tooling, how DevOps works, and how work is done in DevOps. We'll look at the importance of culture, collaboration, and automation in DevOps. Using case studies of DevOps "Unicorns" – the Internet tech leaders who have created the DNA for DevOps – we'll show you how and why they succeeded. This includes the keys to their DevOps security programs. Then you'll learn Continuous Delivery – the automation engine in DevOps – and how to build up a Continuous Delivery or Continuous Deployment pipeline. This includes how security controls can be folded into or wired into the CD pipeline, and how to automate security checks and tests in CD.

Topics: Introduction to DevOps; Case Studies on DevOps Unicorns; Working in DevOps; Security Challenges in DevOps; Building a CD Pipeline; DevOps Deployment Data; Secure Continuous Delivery; Security in Pre-Commit; Security in Commit; Security in Acceptance

SECTION 2: Moving to Production

Building on the ideas and frameworks developed in the first course section, you will learn how secure Infrastructure as code, using modern automated configuration management tools like Puppet, Chef and Ansible, allows you to quickly and consistently deploy new infrastructure and manage configurations. Because the automated CD pipeline is so critically important to DevOps, you'll also learn to secure the pipeline, including RASP and other run-time defense technologies. As the infrastructure and application code moves to production, we'll spend the second half of the section exploring container security issues associated with tools such as Docker and Kubernetes, as well as how to protect secrets using Vault and how to build continuous security monitoring using Graphana, Graphite, and StatsD. Finally, we'll discuss how to build compliance into Continuous Delivery, using the security controls and guardrails that have been built in the DevOps toolchain.

Topics: Secure Infrastructure as Code; Security with Puppet Lab; Securing Your CD Pipeline; Threat Modeling and Locking Down Your Build and Deployment Environment; Run-Time Defense; Container Security; Security in Monitoring; Red Teaming, Bug Bounties and Blameless Postmortems; Managing Secrets; Compliance as Code

SECTION 3: Moving to the Cloud

Observing DevOps principles, you'll learn to deploy infrastructure, applications, and the CI/CD toolchain into the cloud. This section provides an overview of Amazon Web Services (AWS) and introduces the foundational tools and practices you'll need to securely deploy your applications in the cloud.

Topics: Introduction to the Cloud; Cloud Architecture Overview; Secure Cloud Deployment; Security Scanning in CI/CD

SECTION 4: Cloud Application Security

In this section, you'll learn to leverage cloud application security services to ensure that applications have appropriate encryption, authentication, authorization, and access control, while also maintaining functional and high-availability systems.

Topics: Data Protection; Secure Content Delivery; Microservice Security; Serverless Security

SECTION 5: Cloud Security Automation

Expanding on the foundation of the previous sections, we'll now focus on leveraging cloud services to automate security tasks such as deploying application patches to blue/green environments, deploying and configuring cloud web application firewalls, enabling cloud security monitoring, and automating cloud compliance scanning.

Topics: Blue/Green Deployment Options; Security Automation; Security Monitoring; Cloud Compliance

Who Should Attend

- Anyone working in the DevOps environment or transitioning to a DevOps environment
- Anyone who wants to understand where to add security checks, testing, and other controls to DevOps and Continuous Delivery
- Anyone interested in learning how to migrate DevOps workflows to the cloud, specifically Amazon Web Services (AWS)
- Anyone interested in learning how to leverage cloud application security services provided by AWS
- Developers
- Software architects
- Operations engineers
- System administrators
- Security analysts
- Security engineers
- Auditors
- Risk managers
- Security consultants

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Simulcast

Online Training. . . . . Feb 3-7

Online Training. . . . . May 8-12

DEV522: **Defending Web Applications Security Essentials**

GWEB
Web Application Defender
giac.org/gweb

6 Day Program	36 CPEs	Laptop Required

You Will Be Able To

- Understand the major risks and common vulnerabilities related to web applications through real-world examples
- Mitigate common security vulnerabilities in web applications using proper coding techniques, software components, configurations, and defensive architecture
- Understand the best practices in various domains of web application security such as authentication, access control, and input validation
- Fulfill the training requirement as stated in PCI DSS 6.5
- Deploy and consume web services (SOAP and REST) in a more secure fashion
- Proactively deploy cutting-edge defensive mechanisms such as the defensive HTTP response headers and Content Security Policy to improve the security of web applications
- Strategically roll out a web application security program in a large environment
- Incorporate advanced web technologies such as HTML5 and AJAX cross-domain requests into applications in a safe and secure manner
- Develop strategies to assess the security posture of multiple web applications

This is the course to take if you have to defend web applications!

The quantity and importance of data entrusted to web applications is growing, and defenders need to learn how to secure them. Traditional network defenses, such as firewalls, fail to secure web applications. DEV522 covers the OWASP Top 10 Risks and will help you better understand web application vulnerabilities, thus enabling you to properly defend your organization's web assets.

Mitigation strategies from an infrastructure, architecture, and coding perspective will be discussed alongside real-world applications that have been proven to work. The testing aspect of vulnerabilities will also be covered so that you can ensure your application is tested for the vulnerabilities discussed in class.

To maximize the benefit for a wider range of audiences, the discussions in this course will be programming language agnostic. Focus will be maintained on security strategies rather than coding-level implementation.

DEV522: Defending Web Applications Security Essentials is intended for anyone tasked with implementing, managing, or protecting web applications. It is particularly well suited to application security analysts, developers, application architects, pen testers, auditors who are interested in recommending proper mitigations for web security issues, and infrastructure security professionals who have an interest in better defending their web applications.

The course will also cover additional issues the authors have found to be important in their day-to-day web application development practices. The topics that will be covered include:

- Infrastructure security
- Server configuration
- Authentication mechanisms
- Application language configuration
- Application coding errors like SQL injection and cross-site scripting
- Cross-site request forging
- Authentication bypass
- Web services and related flaws
- Web 2.0 and its use of web services
- XPATH and XQUERY languages and injection
- Business logic flaws
- Protective HTTP headers

The course will make heavy use of hands-on exercises and conclude with a large defensive exercise that reinforces the lessons learned throughout the week.

***DEV522** is available via (subject to change):*

Live Training sans.org/events

San Francisco Spring . . . San Francisco, CA . . . . . Mar 16-21

SANS 2020 . . . . . **Orlando, FL** . . . . . **Apr 5-10**

Private Training

This course is also available through Private Training.

Mentor Events

Novi, MI . . . . . Apr 21 - May 21

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training . . . . . Mar 16-21

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Web Basics and Authentication Security

We begin section one with an overview of recent web application attack and security trends, then follow up by examining the essential technologies that are at play in web applications. You cannot win the battle if you do not understand what you are trying to defend. We arm you with the right information so you can understand how web applications work and the security concepts related to them.

Topics: HTTP Basics; Overview of Web Technologies; Web Application Architecture; Recent Attack Trends; Authentication Vulnerabilities and Defense; Authorization Vulnerabilities and Defense

SECTION 2: Web Application Common Vulnerabilities & Mitigations

Since the Internet does not guarantee the secrecy of information being transferred, encryption is commonly used to protect the integrity and secrecy of information on the web. This course section covers the security of data in transit or on disk and how encryption can help with securing that information in the context of web application security.

Topics: SSL Vulnerabilities and Testing; Proper Encryption Use in Web Application; Session Vulnerabilities and Testing; Cross-site Request Forgery; Business Logic Flaws; Concurrency; Input-related Flaws and Related Defenses; SQL Injection Vulnerabilities, Testing, and Defense

SECTION 3: Proactive Defense and Operation Security

Day three begins with a detailed discussion on cross-site scripting and related mitigation and testing strategies, as well as HTTP response splitting. The code in an application may be totally locked down, but if the server setting is insecure, the server running the application can be easily compromised. Locking down the web environment is essential, so we cover this basic concept of defending the platform and host. To enable any detection of intrusion, logging and error handling must be done correctly. We will discuss the correct approach to handling incidents and logs, then dive even further to cover the intrusion detection aspect of web application security. In the afternoon we turn our focus to the proactive defense mechanism so that we are ahead of the bad guys in the game of hack and defend.

Topics: Cross-site Scripting Vulnerability and Defenses; Web Environment Configuration Security; Intrusion Detection in Web Applications; Incident Handling; Honeytoken

SECTION 4: AJAX and Web Services Security

Day four is dedicated to the security of asynchronous JavaScript and XML (AJAX) and web services, which are currently the most active areas in web application development. Security issues continue to arise as organizations dive head first into insecurely implementing new web technologies without first understanding them. We will cover security issues, mitigation strategies, and general best practices for implementing AJAX and web services. We will also examine real-world attacks and trends to give you a better understanding of exactly what you are protecting against. Discussion focuses on the web services in the morning and AJAX technologies in the afternoon.

Topics: Web Services Overview; Security in Parsing of XML; XML Security; AJAX Technologies Overview; AJAX Attack Trends and Common Attacks; AJAX Defense

SECTION 5: Cutting-Edge Web Security

Day five focuses on cutting-edge web application technologies and current research areas. Topics such as clickjacking and DNS rebinding are covered. These vulnerabilities are difficult to defend and multiple defense strategies are needed for their defense to be successful. Another topic of discussion is the new generation of single-sign-on solutions such as OpenID. We cover the implications of using these authentication systems and the common "gotchas" to avoid. With the adoption of Web2.0, the use of Java applet, Flash, ActiveX, and Silverlight is on the increase. The security strategies of defending these technologies are discussed so that these client-side technologies can be locked down properly.

Topics: Clickjacking; DNS Rebinding; Flash Security; Java Applet Security; Single-Sign-On Solution and Security; IPv6 Impact on Web Security

SECTION 6: Capture-and-Defend-the-Flag Exercise

Day six starts with an introduction to the secure software development life cycle and how to apply it to web development. But the focus is a large lab that will tie together the lessons learned during the week and reinforce them with hands-on applications. Students will be provided with a virtual machine to implement a complete database-driven dynamic website. In addition, they will use a custom tool to enumerate security vulnerabilities and simulate a vulnerability assessment of the website. Students will then have to decide which vulnerabilities are real and which are false positives, and then mitigate the vulnerabilities. The scanner will score the student as vulnerabilities are eliminated or checked off as false positives. Advanced students will be able to extend this exercise and find vulnerabilities not presented by the scanner. Students will learn through these hands-on exercises how to secure the web application, starting with the operating system, the web server, finding configuration problems in the application language setup, and finding and fixing coding problems in the site.

Topics: Mitigation of Server Configuration Errors; Discovering and Mitigating Coding Problems; Testing Business Logic Issues and Fixing Problems; Web Services Testing and Security Problem Mitigation

Who Should Attend

- Application developers
- Application security analysts or managers
- Application architects
- Penetration testers who are interested in learning about defensive strategies
- Security professionals who are interested in learning about web application security
- Auditors who need to understand defensive mechanisms in web applications
- Employees of PCI-compliant organizations who need to be trained to comply with those requirements

"Brilliant! The combination of hands-on exercises and Q&A streamlines learning like nothing else."

— McKell Gomm, **Henry Schein**

ICS410: **ICS/SCADA Security Essentials**

GICSP
Industrial Cyber Security Professional
giac.org/gicsp

5 Day Program	30 CPEs	Laptop Required

You Will Be Able To

- Better understand various industrial control systems and their purpose, application, function, and dependencies on network IP and industrial communications
- Work with control network infrastructure design (network architecture concepts, including topology, protocols, and components) and their relation to IEC 62443 and the Purdue Model
- Run Windows command line tools to analyze the system looking for high-risk items
- Run Linux command line tools (ps, ls, netstat, ect) and basic scripting to automate the running of programs to perform continuous monitoring of various tools
- Work with operating systems (system administration concepts for Unix/Linux and/or Windows operating systems)
- Better understand the systems' security lifecycle
- Better understand information assurance principles and tenets (confidentiality, integrity, availability, authentication, non-repudiation)
- Use your skills in computer network defense (detecting host- and network-based intrusions via intrusion detection technologies)
- Implement incident response and handling methodologies
- Map different ICS technologies, attacks, and defenses to various cybersecurity standards including the NIST Cyber Security Framework, ISA/IEC 62443, ISO/IEC 27001, NIST SP 800-53, Center for Internet Security Critical Security Controls, and COBIT 5

SANS has joined forces with industry leaders to equip security professionals and control system engineers with the cybersecurity skills they need to defend national critical infrastructure. ICS410: ICS/SCADA Security Essentials provides a foundational set of standardized skills and knowledge for industrial cybersecurity professionals. The course is designed to ensure that the workforce involved in supporting and defending industrial control systems (ICS) is trained to keep the operational environment safe, secure, and resilient against current and emerging cyber threats.

The course will provide you with:

- An understanding of ICS components, purposes, deployments, significant drivers, and constraints
- Hands-on lab learning experiences to control system attack surfaces, methods, and tools
- Control system approaches to system and network defense architectures and techniques
- Incident-response skills in a control system environment
- Governance models and resources for industrial cybersecurity professionals

When examining the greatest risks and needs in critical infrastructure sectors, the course authors looked carefully at the core security principles necessary for the range of tasks involved in supporting control systems on a daily basis. While other courses are available for higher-level security practitioners who need to develop specific skills such as ICS penetration testing, vulnerability analysis, malware analysis, forensics, secure coding, and red team training, most of these courses do not focus on the people who operate, manage, design, implement, monitor, and integrate critical infrastructure production control systems.

With the dynamic nature of ICS, many engineers do not fully understand the features and risks of many devices. For their part, IT support personnel who provide the communications paths and network defenses do not always grasp the systems' operational drivers and constraints. This course is designed to help traditional IT personnel fully understand the design principles underlying control systems and how to support those systems in a manner that ensures availability and integrity. In parallel, the course addresses the need for control system engineers and operators to better understand the important role they play in cybersecurity. This starts by ensuring that a control system is designed and engineered with cybersecurity built into it, and that cybersecurity has the same level of focus as system reliability throughout the system lifecycle.

When these different groups of professionals complete this course, they will have developed an appreciation, understanding, and common language that will enable them to work together to secure their ICS environments. The course will help develop cyber-secure-aware engineering practices and real-time control system IT/OT support carried out by professionals who understand the physical effects of actions in the cyber world.

"The course is informative and relevant to anyone working with or alongside industrial control systems."

— Abrael Delgado, **Compuquip Technologies**

***ICS410** is available via (subject to change):*

Live Training sans.org/events

Anaheim	Anaheim, CA	Jan 20-24
Security East	**New Orleans, LA**	**Feb 3-7**
SANS 2020	**Orlando, FL**	**Apr 5-9**
Bethesda	Bethesda, MD	Apr 14-18
Security West	**San Diego, CA**	**May 8-12**
Nashville Spring	Nashville, TN	May 26-30
SANSFIRE	**Washington, DC**	**Jun 15-19**
Pittsburgh	Pittsburgh, PA	Jun 22-26

Summit Events

ICS Security	Orlando, FL	Mar 4-8

Community Events

Peoria, IL	Feb 3-7

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: ICS Overview

Students will develop and reinforce a common language and understanding of industrial control system (ICS) cybersecurity as well as the important considerations that come with cyber-to-physical operations within these environments. Each student will receive programmable logic controller (PLC) hardware to keep. The PLC contains physical inputs and outputs that will be programmed in class and mapped to an operator interface, or HMI, also created in class. This improved hardware-enabled approach provides the necessary cyber-to-physical knowledge that allows students to better understand important ICS operational drivers and constraints that require specific safety protection, communications needs, system management approaches, and cybersecurity implementations. Essential terms, architectures, methodologies, and devices are all covered to build a common language for students from a variety of different roles.

Topics: Global Industrial Cybersecurity Professional (GICSP) Overview; Purdue Levels 0 and 1; Purdue Levels 2 and 3; DCS and SCADA; IT & ICS Differences; Physical and Cybersecurity; Secure ICS Network Architectures

SECTION 2: Field Devices and Controllers

If you know the adversary's approaches to attacking an ICS environment, you will be better prepared to defend that environment. Numerous attack vectors exist within an ICS environment. Some are similar to traditional IT systems, while others are more specific to ICS. During section 2, students will develop a better understanding of where these specific attack vectors exist and how to block them, starting at the lowest levels of the control network. Students will look at different technologies and communications used in Purdue Levels 0 and 1, the levels that are the most different from an IT network. Students will capture fieldbus traffic from the PLCs they programmed in section 1 and look at what other fieldbus protocols are used in the industry. Later in the section, students will analyze network captures containing other control protocols that traverse Ethernet-only networks and TCP/IP networks, set up a simulated controller, and interact with it through a control protocol.

Topics: ICS Attack Surface; Purdue Levels 0 and 1; Ethernet and TCP/IP

Who Should Attend

The course is designed for the range of individuals who work in, interact with, or can affect industrial control system environments, including asset owners, vendors, integrators, and other third parties. These personnel primarily come from four domains:

- IT (includes operational technology support)
- IT security (includes operational technology security)
- Engineering
- Corporate, industry, and professional standards

SECTION 3: Supervisory Systems

Section 3 will take students through the middle layers of control networks. Students will learn about different methods to segment and control the flow of traffic through the control network. Students will explore cryptographic concepts and how they can be applied to communications protocols and on devices that store sensitive data. Students will learn about the risks of using wireless communications in control networks, which wireless technologies are commonly used, and available defenses for each. After a hands-on network forensics exercise where students follow an attacker from phishing campaign to HMI breach, students will look at HMI, historian, and user interface technologies used in the middle to upper levels of the control network, namely Purdue Levels 2 and 3, while performing attacks on HMI web technologies and interfaces susceptible to password brute force attacks.

Topics: Enforcement Zone Devices; Understanding Basic Cryptography; Wireless Technologies; Wireless Attacks and Defenses; Exercise: Network Forensics of an Attack; Purdue Level 2 and 3 Attacks

SECTION 4: Workstations and Servers

Students will learn essential ICS-related server and workstation operating system capabilities, implementation approaches, and system management practices. Students will receive and work with both Windows- and Linux-based virtual machines in order to understand how to monitor and harden these hosts from attack. Students will examine concepts that benefit ICS systems such as system hardening, log management, monitoring, alerting, and audit approaches, then look at some of the more common applications and databases used in ICS environments across multiple industries. Finally, students will explore attacks and defenses on remote access for control systems.

Topics: Patching ICS Systems; Defending Microsoft Windows; Defending Unix and Linux; Endpoint Security Software; Event Logging and Analysis; Remote Access Attacks

SECTION 5: ICS Security Governance

Students will learn about the various models, methodologies, and industry-specific regulations that are used to govern what must be done to protect critical ICS systems. Key business processes that consider risk assessments, disaster recovery, business impact analysis, and contingency planning will be examined from the perspective of ICS environments. On this final course section, students will work together on an incident response exercise that places them squarely in an ICS environment that is under attack. This exercise ties together key aspects of what has been learned throughout the course and presents students with a scenario to review with their peers. Specific incident-response roles and responsibilities are considered, and actions available to defenders throughout the incident response cycle are explored. Students will leave with a variety of resources for multiple industries and will be well prepared to pursue the GICSP, an important ICS-focused professional certification.

Topics: Building an ICS Cybersecurity Program; Creating ICS Cybersecurity Policy; Disaster Recovery; Measuring Cybersecurity Risk; Incident Response; Exercise: Incident Response Tabletop Exercise; Final Thoughts and Next Steps

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training. . . . . Apr 14-18

Online Training. . . . . Jun 15-19

ICS456: **Essentials for NERC Critical Infrastructure Protection**

GCIP
Critical Infrastructure Protection
giac.org/gcip

5	31	Laptop
Day Program	CPEs	Required

You Will Be Able To

- Understand the cybersecurity objectives of the NERC Critical Infrastructure Protection (CIP) standards
- Understand the NERC regulatory framework, its source of authority, and the process for developing CIP standards, as well as their relationship to the other Bulk Electric System (BES) reliability standards
- Speak fluent NERC CIP and understand how seemingly similar terms can have significantly different meanings and impacts on your compliance program
- Break down the complexity to more easily identify and categorize BES cyber assets and systems
- Develop better security management controls by understanding what makes for effective cybersecurity policies and procedures
- Understand physical and logical controls and monitoring requirements
- Make sense of the CIP-007 system management requirements and their relationship to CIP-010 configuration management requirements, and understand the multiple timelines for assessment and remediation of vulnerabilities
- Determine what makes for a sustainable personnel training and risk assessment program
- Develop strategies to protect and recover BES cyber system information
- Know the keys to developing and maintaining evidence that demonstrates compliance and be prepared to be an active member of the audit support team.
- Sharpen your CIP Ninja!

This five-day course empowers students with knowledge of the "what" and the "how" of the version 5/6 standards. The course addresses the role of the Federal Energy Regulatory Commission (FERC), North American Reliability Corporation (NERC), and the Regional Entities, provides multiple approaches for identifying and categorizing Bulk Electric System (BES) cyber systems, and helps asset owners determine the requirements applicable to specific implementations. Additionally, the course covers implementation strategies for the version 5/6 requirements with a balanced practitioner approach to both cybersecurity benefits, as well as regulatory compliance.

The course features 25 hands-on labs range from securing workstations to digital forensics and lock picking.

The SANS ICS456: NERC Critical Infrastructure Protection Essentials course was developed by SANS ICS team members with extensive electric industry experience, including former Registered Entity Primary Contacts, a former NERC officer, and a Co-Chair of the NERC Critical Infrastructure Protection (CIP) Interpretation Drafting Team. Together the authors bring real-world, practitioner experience gained from developing and maintaining NERC CIP and NERC 693 compliance programs and actively participating in the standards development process.

You Will Learn:

- BES cyber system identification and strategies for lowering their impact rating
- Nuances of NERC-defined terms and the applicability of CIP standards and how subtle changes in definitions can have a big impact on your program
- The significance of properly determining cyber system impact ratings and strategies for minimizing compliance exposure
- Strategic implementation approaches for supporting technologies
- How to manage recurring tasks and strategies for CIP program maintenance
- Effective implementations for cyber and physical access controls
- How to break down the complexity of NERC CIP in order to communicate with your leadership
- What to expect in your next CIP audit, how to prepare supporting evidence, and how to avoid common pitfalls
- How to understand the most recent Standards Development Team's efforts and how that may impact your current CIP program

"This is best-in-class NERC CIP training. The courseware provides valuable compliance approaches and software tools for peer collaboration to build consent on implementation."

— Jeff Mantong, **WAPA**

***ICS456** is available via (subject to change):*

Live Training sans.org/events

Bethesda . . . . . Bethesda, MD . . . . . Apr 14-19

Security West . . . . . **San Diego, CA** . . . . . **May 8-12**

Summit Events

ICS Security . . . . . Orlando, FL . . . . . Mar 4-8

Section Descriptions

SECTION 1: Asset Identification and Governance

A transition is under way from NERC CIP programs that are well defined and understood to a new CIP paradigm that expands its scope into additional environments and adds significantly more complexity. On section 1 students will develop an understanding of the electricity sector regulatory structure and history as well as an appreciation for how the CIP standards fit into the overall framework of the reliability standards. Key NERC terms and definitions related to NERC CIP are reviewed using realistic concepts and examples that prepare students to better understand their meaning. We will explore multiple approaches to BES cyber asset identification and learn the critical role of strong management and governance controls. The section will examine a series of architectures, strategies, and difficult compliance questions in a way that highlights the reliability and cybersecurity strengths of particular approaches. Unique labs will include a scenario-based competition that helps bring the concepts to life and highlights the important role we play in defending the grid.

Topics: Regulatory History and Overview; NERC Functional Model; NERC Reliability Standards; CIP History; Terms and Definitions; CIP-002: BES Cyber System Categorization; CIP-003: Security Management Controls

SECTION 2: Access Control and Monitoring

Strong physical and cyber access controls are at the heart of any good cybersecurity program. During section 2 we move beyond the "what" of CIP compliance to understanding the "why" and the "how." Firewalls, proxies, gateways, IDS and more – learn where and when they help and learn practical implementations to consider and designs to avoid. Physical protections include more than fences and you'll learn about the strengths and weaknesses of common physical controls and monitoring schemes. Labs will reinforce the learnings throughout the section and will introduce architecture review and analysis, firewall rules, IDS rules, compliance evidence demonstration, and physical security control reviews.

Topics: CIP-005: Electronic Security Perimeter(s); Interactive Remote Access; External Routable Communication and Electronic Access Points; CIP-006: Physical Security of BES Cyber Systems; Physical Security Plan; Visitor Control Programs; PACS Maintenance and Testing; CIP-014: Physical Security

Who Should Attend

- IT and OT (ICS) cybersecurity
- Field support personnel
- Security operations personnel
- Incident response personnel
- Compliance staff
- Team leaders
- Persons involved in governance
- Vendors/Integrators
- Auditors

SECTION 3: System Management

CIP-007 has consistently been one of the most violated standards going back to CIP version 1. With the CIP standards moving to a systematic approach with varying requirement applicability based on system impact rating, the industry now has new ways to design and architect system management approaches. Throughout section 3, students will dive into CIP-007. We'll examine various Systems Security Management requirements with a focus on implementation examples and the associated compliance challenges. This section will also cover the CIP-010 requirements for configuration change management and vulnerability assessments that ensure systems are in a known state and under effective change control. We'll move through a series of labs that reinforce the topics covered from the perspective of the CIP practitioner responsible for implementation and testing.

Topics: CIP-007: System Management; Physical and Logical Ports; Patch Management; Malicious Code Prevention; Account Management; CIP-010: Configuration Change Management and Vulnerability Assessments; Change Management Program; Baseline Configuration Methodology; Change Management Alerting/Prevention

SECTION 4: Information Protection and Response

Education is key to every organization's success with NERC CIP and the students in ICS 456 will be knowledgeable advocates for CIP when they return to their place of work. Regardless of their role, all students can be a valued resource to their organization's CIP-004 training program, the CIP-011 information protection program. Students will be ready with resources for building and running strong awareness programs that reinforce the need for information protection and cybersecurity training. On section 4 we'll examine CIP-008 and CIP-009 covering identification, classification, communication of incidents, and the various roles and responsibilities needed in an incident response or a disaster recovery event. Labs on section 4 will introduce tools for ensuring file integrity and sanitization of files to be distributed, how to best utilize and communicate with the E-ISAC, and how to preserve incident data for future analysis.

Topics: CIP-004: Personnel & Training; Security Awareness Program; CIP Training Program; PRA Evaluation Process; CIP-011: Information Protection; Information Protection Program; Data Sanitization; CIP-008: Incident Reporting and Response Planning; Incident Response Plan/Testing; Reporting Requirements; CIP-009: Recovery Plans for BES Cyber Systems; Recovery Plans; System Backup

SECTION 5: CIP Process

On the final section students will learn the key components for running an effective CIP compliance program. We will review the NERC processes for standards development, violation penalty determination, Requests For Interpretation, and recent changes stemming from the Reliability Assurance Initiative. Additionally we'll identify recurring and audit-related processes that keep a CIP compliance program on track: culture of compliance, annual assessments, gap analysis, TFEs, and self-reporting. We'll also look at the challenge of preparing for NERC audits and provide tips to be prepared to demonstrate the awesome work your team is doing. Finally, we'll look at some real-life CIP violations and discuss what happened and the lessons we can take away. At the end of section 5 students will have a strong call to action to participate in the ongoing development of CIP within their organization and in the industry overall as well as a sense that CIP is doable! Labs on section 5 will cover DOE C2M2, audit tools, and an audit-focused take on a blue team-red team exercise.

Topics: Scenario One:
CIP Processes for Maintaining Compliance; Preparing for an Audit; Audit Follow-Up; CIP Industry Activities; Standards Process; CIP of the Future

"This is a great course that examines NERC CIP standards and compliance from a variety of perspectives. I recommend it to anyone working with CIP."

— Tom Duffey, **Accenture Security**

ICS515: **ICS Active Defense and Incident Response**

GRID
Response and Industrial Defense
giac.org/grid

5 Day Program	30 CPEs	Laptop Required

You Will Be Able To

- Perform ICS incident response focusing on security operations and prioritizing the safety and reliability of operations
- Determine how ICS threat intelligence is generated and how to use what is available in the community to support ICS environments. The analysis skills you learn will enable you to critically analyze and apply information from ICS threat intelligence reports on a regular basis.
- Identify ICS assets and their network topologies and how to monitor ICS hotspots for abnormalities and threats. The course will introduce and reinforce methodologies such as ICS network security monitoring and approaches to reducing the control system threat landscape
- Analyze ICS threats and extract the most important information needed to quickly scope the environment and understand the nature of the threat
- Operate through an attack and gain the information necessary to instruct teams and decision-makers on whether operations must shut down or it is safe to respond to the threat and continue operations
- Use multiple security disciplines in tandem to leverage an active defense and safeguard an ICS, all reinforced with hands-on labs and technical concepts

ICS515: ICS Active Defense and Incident Response will help you deconstruct industrial control system (ICS) cyber attacks, leverage an active defense to identify and counter threats to your ICS, and use incident response procedures to maintain the safety and reliability of operations.

The course will empower students to understand their networked ICS environment, monitor it for threats, perform incident response against identified threats, and learn from interactions with the adversary to enhance network security. This process of monitoring, responding to, and learning from threats internal to the network is known as active defense, which is needed to counter advanced adversaries targeting ICS, as has been seen with malware such as STUXNET, HAVEX, CRASHOVERRIDE, and TRISIS. Students can expect to come out of this course with the ability to deconstruct targeted ICS attacks and fight these adversaries and others.

The course uses a hands-on approach and real-world malware to break down cyber attacks on ICS from start to finish. Students will gain a practical and technical understanding of leveraging active defense concepts such as using threat intelligence, performing network security monitoring, and utilizing threat analysis and incident response to ensure the safety and reliability of operations. The strategic and technical skills presented in this course serve as a basis for ICS organizations looking to show that defense is do-able.

This course will prepare you to:

- Examine ICS networks and identify the assets and their data flows in order to understand the network baseline information needed to identify advanced threats
- Use active defense concepts such as threat intelligence consumption, network security monitoring, malware analysis, and incident response to safeguard the ICS
- Build your own Programmable Logic Controller using a CYBATIworks Kit, which you can keep after the class ends
- Gain hands-on experience with samples of Havex, BlackEnergy2, and Stuxnet by engaging in labs and de-constructing these threats and others
- Leverage technical tools such as Shodan, Security Onion, TCPDump, Wireshark, Snort, Bro, SGUIL, ELSA, Volatility, Redline, FTK Imager, PDF analyzers, malware sandboxes, and more
- Create indicators of compromise (IOCs) in OpenIOC and YARA and gain an understanding of sharing standards such as STIX and TAXII
- Take advantage of models such as the Sliding Scale of Cybersecurity, the Active Cyber Defense Cycle, and the ICS Cyber Kill Chain to extract information from threats and use it to encourage the long-term success of ICS network security

"This course was like a catalyst. It not only boosted my knowledge about the threats facing ICS environments and provided me with a framework to actively defend these threats, it also inspired me to learn more."

— Srinath Kannan, **Accenture**

***ICS515** is available via (subject to change):*

Live Training sans.org/events

Las Vegas	Las Vegas, NV	Jan 27-31
Baltimore Spring	Baltimore, MD	Apr 27 - May 1
Security West	**San Diego, CA**	**May 8-12**
San Antonio	San Antonio, TX	May 17-21
New Orleans	New Orleans, LA	Jun 8-12
SANSFIRE	**Washington, DC**	**Jun 15-19**

Summit Events

ICS Security	Orlando, FL	Mar 4-8

Private Training

This course is also available through Private Training.

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Simulcast

Online Training	Jan 27-31
Online Training	May 17-21

Section Descriptions

Course Preview
available at:
sans.org/demo

SECTION 1: Threat Intelligence

Industrial control system (ICS) security professionals must be able to leverage internal and external threat intelligence to critically analyze threats, extract indicators of compromise (IOCs), document tactics, techniques, and procedures (TTPs), and guide security teams to find threats in the environment. On this first course day students will learn how threat intelligence is generated, how to critically analyze reports, and the basic tenets of active defense functions. Students will become better analysts and critical thinkers by learning skills useful in day-to-day operations, regardless of their jobs and roles. This day features five hands-on labs that include building a Programmable Logic Controller (PLC), identifying information available about assets online through Shodan, completing an analysis of competing hypotheses, visualizing the attack space, and ingesting threat intelligence reports to guide their practices over the rest of the labs in the course.

Topics: Case Study: STUXNET; Introduction to ICS Active Defense and Incident Response; Intelligence Life-Cycle and Threat Intelligence; ICS Cyber Kill Chain; Identifying and Reducing the Threat Landscape; Sharing and Consuming ICS Threat Intelligence

SECTION 2: Asset Identification and Network Security Monitoring

Understanding the networked environment is the only way to fully defend it: you cannot defend what you do not know. This course section will teach students to use tools such as Wireshark, TCPdump, CyberLens, ELSA, Bro, and Snort to map their ICS network, collect data, detect threats, and analyze threats to drive incident response procedures. During this section, students will be introduced to the lab network and an advanced persistent threat (APT) that is present on it. Drawing on threat intelligence from the previous course section, students will have to discover, identify, and analyze the threat using their new active defense skills to guide incident responders to the affected Human Machine Interface (HMI).

Topics: Case Study: HAVEX; ICS Asset and Network Visibility; ICS Network Security Monitoring – Collection; ICS Network Security Monitoring – Detection; ICS Network Security Monitoring – Analysis

SECTION 3: Incident Response

The ability to prepare for and perform ICS incident response is vital to the safety and reliability of control systems. ICS incident response is a core concept of ICS active defense and requires that analysts safely acquire digital evidence while scoping the environment for threats and their impact on operations. ICS incident response is a young field with many challenges, but during this section students will learn effective tactics and tools to collect and preserve forensic-quality data. Students will then use these data to perform timely forensic analysis and create IOCs. In the previous section's labs, APT malware was identified in the network. In this section, the labs will focus on identifying which system is impacted and gathering a sample of the threat that can be analyzed.

Topics: Case Study: German Steelworks Attack; Incident Response and Digital Forensics Overview; Evidence Acquisition; Sources of Forensic Data in ICS Networks; Memory Forensics and Identifying Capabilities; Integrated Timely Analysis

SECTION 4: Threat and Environment Manipulation

Understanding the threat is key to discovering its capabilities and its potential to affect the ICS. The information extracted from threats through processes such as malware analysis is also critical to being able to make the necessary changes to the environment to reduce the effectiveness of the threat. The information obtained is vital to an ICS active defense, which requires internal data collection to create and share threat intelligence. In this section, students will learn how to analyze initial attack vectors such as spearphishing emails, perform timely malware analysis techniques, analyze memory images, and create Indicators of Compromise in YARA. The previous section's labs identified the infected HMI and gathered a sample of the APT malware. In this section's labs, students will analyze the malware, extract information, and develop YARA rules to complete the active defense model introduced in the class and maintain operations.

Topics: Case Study: BlackEnergy2; ICS Threat and Environment Manipulation Goals and Considerations; Analyzing Acquired Evidence; Case Study: Ukraine Power Grid Attack, 2015; Malware Analysis Methodologies; Case Study: CRASHOVERRIDE; Documenting Knowledge; Case Study: TRISIS

SECTION 5: Active Defense and Incident Response Challenge

This section focuses on reinforcing the strategy, methodologies, skillsets, and tools introduced in the first four sections of the course. This entirely hands-on section will present students with two different scenarios. The first involves data collected from an intrusion into SANS Cyber City. The second involves data collected from a Distributed Control System (DCS) infected with malware. This section will truly challenge students to utilize their ICS active defense and incident response skills and test themselves.

Topics:

Scenario One:
Identify the Assets and Map the ICS Networks; Perform ICS Network Security Monitoring to Identify the Abnormalities; Execute ICS Incident Response Procedures Into the SANS Cyber City Data Files; Analyze the Malicious Capability and Determine if the Threat Is an Insider Threat or a Targeted External Threat

Scenario Two:
Identify the Software and Information Present on the DCS; Leverage ICS Active Defense Concepts to Identify the Real-World Malware; Determine the Impact on Operations and Remediation Needs

Who Should Attend

- ICS incident response team leads and members
- ICS and operations technology security personnel
- IT security professionals
- Security Operations Center team leads and analysts
- ICS red team and penetration testers
- Active defenders

"ICS515 integrated the OT/ICS side of security into the course well, not like other courses I've taken that taught general IT security with OT added as an afterthought."

— Josh Tanski, **Morton Salt**

ICS612: **ICS Cyber Security In-Depth** NEW

5 Day Program | 30 CPEs | Laptop Required

You Will Be Able To

- Gain hands-on experience with typical assets found within an industrial environment, including Programmable Logic Controller (PLC), Operator Interfaces (OI) for local control, Human Machine Interface (HMI) servers, Historian server, switches, routers, and firewall(s).
- Gain an understanding of PLC execution through hands-on exercises.
- Identify security methods that can be applied to real-time control and Input/Output systems.
- Understand the pros and cons of various PLC and HMI architectures with recommendations for improving security postures of these real-time control systems.
- Identify where critical assets exist within an industrial environment.
- Understand the role and design of an Industrial Demilitarized Zone (IDMZ).
- Gain hands-on experience with firewalls placed within the industrial zone to achieve cell-to-cell isolation and perimeter restrictions.
- Dissect multiple industrial protocols to understand normal and abnormal traffic used in the operational control of assets.
- Gain an understanding of the role of IT network services within ICS and identify security methods that can be applied.
- Use the RELICS virtual machine for asset and traffic identification.
- Troubleshoot configuration errors within an operational environment.
- Understand adversary approaches in targeting and manipulating industrial control systems.

ICS-AWARE MALWARE AND ATTACKS ON CRITICAL INFRASTRUCTURE ARE INCREASING IN FREQUENCY AND SOPHISTICATION. YOU NEED TO IDENTIFY THREATS AND VULNERABILITIES AND METHODS TO SECURE YOUR ICS ENVIRONMENT. LET US SHOW YOU HOW!

The ICS612: ICS Cybersecurity In-Depth course will help you:

- Learn active and passive methods to safely gather information about an ICS environment
- Identify vulnerabilities in ICS environments
- Determine how attackers can maliciously interrupt and control processes and how to build defenses
- Implement proactive measures to prevent, detect, slow down, or stop attacks
- Understand ICS operations and what "normal" looks like
- Build choke points into an architecture and determine how they can be used to detect and respond to security incidents
- Manage complex ICS environments and develop the capability to detect and respond to ICS security events

The course concepts and learning objectives are primarily driven by the focus on hands-on labs. The in-classroom lab setup was developed to simulate a real-world environment where a controller is monitoring/controlling devices deployed in the field along with a field-mounted touchscreen Human Machine Interface (HMI) available for local personnel to make needed process changes. Utilizing operator workstations in a remotely located control center, system operators use a SCADA system to monitor and control the field equipment. Representative of a real ICS environment, the classroom setup includes a connection to the enterprise, allowing for data transfer (i.e., Historian), remote access, and other typical corporate functions.

The labs move students through a variety of exercises that demonstrate how an attacker can attack a poorly architected ICS (which, sadly, is not uncommon) and how defenders can secure and manage the environment.

"Truly understanding the devices we are charged with defending is imperative to effectively implementing security measures."

— Crystal B., **U.S. Army**

***ICS612** is available via (subject to change):*

Live Training sans.org/events

Security West . . . . . **San Diego, CA** . . . . . **May 8-12**

Summit Events

ICS Security . . . . . Orlando, FL . . . . . Mar 4-8

Section Descriptions

SECTION 1: Local Process

Learning Objectives:

- Review of Lab Setup
- Introduction to the PLC Platform Application Tools
- Introduction to Programming a PLC
- Service Discovery on PLC
- Introduction to the HMI Platform Application Tools
- Understand HMI to PLC Communication

Topics: Process familiarization using the Purdue model: Communication flow mapping referencing the Zones and conduit approach: Components of Level 0-2: Local I/O and local HMI communications: Understand operational functions: Understand inherent process weaknesses: Protocol dissection of operational data: Embedded device essentials: Operator Interface (I/O) subsystems and communications: Safety systems: Process time

SECTION 2: System of Systems

Learning Objectives:

- Introduction to Peer-to-Peer Communications
- Introduction to SCADA Systems
- OPC Communications

Topics: Learn components of Level 3: Learn peer-to-peer communications between PLCs: Learn SCADA/OPC communications: Learn the use and dependencies of traditional IT services (DNS, AD, DHCP, NTP, etc.): Vendor security models and industrial DMZs: Learn attack vectors and defense techniques from Level 3

SECTION 3: Network Infrastructure – Architecture Design & Implementation

Learning Objectives:

- Network Architecture and Technology in ICS
- ICS Firewalls
- ICS Perimeter
- Historians
- Remote Access and Jump Host/2FA

Topics: Understand connected process: Analyze case studies in ICS environments and secure plant design: Identify typical trusted communications flows (Time, File sharing, Remote Access, Historians, AD replication, Reverse Web Proxies, Patch servers)

SECTION 4: System Management Implementation

Learning Objectives:

- ICS System Monitoring and Logging
- ICS Asset Management
- ICS Asset Validation

Topics: Logging and traffic collection in an ICS environment: Monitoring and alerting in ICS networks: Monitoring and alerting in a serial network: System integrity verification

SECTION 5: Attack Vectors, ICS Targets, and Kill Chain Mapping

Learning Objective:

- Hands-on environment troubleshooting

Attack/Defend – ICS NetWars Style Challenge

Topics: Pivoting and positioning in an ICS target environment: Operational traffic reverse engineering: Protocol-level manipulation: Firmware manipulation: Industrial wireless discovery and attack: Time synchronization manipulation: Data table and scaling modifications

Who Should Attend

- ICS410 course alumni – students who have successfully completed ICS410: ICS/SCADA Security Essentials will have the base knowledge considered as a prerequisite for this course.
- Process control engineers
- Systems or safety system Engineers
- Active defenders in ICS
- Anyone with significant control system experience interested in understanding processes and methods to secure the ICS environment

"The training starts with theory and quickly progresses into full hands-on interaction with all components. This experience is not easy to find. It is an amazing course."

— Bassem Hemida, **Deloitte**

SEC402: Cybersecurity Writing: Hack the Reader

2 Day Course | 12 CPEs | Laptop Not Needed

Want to write better? Learn to hack the reader! Discover how to find an opening, break down your readers' defenses, and capture their attention to deliver your message—even if they're too busy or indifferent to others' writing. This unique course, built exclusively for cybersecurity professionals, will strengthen your writing skills and boost your security career. You will:

- Uncover the five "golden elements" of effective reports, briefings, emails, and other cybersecurity writing.
- Make these elements part of your arsenal through hands-on exercises that draw upon common security scenarios.
- Learn the key topics you need to address in security reports and other written communications.
- Understand how to pick the best words, structure, look, and tone.
- Begin improving your skills at once by spotting and fixing weaknesses in security samples.
- Receive practical checklists to ensure you'll write clearly and effectively right away.

Live Training* sans.org/events

SANS 2020	Orlando, FL	Apr 3-4

Online Training sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

SEC440: Critical Security Controls: Planning, Implementing, and Auditing

2 Day Course | 12 CPEs | Laptop Not Needed

This course helps you master specific, proven techniques and tools needed to implement and audit the Critical Security Controls as documented by the Center for Internet Security (CIS). These Critical Security Controls are rapidly becoming accepted as the highest priority list of what must be done and proven before anything else at nearly all serious and sensitive organizations. These controls were selected and defined by the U.S. military and other government and private organizations (including the NSA, DHS, GAO, and many others) that are the most respected experts on how attacks actually work and what can be done to stop them. They defined these controls as their consensus for the best way to block known attacks and help find and mitigate damage from attacks that get through. For security professionals, the course enables you to see how to put the controls in place in your existing network though effective and widespread use of cost-effective automation. For auditors, CIOs, and risk officers, the course is the best way to understand how you will measure whether the controls are effectively implemented.

Live Training* sans.org/events

Security East	New Orleans, LA	Feb 1-2
SANS 2020	Orlando, FL	Apr 3-4
Security West	San Diego, CA	May 6-7
SANSFIRE	Washington, DC	Jun 13-14

Online Training* sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

SEC455: SIEM Design & Implementation

2 Day Course | 12 CPEs | Laptop Required

Security Information and Event Management (SIEM) can be an extraordinary benefit to an organization's security posture, but understanding and maintaining it can be difficult. Many solutions require complex infrastructure and software that necessitate professional services for installation. The use of professional services can leave security teams feeling as if they do not truly own or understand how their SIEM operates. Combine this situation of complicated solutions with a shortage of available skills, a lack of simple documentation, and the high costs of software and labor, and it is not surprising that deployments often fail to meet expectations. A SIEM can be the most powerful tool a cyber defense team can wield, but only when it is used to its fullest potential. This course is designed to address this problem by demystifying SIEMs and simplifying the process of implementing a solution that is usable, scalable, and simple to maintain.

Live Training* sans.org/events

Security East	New Orleans, LA	Feb 1-2
SANS 2020	Orlando, FL	Apr 3-4
SANSFIRE	Washington, DC	Jun 13-14

Online Training* sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

SEC546: IPv6 Essentials

2 Day Course | 12 CPEs | Laptop Required

Implementing IPv6 should not happen without carefully considering the security impact of the new protocol. Even if you haven't implemented it yet, the ubiquitous IPv6 support in modern operating systems easily leads to unintentional IPv6 implementation, which may put your network at risk. In this course, we will start out by introducing the IPv6 protocol, explaining in detail many of its features like the IPv6 header, extension headers and auto configuration. Only by understanding the design of the protocols in depth will it be possible to appreciate the various attacks and mitigation techniques. The course will address how to take advantage of IPv6 to re-think how to assign addresses in your network and how to cope with what some suggest is the biggest security problem in IPv6: no more NAT! IPv6 doesn't stop at the network layer. Many application layer protocols change in order to support IPv6, and we will take a close look at protocols like DNS, DHCPv6 and more.

Live Training* sans.org/events

*Private Training

This course is also available through Private Training.

Penetration Testing | **Beta, 2-Day & Hosted Courses**

SEC699: Purple Team Tactics – Adversary Emulation for Breach Prevention & Detection BETA

2 Day Course | 12 CPEs | Laptop Required

SEC699 is SANS' advanced purple team offering, with a key focus on adversary emulation for data breach prevention and detection. Throughout this course, students will learn how real-life threat actors can be emulated in a realistic, enterprise, environment. In true purple fashion, the goal of the course is to educate students on how adversarial techniques can be emulated and detected.

Live Training* sans.org/events

SEC564: Red Team Exercises & Adversary Emulation NEW!

2 Day Course | 12 CPEs | Laptop Required

Red Teaming is the process of using tactics, techniques, and procedures (TTPs) to emulate real-world adversaries in order to train and measure the effectiveness of the people, processes, and technology used to defend organizations. SEC564 will provide you with the skills to manage and operate a Red Team, conduct Red Team exercises and adversary emulations, and understand the role of the team and its importance in security testing.

Built on the fundamentals of penetration testing, Red Team exercises use a comprehensive approach to gain a holistic view of an organization's security posture in order to improve its ability to detect, respond to, and recover from an attack. When properly conducted, Red Team exercises significantly improve an organization's security posture and controls, hone its defensive capabilities, and measure the effectiveness of its security operations.

Live Training* sans.org/events

SANS 2020	Orlando, FL	Apr 3-4
Security West	San Diego, CA	May 6-7
SANSFIRE	Washington, DC	Jun 13-14

SEC580: Metasploit Kung Fu for Enterprise Pen Testing

2 Day Course | 12 CPEs | Laptop Required

Many enterprises today face regulatory or compliance requirements that mandate regular penetration testing and vulnerability assessments. Commercial tools and services for performing such tests can be expensive. While really solid free tools such as Metasploit are available, many testers do not understand the comprehensive feature sets of such tools and how to apply them in a professional-grade testing methodology. Metasploit was designed to help testers with confirming vulnerabilities using an open-source and easy-to-use framework. This course will help students get the most out of this free tool. This class will show students how to apply the incredible capabilities of the Metasploit Framework in a comprehensive penetration testing and vulnerability assessment regimen, according to a thorough methodology for performing effective tests. Students who complete the course will have a firm understanding of how Metasploit can fit into their penetration testing and day-to-day assessment activities. The course will provide an in-depth understanding of the Metasploit Framework far beyond simply showing attendees how to exploit a remote system.

Live Training* sans.org/events

Security East	New Orleans, LA	Feb 1-2
SANS 2020	Orlando, FL	Apr 3-4
Security West	San Diego, CA	May 6-7
SANSFIRE	Washington, DC	Jun 13-14

Online Training* sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

HOSTED: Physical Security Specialist – Full Comprehensive Edition

6 Day Course | 36 CPEs | Laptop Required

Those who attend this course will leave with a full awareness of how to best protect buildings and grounds from unauthorized access, as well as how to compromise most existing physical security in order to gain access themselves. Our subject matter experts will immerse you in all the necessary components of a well-layered physical defense system and then teach you how to conduct a thorough site analysis of a facility.

Live Training* sans.org/events

SANS 2020	Orlando, FL	Apr 5-10

Team-Based Training **Course**

TBT570: Team-Based Training – Blue Team & Red Team Dynamic Workshop

6 Day Program | 36 CPEs | Laptop Required

Throughout this unique team-based training course, student teams of three-to-five participants function together as part of a Blue Team battling an adversary in real time over multiple days and campaigns. The technical terrain is a realistic enterprise environment: The SANS Red/Blue Cyber Range.

Live Training sans.org/events

SANS 2020	Orlando, FL	Apr 5-10
SANSFIRE	Washington, DC	Jun 15-20

*Private Training

This course is also available through Private Training.

MGT521: Driving Cybersecurity Change – Establishing a Culture of Protect, Detect and Respond BETA

2 Day Course | 12 CPEs | Laptop Not Needed

Cybersecurity is no longer just about technology it is ultimately about organizational change. Change in not only how people think about security but what they prioritize and how they act, from the Board of Directors on down. Organizational change is a field of management study that enables organizations to analyze, plan, and then improve their operations and structures by focusing on people and culture. SANS course MGT521 will teach leaders how to leverage the principles of organizational change, enabling them to develop, maintain and measure a security-driven culture. Through hands-on, real-world instruction and a series of interactive labs and exercises in which you will apply the concepts of organizational change to a variety of different security initiatives, you will quickly learn how to embed cybersecurity into your organizational culture.

MGT415: A Practical Introduction to Cyber Security Risk Management

2 Day Course | 12 CPEs | Laptop Required

In this course students will learn the practical skills necessary to perform regular risk assessments for their organizations. The ability to perform risk management is crucial for organizations hoping to defend their systems. There are simply too many threats, too many potential vulnerabilities that could exist, and not enough resources to create an impregnable security infrastructure. Therefore every organization, whether it does so in an organized manner or not, will make priority decisions on how best to defend its valuable data assets. Risk management should be the foundational tool used to facilitate thoughtful and purposeful defense strategies.

Live Training sans.org/events

Security East	**New Orleans, LA**	**Feb 1-2**
SANS 2020	**Orlando, FL**	**Apr 3-4**
Security West	**San Diego, CA**	**May 6-7**
SANSFIRE	**Washington, DC**	**Jun 13-14**

Community Events

Philadelphia, PA	Feb 10-11

MGT433: SANS Security Awareness: How to Build, Maintain, and Measure a Mature Awareness Program

SSAP
Security Awareness Professional
giac.org/ssap

2 Day Course | 12 CPEs | Laptop Not Needed

Organizations have invested a tremendous amount of money and resources into securing technology, but little if anything into securing their workforce. As a result, people, not technology, have become the most common target for cyber attackers. The most effective way to secure the human element is to establish a mature security awareness program that goes beyond just compliance, changes people's behaviors and ultimately creates a secure culture. This intense two-day course will teach you the key concepts and skills needed to do just that, and is designed for those establishing a new program or wanting to improve an existing one. The course content is based on lessons learned from hundreds of security awareness programs from around the world. In addition, you will learn not only from your instructor, but from extensive interaction with your peers. Finally, through a series of labs and exercises, you will develop your own custom security awareness plan that you can implement as soon as you return to your organization.

Live Training* sans.org/events

SANS 2020	**Orlando, FL**	**Apr 3-4**
SANSFIRE	**Washington, DC**	**Jun 13-14**

Online Training* sans.org/online-training

OnDemand

Complete this course anywhere, anytime, at your own pace, with four months of online access in the OnDemand platform.

Course Preview available at: **sans.org/demo**

*Private Training
This course is also available through Private Training.

Industrial Control Systems | **Hosted Courses**

HOSTED: Assessing and Exploiting Control Systems

6 Day Program | 36 CPEs | Laptop Required

This course teaches hands-on penetration testing techniques used to test individual components of a control system, including embedded electronic field devices, network protocols, RF communications, Human Machine Interfaces (HMIs), and various forms of master servers and their ICS applications. Skills you will learn in this course will apply directly to systems such as the Smart Grid, PLCs, RTUs, smart meters, building management, manufacturing, Home Area Networks (HAN), smart appliances, SCADA, substation automation, and synchrophasors. This course is structured around the formal penetration testing methodology created by UtiliSec for the U.S. Department of Energy.

Live Training sans.org/events

Summit Events

ICS Security . . . . . Orlando, FL . . . . . Mar 4-9

HOSTED: ICS Cybersecurity for Managers NEW!

1 Day Course | 6 CPEs | Laptop Required

Are you responsible for implementing an industrial control system (ICS) or an operational technology (OT) cybersecurity program? This course is for you whether you are a manager or a team member, or whether you work for corporate or at a site. We'll take you on a tour of the risks, concepts, terminology, standards, regulations, best practices, and jargon surrounding this important new field. You'll learn how to navigate through these complex considerations and apply effective structure and priorities to your implementation strategy and plan. This course was developed and is taught by two highly experienced professionals: a former CISO of an oil and gas company, and the vice-president of industrial cybersecurity for an engineering and process safety services firm.

Live Training sans.org/events

SANS 2020 . . . . . **Orlando, FL** . . . . . **Apr 5-10**

DevSecOps | **2-Day Course**

SEC534 Secure DevOps: A Practical Introduction

2 Day Course | 12 CPEs | Laptop Required

SEC534: Secure DevOps: A Practical Introduction explains the fundamentals of DevOps and how DevOps teams can build and deliver secure software. You will learn DevOps principles, practices, and tools and how they can be leveraged to improve the reliability, integrity, and security of systems.

Using lessons from successful DevOps security programs, this course will explain how Secure DevOps can be implemented. Students will gain hands-on experience using popular open-source tools such as Puppet, Jenkins, GitLab, Vault, Grafana, and Docker to automate Configuration Management ("Infrastructure as Code"), Continuous Integration (CI), Continuous Delivery (CD), containerization, micro-segmentation, automated compliance ("Compliance as Code"), and Continuous Monitoring. The lab environment starts with a CI/CD pipeline that automatically builds, tests, and deploys infrastructure and applications. Leveraging the Secure DevOps toolchain, students perform a series of labs injecting security into the CI/CD pipeline using a variety of security tools, patterns, and techniques.

Live Training sans.org/events

Security East . . . . . **New Orleans, LA** . . . . . **Feb 1-2**

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SANSFIRE . . . . . **Washington, DC** . . . . . **Jun 13-14**

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OnDemand

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*Private Training

This course is also available through Private Training.

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YOUR CYBER RANGE AVAILABLE 24/7

Advance your cybersecurity skills — on your schedule and at your pace. The latest version of Core NetWars Continuous comes jam-packed with all new features, challenges, and interactive video games that make cybersecurity skill development fun and engaging.

> **"Having participated in NetWars Continuous and in NetWars Tournament, I can honestly say that they were the most intellectually challenging and the most enjoyable tests of technical skills in which I have had the privilege to participate."**
>
> — Kees Leune, **Adelphi University**

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SANS

SANS SUMMITS

Advancing Cybersecurity Through Collaboration

"I was impressed by the expertise of the speakers and more impressed by the quality of attendees. Both the information presented in the conference and after-hours discussions were engaging and productive."

— Doug Short, **Trinity River Authority**

Upcoming SANS Summit & Training Events

Cyber Threat Intelligence
Washington, DC | Jan 20-27

Open-Source Intelligence
Washington, DC | Feb 18-24

ICS Security
Orlando, FL | Mar 2-9

Blue Team
Louisville, KY | Mar 2-9

Cloud Security
Dallas, TX | May 27 - Jun 3

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