CompTIA Security+ Certification Exam Objectives

EXAM NUMBER: SYO-501
About the Exam

The CompTIA Security+ certification is a vendor-neutral credential. The CompTIA Security+ exam is an internationally recognized validation of foundation-level security skills and knowledge, and is used by organizations and security professionals around the globe.

The CompTIA Security+ exam will certify the successful candidate has the knowledge and skills required to install and configure systems to secure applications, networks, and devices; perform threat analysis and respond with appropriate mitigation techniques; participate in risk mitigation activities; and operate with an awareness of applicable policies, laws, and regulations. The successful candidate will perform these tasks to support the principles of confidentiality, integrity, and availability.

The CompTIA Security+ certification is aimed at an IT security professional who has:

- A minimum of two years' experience in IT administration with a focus on security
- Day-to-day technical information security experience
- Broad knowledge of security concerns and implementation, including the topics in the domain list

These content examples are meant to clarify the test objectives and should not be construed as a comprehensive listing of all content in this examination.

EXAM ACCREDITATION

CompTIA Security+ is accredited by ANSI to show compliance with the ISO 17024 Standard and, as such, the exam objectives undergo regular reviews and updates.

EXAM DEVELOPMENT

CompTIA exams result from subject matter expert workshops and industry-wide survey results regarding the skills and knowledge required of an IT professional.

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PLEASE NOTE

The lists of examples provided in bulleted format are not exhaustive lists. Other examples of technologies, processes or tasks pertaining to each objective may also be included on the exam although not listed or covered in this objectives document. CompTIA is constantly reviewing the content of our exams and updating test questions to be sure our exams are current and the security of the questions is protected. When necessary, we will publish updated exams based on existing exam objectives. Please know that all related exam preparation materials will still be valid.
TEST DETAILS

Required exam: CompTIA Security+ SY0-501
Number of questions: Maximum of 90
Types of questions: Multiple choice and performance-based
Length of test: 90 minutes
Recommended experience: At least two years of experience in IT administration with a focus on security
Passing score: 750 (on a scale of 100–900)

EXAM OBJECTIVES (DOMAINS)

The table below lists the domains measured by this examination and the extent to which they are represented:

<table>
<thead>
<tr>
<th>DOMAIN</th>
<th>PERCENTAGE OF EXAMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Threats, Attacks and Vulnerabilities</td>
<td>21%</td>
</tr>
<tr>
<td>2.0 Technologies and Tools</td>
<td>22%</td>
</tr>
<tr>
<td>3.0 Architecture and Design</td>
<td>15%</td>
</tr>
<tr>
<td>4.0 Identity and Access Management</td>
<td>16%</td>
</tr>
<tr>
<td>5.0 Risk Management</td>
<td>14%</td>
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<tr>
<td>6.0 Cryptography and PKI</td>
<td>12%</td>
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CompTIA Security+ Certification Exam Objectives Version 3.0 (Exam Number: SY0-501)
1.0 Threats, Attacks and Vulnerabilities

1.1 Given a scenario, analyze indicators of compromise and determine the type of malware.

- Viruses
- Crypto-malware
- Ransomware
- Worm
- Trojan
- Rootkit
- Keylogger
- Adware
- Spyware
- Bots
- RAT
- Logic bomb
- Backdoor

1.2 Compare and contrast types of attacks.

- Social engineering
  - Phishing
  - Spear phishing
  - Whaling
  - Vishing
  - Tailgating
  - Impersonation
  - Dumpster diving
  - Shoulder surfing
  - Hoax
  - Watering hole attack
  - Principles (reasons for effectiveness)
    - Authority
    - Intimidation
    - Consensus
    - Scarcity
    - Familiarity
    - Trust
    - Urgency
- Application/service attacks
  - DoS
  - DDoS
  - Man-in-the-middle
  - Buffer overflow
- Injection
- Cross-site scripting
- Cross-site request forgery
- Privilege escalation
- ARP poisoning
- Amplification
- DNS poisoning
- Domain hijacking
- Man-in-the-browser
- Zero day
- Replay
- Pass the hash
- Hijacking and related attacks
  - Clickjacking
  - Session hijacking
  - URL hijacking
  - Typo squatting
  - Driver manipulation
  - Shimming
  - Refactoring
  - MAC spoofing
  - IP spoofing
- Wireless attacks
  - Replay
- IV
- Evil twin
- Rogue AP
- Jamming
- WPS
- Bluejacking
- Bluesnarfing
- RFID
- NFC
- Disassociation
- Cryptographic attacks
  - Birthday
  - Known plain text/cipher text
  - Rainbow tables
  - Dictionary
  - Brute force
    - Online vs. offline
  - Collision
  - Downgrade
  - Replay
  - Weak implementations
1.3 Explain threat actor types and attributes.

- Types of actors
  - Script kiddies
  - Hacktivist
  - Organized crime
  - Nation states/APT
  - Insiders
  - Competitors

- Attributes of actors
  - Internal/external
  - Level of sophistication
  - Resources/funding
  - Intent/motivation
  - Use of open-source intelligence

1.4 Explain penetration testing concepts.

- Active reconnaissance
- Passive reconnaissance
- Pivot
- Initial exploitation
- Persistence
- Escalation of privilege
- Black box
- White box
- Gray box
- Penetration testing vs. vulnerability scanning

1.5 Explain vulnerability scanning concepts.

- Passively test security controls
- Identify vulnerability
- Identify lack of security controls
- Identify common misconfigurations
- Intrusive vs. non-intrusive
- Credentialed vs. non-credentialed
- False positive

1.6 Explain the impact associated with types of vulnerabilities.

- Race conditions
- Vulnerabilities due to:
  - End-of-life systems
  - Embedded systems
  - Lack of vendor support
  - Improper input handling
  - Improper error handling
  - Misconfiguration/weak configuration
  - Default configuration
  - Resource exhaustion
  - Untrained users
  - Improperly configured accounts
  - Vulnerable business processes
  - Weak cipher suites and implementations

- Memory(buffer) vulnerability
  - Memory leak
  - Integer overflow
  - Buffer overflow
  - Pointer dereference
  - DLL injection
  - System sprawl/undocumented assets
  - Architecture/design weaknesses
  - New threats/zero day
  - Improper certificate and key management
2.0 Technologies and Tools

2.1 Install and configure network components, both hardware- and software-based, to support organizational security.

- **Firewall**
  - ACL
  - Application-based vs. network-based
  - Stateful vs. stateless
  - Implicit deny
- **VPN concentrator**
  - Remote access vs. site-to-site
  - IPSec
    - Tunnel mode
    - Transport mode
    - AH
    - ESP
  - Split tunnel vs. full tunnel
  - TLS
  - Always-on VPN
- **NIPS/NIDS**
  - Signature-based
  - Heuristic/behavioral
  - Anomaly
  - Inline vs. passive
  - In-band vs. out-of-band
  - Rules
  - Analytics
    - False positive
    - False negative
- **Router**
  - ACLs
  - Antispoofing
- **Switch**
  - Port security
  - Layer 2 vs. Layer 3
  - Loop prevention
  - Flood guard
- **Proxy**
  - Forward and reverse proxy
  - Transparent
  - Application/multipurpose
- **Load balancer**
  - Scheduling
    - Affinity
    - Round-robin
  - Active-passive
  - Active-active
  - Virtual IPs
- **Access point**
  - SSID
  - MAC filtering
  - Signal strength
  - Band selection/width
  - Antenna types and placement
  - Fat vs. thin
  - Controller-based vs. standalone
- **SIEM**
  - Aggregation
  - Correlation
  - Automated alerting and triggers
  - Time synchronization
  - Event deduplication
  - Logs/WORM
- **DLP**
  - USB blocking
  - Cloud-based
  - Email
- **NAC**
  - Dissolvable vs. permanent
  - Host health checks
  - Agent vs. agentless
- **Mail gateway**
  - Spam filter
  - DLP
  - Encryption
- **Bridge**
- **SSL/TLS accelerators**
- **SSL decryptors**
- **Media gateway**
- **Hardware security module**

2.2 Given a scenario, use appropriate software tools to assess the security posture of an organization.

- **Protocol analyzer**
- **Network scanners**
  - Rogue system detection
  - Network mapping
- **Wireless scanners/cracker**
- **Password cracker**
- **Vulnerability scanner**
- **Configuration compliance scanner**
- **Exploitation frameworks**
- **Data sanitization tools**
- **Steganography tools**
- **Honeypot**
- **Backup utilities**
- **Banner grabbing**
- **Passive vs. active**
- **Command line tools**
  - ping
  - netstat
- **tracert**
- **nslookup/dig**
- **arp**
- **ipconfig/ip/ifconfig**
- **tcpdump**
- **nmap**
- **netcat**
2.3 Given a scenario, troubleshoot common security issues.

- Unencrypted credentials/clear text
- Logs and events anomalies
- Permission issues
- Access violations
- Certificate issues
- Data exfiltration
- Misconfigured devices
  - Firewall
- Content filter
- Access points
- Weak security configurations
- Personnel issues
  - Policy violation
  - Insider threat
  - Social engineering
  - Social media
- Personal email
- Unauthorized software
- Baseline deviation
- License compliance violation
  (availability/integrity)
- Asset management
- Authentication issues

2.4 Given a scenario, analyze and interpret output from security technologies.

- HIDS/HIPS
- Antivirus
- File integrity check
- Host-based firewall
- Application whitelisting
- Removable media control
- Advanced malware tools
- Patch management tools
- UTM
- DLP
- Data execution prevention
- Web application firewall

2.5 Given a scenario, deploy mobile devices securely.

- Connection methods
  - Cellular
  - WiFi
  - SATCOM
  - Bluetooth
  - NFC
  - ANT
  - Infrared
  - USB
- Mobile device management concepts
  - Application management
  - Content management
  - Remote wipe
  - Geofencing
  - Geolocation
  - Screen locks
  - Push notification services
  - Passwords and pins
  - Biometrics
  - Context-aware authentication
  - Containerization
  - Storage segmentation
  - Full device encryption
  - Enforcement and monitoring for:
    - Third-party app stores
    - Rooting/jailbreaking
    - Sideloading
    - Custom firmware
    - Carrier unlocking
    - Firmware OTA updates
  - Camera use
  - SMS/MMS
  - External media
  - USB OTG
  - Recording microphone
  - GPS tagging
  - WiFi direct/ad hoc
  - Tethering
  - Payment methods
- Deployment models
  - BYOD
  - COPE
  - CYOD
  - Corporate-owned
  - VDI

2.6 Given a scenario, implement secure protocols.

- Protocols
  - DNSSEC
  - SSH
  - S/MIME
  - SRTP
  - LDAPS
  - FTPS
  - SFTP
  - SNMPv3
  - SSL/TLS
  - HTTPS
  - Secure POP/IMAP
  - Use cases
    - Voice and video
    - Time synchronization
    - Email and web
  - File transfer
  - Directory services
  - Remote access
  - Domain name resolution
  - Routing and switching
  - Network address allocation
  - Subscription services
3.0 Architecture and Design

3.1 Explain use cases and purpose for frameworks, best practices and secure configuration guides.
- Industry-standard frameworks and reference architectures
  - Regulatory
  - Non-regulatory
  - National vs. international
  - Industry-specific frameworks
- Benchmarks/secure configuration guides
  - Platform/vendor-specific guides
    - Web server
    - Operating system
    - Application server
    - Network infrastructure devices
    - General purpose guides
- Defense-in-depth/layered security
  - Vendor diversity
  - Control diversity
    - Administrative
    - Technical
    - User training

3.2 Given a scenario, implement secure network architecture concepts.
- Zones/topologies
  - DMZ
  - Extranet
  - Intranet
  - Wireless
  - Guest
  - Honeynets
  - NAT
  - Ad hoc
- Logical (VLAN)
- Virtualization
- Air gaps
- Tunneling/VPN
  - Site-to-site
  - Remote access
- Security device/technology placement
  - Sensors
  - Collectors
  - Correlation engines
  - Filters
- Proxies
- Firewalls
- VPN concentrators
- SSL accelerators
- Load balancers
- DDoS mitigator
- Aggregation switches
- Taps and port mirror
  - SDN

3.3 Given a scenario, implement secure systems design.
- Hardware/firmware security
  - FDE/SED
  - TPM
  - HSM
  - UEFI/BIOS
  - Secure boot and attestation
  - Supply chain
  - Hardware root of trust
  - EMI/EMP
- Operating systems
  - Types
    - Network
    - Server
  - Workstation
  - Appliance
  - Kiosk
  - Mobile OS
  - Patch management
  - Disabling unnecessary ports and services
  - Least functionality
  - Secure configurations
  - Trusted operating system
  - Application whitelisting/blacklisting
  - Disable default accounts/passwords
- Peripherals
  - Wireless keyboards
  - Wireless mice
  - Displays
  - WiFi-enabled MicroSD cards
  - Printers/MFDs
  - External storage devices
  - Digital cameras
3.0 Architecture and Design

3.4 Explain the importance of secure staging deployment concepts.
- Sandboxing
  - Environment
    - Development
    - Test
  - Secure baseline
  - Integrity measurement
- Staging
- Production

3.5 Explain the security implications of embedded systems.
- SCADA/ICS
- Smart devices/IoT
  - Wearable technology
  - Home automation
- HVAC
- SoC
- RTOS
- Printers/MFDs
- Camera systems
- Special purpose
  - Medical devices
  - Vehicles
  - Aircraft/UAV

3.6 Summarize secure application development and deployment concepts.
- Development life-cycle models
  - Waterfall vs. Agile
- Secure DevOps
  - Security automation
  - Continuous integration
  - Baselining
  - Immutable systems
  - Infrastructure as code
- Version control and change management
- Provisioning and deprovisioning
- Secure coding techniques
  - Proper error handling
  - Proper input validation
  - Normalization
  - Stored procedures
  - Code signing
  - Encryption
  - Obfuscation/camouflage
  - Code reuse/dead code
  - Server-side vs. client-side execution and validation
- Compiled vs. runtime code
- Memory management
- Use of third-party libraries and SDKs
- Data exposure
- Code quality and testing
  - Static code analyzers
  - Dynamic analysis (e.g., fuzzing)
  - Stress testing
  - Sandboxing
  - Model verification

3.7 Summarize cloud and virtualization concepts.
- Hypervisor
  - Type I
  - Type II
  - Application cells/containers
- VM sprawl avoidance
- VM escape protection
- Cloud storage
- Cloud deployment models
  - SaaS
  - PaaS
  - IaaS
  - Private
  - Public
  - Hybrid
  - Community
- On-premise vs. hosted vs. cloud
- VDI/VDE
- Cloud access security broker
- Security as a Service
3.8 Explain how resiliency and automation strategies reduce risk.

- Automation/scripting
  - Automated courses of action
  - Continuous monitoring
  - Configuration validation
- Templates
- Master image
- Non-persistence
  - Snapshots
  - Revert to known state
  - Rollback to known configuration
  - Live boot media
- Elasticity
- Scalability
- Distributive allocation
- Redundancy
- Fault tolerance
- High availability
- RAID

3.9 Explain the importance of physical security controls.

- Lighting
- Signs
- Fencing/gate/cage
- Security guards
- Alarms
- Safe
- Secure cabinets/enclosures
- Protected distribution/Protected cabling
- Airgap
- Mantrap
- Faraday cage
- Lock types
- Biometrics
- Barricades/bollards
- Tokens/cards
- Environmental controls
  - HVAC
  - Hot and cold aisles
  - Fire suppression
- Cable locks
- Screen filters
- Cameras
- Motion detection
- Logs
- Infrared detection
- Key management
4.0 Identity and Access Management

4.1 Compare and contrast identity and access management concepts

- Identification, authentication, authorization and accounting (AAA)
- Multifactor authentication
  - Something you are
- Something you have
- Something you know
- Somewhere you are
- Something you do
- Federation
- Single sign-on
- Transitive trust

4.2 Given a scenario, install and configure identity and access services.

- LDAP
- Kerberos
- TACACS+
- CHAP
- PAP
- MSCHAP
- RADIUS
- SAML
- OpenID Connect
- OAuth
- Shibboleth
- Secure token
- NTLM

4.3 Given a scenario, implement identity and access management controls.

- Access control models
  - MAC
  - DAC
  - ABAC
  - Rule-based access control
  - Role-based access control
- Physical access control
  - Proximity cards
  - Smart cards
- Biometric factors
  - Fingerprint scanner
  - Retinal scanner
  - Iris scanner
  - Voice recognition
  - Facial recognition
  - False acceptance rate
  - False rejection rate
  - Crossover error rate
- Tokens
  - Hardware
  - Software
  - HOTP/TOTP
- Certificate-based authentication
  - PIV/CAC/smart card
  - IEEE 802.1x
- File system security
- Database security

4.4 Given a scenario, differentiate common account management practices.

- Account types
  - User account
  - Shared and generic accounts/credentials
  - Guest accounts
  - Service accounts
  - Privileged accounts
- General Concepts
  - Least privilege
  - Onboarding/offboarding
- Account policy enforcement
  - Credential management
- Permission auditing and review
- Usage auditing and review
- Time-of-day restrictions
- Recertification
- Standard naming convention
- Account maintenance
- Group-based access control
- Location-based policies
- Group policy
- Password complexity
- Expiration
- Recovery
- Disablement
- Lockout
- Password history
- Password reuse
- Password length
5.0 Risk Management

5.1 Explain the importance of policies, plans and procedures related to organizational security.

- Standard operating procedure
- Agreement types
  - BPA
  - SLA
  - ISA
  - MOU/MOA
- Personnel management
  - Mandatory vacations
  - Job rotation
  - Separation of duties
- Clean desk
- Background checks
- Exit interviews
- Role-based awareness training
  - Data owner
  - System administrator
  - System owner
  - User
  - Privileged user
  - Executive user
- NDA
- Onboarding
- Continuing education
- Acceptable use policy/rules of behavior
- Adverse actions
- General security policies
  - Social media networks/applications
  - Personal email

5.2 Summarize business impact analysis concepts.

- RTO/RPO
- MTBF
- MTTR
- Mission-essential functions
- Identification of critical systems
- Single point of failure
- Impact
  - Life
  - Property
  - Safety
- Finance
- Reputation
- Privacy impact assessment
- Privacy threshold assessment

5.3 Explain risk management processes and concepts.

- Threat assessment
  - Environmental
  - Manmade
  - Internal vs. external
- Risk assessment
  - SLE
  - ALE
  - ARO
  - Asset value
  - Risk register
- Likelihood of occurrence
- Supply chain assessment
- Impact
- Quantitative
- Qualitative
- Testing
  - Penetration testing authorization
  - Vulnerability testing authorization
- Risk response techniques
  - Accept
  - Transfer
  - Avoid
  - Mitigate
- Change management
5.0 Risk Management

5.4 Given a scenario, follow incident response procedures.

- Incident response plan
  - Documented incident types/category definitions
  - Roles and responsibilities
  - Reporting requirements/escalation
- Cyber-incident response teams
- Exercise
- Incident response process
  - Preparation
  - Identification
- Containment
- Eradication
- Recovery
- Lessons learned

5.5 Summarize basic concepts of forensics.

- Order of volatility
- Chain of custody
- Legal hold
- Data acquisition
  - Capture system image
  - Network traffic and logs
- Capture video
- Record time offset
- Take hashes
- Screenshots
- Witness interviews
- Preservation
- Recovery
- Strategic intelligence/counterintelligence gathering
  - Active logging
  - Track man-hours

5.6 Explain disaster recovery and continuity of operation concepts.

- Recovery sites
  - Hot site
  - Warm site
  - Cold site
- Order of restoration
- Backup concepts
  - Differential
  - Incremental
- Snapshots
- Full
- Geographic considerations
  - Off-site backups
  - Distance
  - Location selection
  - Legal implications
  - Data sovereignty
- Continuity of operation planning
  - Exercises/tabletop
  - After-action reports
  - Failover
  - Alternate processing sites
  - Alternate business practices

5.7 Compare and contrast various types of controls.

- Deterrent
- Preventive
- Detective
- Corrective
- Compensating
- Technical
- Administrative
- Physical

5.8 Given a scenario, carry out data security and privacy practices.

- Data destruction and media sanitization
  - Burning
  - Shredding
  - Pulping
  - Pulverizing
  - Degaussing
  - Purging
  - Wiping
- Data sensitivity labeling and handling
  - Confidential
  - Private
  - Public
  - Proprietary
  - PII
  - PHI
- Data roles
  - Owner
  - Steward/custodian
  - Privacy officer
- Data retention
- Legal and compliance
6.0 Cryptography and PKI

6.1 Compare and contrast basic concepts of cryptography.

- Symmetric algorithms
- Modes of operation
- Asymmetric algorithms
- Hashing
- Salt, IV, nonce
- Elliptic curve
- Weak/deprecated algorithms
- Key exchange
- Digital signatures
- Diffusion
- Confusion
- Collision
- Steganography
- Obfuscation
- Stream vs. block

- Key strength
- Session keys
- Ephemeral key
- Secret algorithm
- Data-in-transit
- Data-at-rest
- Data-in-use
- Random/pseudo-random number generation
- Key stretching
- Implementation vs. algorithm selection
- Crypto service provider
- Crypto modules
- Perfect forward secrecy
- Security through obscurity

- Common use cases
- Low power devices
- Low latency
- High resiliency
- Supporting confidentiality
- Supporting integrity
- Supporting obfuscation
- Supporting authentication
- Supporting non-repudiation
- Resource vs. security constraints

6.2 Explain cryptography algorithms and their basic characteristics.

- Symmetric algorithms
  - AES
  - DES
  - 3DES
  - RC4
  - Blowfish/Twofish
- Cipher modes
  - CBC
  - GCM
  - ECB
  - CTR
  - Stream vs. block
- Asymmetric algorithms
  - RSA
  - DSA
  - Diffe-Hellman
  - Groups
  - DHE
  - ECDHE
  - Elliptic curve
  - PGP/GPG
- Hashing algorithms
  - MD5
  - SHA
- Key stretching algorithms
  - BCRYPT
  - PBKDF2
- Obfuscation
  - XOR
  - ROT13
  - Substitution ciphers
- HMAC
- RIPEMD

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6.0 Cryptography and PKI

6.3 Given a scenario, install and configure wireless security settings.

- **Cryptographic protocols**
  - WPA
  - WPA2
  - CCMP
  - TKIP

- **Authentication protocols**
  - EAP
  - PEAP
  - EAP-FAST
  - EAP-TLS
  - EAP-TTLS

- **Methods**
  - IEEE 802.1x
  - RADIUS Federation

- **Components**
  - CA
  - Intermediate CA
  - CRL
  - OCSP
  - CSR
  - Certificate
  - Public key
  - Private key
  - Object identifiers (OID)

- **Concepts**
  - Online vs. offline CA

6.4 Given a scenario, implement public key infrastructure.

- **Components**
  - CA
  - Intermediate CA
  - CRL
  - OCSP
  - CSR
  - Certificate
  - Public key
  - Private key
  - Object identifiers (OID)

- **Concepts**
  - Online vs. offline CA

- **Authentication protocols**
  - EAP
  - PEAP
  - EAP-FAST
  - EAP-TLS
  - EAP-TTLS

- **Methods**
  - PSK vs. Enterprise vs. Open
  - WPS
  - Captive portals

- **Components**
  - CA
  - Intermediate CA
  - CRL
  - OCSP
  - CSR
  - Certificate
  - Public key
  - Private key
  - Object identifiers (OID)

- **Concepts**
  - Online vs. offline CA

- **Component formats**
  - DER
  - PEM
  - PFX
  - CER
  - P12
  - P7B
The following is a list of acronyms that appear on the CompTIA Security+ exam. Candidates are encouraged to review the complete list and attain a working knowledge of all listed acronyms as a part of a comprehensive exam preparation program.

<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>3DES</td>
<td>Triple Digital Encryption Standard</td>
<td>CER</td>
<td>Certificate</td>
</tr>
<tr>
<td>AAA</td>
<td>Authentication, Authorization, and Accounting</td>
<td>CER</td>
<td>Cross-over Error Rate</td>
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<tr>
<td>ABAC</td>
<td>Attribute-based Access Control</td>
<td>CERT</td>
<td>Computer Emergency Response Team</td>
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<td>ACL</td>
<td>Access Control List</td>
<td>CFB</td>
<td>Cipher Feedback</td>
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<tr>
<td>AES</td>
<td>Advanced Encryption Standard</td>
<td>CHAP</td>
<td>Challenge Handshake Authentication Protocol</td>
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<td>AES256</td>
<td>Advanced Encryption Standards 256bit</td>
<td>CIO</td>
<td>Chief Information Officer</td>
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<tr>
<td>AH</td>
<td>Authentication Header</td>
<td>CIRT</td>
<td>Computer Incident Response Team</td>
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<tr>
<td>ALE</td>
<td>Annualized Loss Expectancy</td>
<td>CMS</td>
<td>Content Management System</td>
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<tr>
<td>AP</td>
<td>Access Point</td>
<td>COOP</td>
<td>Continuity of Operations Plan</td>
</tr>
<tr>
<td>API</td>
<td>Application Programming Interface</td>
<td>COPE</td>
<td>Corporate Owned, Personally Enabled</td>
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<tr>
<td>APT</td>
<td>Advanced Persistent Threat</td>
<td>CP</td>
<td>Contingency Planning</td>
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<tr>
<td>ARO</td>
<td>Annualized Rate of Occurrence</td>
<td>CRC</td>
<td>Cyclical Redundancy Check</td>
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<td>ARP</td>
<td>Address Resolution Protocol</td>
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<td>Certificate Revocation List</td>
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<td>ASLR</td>
<td>Address Space Layout Randomization</td>
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<tr>
<td>ASP</td>
<td>Application Service Provider</td>
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<td>Chief Security Officer</td>
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<tr>
<td>AUP</td>
<td>Acceptable Use Policy</td>
<td>CSP</td>
<td>Cloud Service Provider</td>
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<tr>
<td>AV</td>
<td>Antivirus</td>
<td>CSR</td>
<td>Certificate Signing Request</td>
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<td>AVL</td>
<td>Asset Value</td>
<td>CSRF</td>
<td>Cross-site Request Forgery</td>
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<td>BAC</td>
<td>Business Availability Center</td>
<td>CSU</td>
<td>Channel Service Unit</td>
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<tr>
<td>BCP</td>
<td>Business Continuity Planning</td>
<td>CTM</td>
<td>Counter-Mode</td>
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<td>BIA</td>
<td>Business Impact Analysis</td>
<td>CTO</td>
<td>Chief Technology Officer</td>
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<td>BIOS</td>
<td>Basic Input/Output System</td>
<td>CTR</td>
<td>Counter</td>
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<td>BPA</td>
<td>Business Partners Agreement</td>
<td>CYOD</td>
<td>Choose Your Own Device</td>
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<tr>
<td>BPU</td>
<td>Bridge Protocol Data Unit</td>
<td>DAC</td>
<td>Discretionary Access Control</td>
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<tr>
<td>BYOD</td>
<td>Bring Your Own Device</td>
<td>DBA</td>
<td>Database Administrator</td>
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<tr>
<td>CA</td>
<td>Certificate Authority</td>
<td>DDoS</td>
<td>Distributed Denial of Service</td>
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<tr>
<td>CAC</td>
<td>Common Access Card</td>
<td>DEP</td>
<td>Data Execution Prevention</td>
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<tr>
<td>CAN</td>
<td>Controller Area Network</td>
<td>DER</td>
<td>Distinguished Encoding Rules</td>
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<td>CAPTCHA</td>
<td>Completely Automated Public Turing</td>
<td>DES</td>
<td>Digital Encryption Standard</td>
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<tr>
<td>CAR</td>
<td>Corrective Action Report</td>
<td>DFIR</td>
<td>Digital Forensics and Investigation Response</td>
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<td>CASB</td>
<td>Cloud Access Security Broker</td>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
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<td>CBC</td>
<td>Cipher Block Chaining</td>
<td>DHE</td>
<td>Data-Handling Electronics</td>
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<td>CCMP</td>
<td>Counter-Mode/CBC-Mac Protocol</td>
<td>DHE</td>
<td>Diffie-Hellman Ephemeral</td>
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<td>CCTV</td>
<td>Closed-circuit Television</td>
<td>DLL</td>
<td>Dynamic Link Library</td>
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<tr>
<td></td>
<td></td>
<td>DLP</td>
<td>Data Loss Prevention</td>
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</tbody>
</table>
DMZ  Demilitarized Zone  ICMP  Internet Control Message Protocol
DNAT  Destination Network Address Transaction  ICS  Industrial Control Systems
DNS  Domain Name Service (Server)  ID  Identification
DoS  Denial of Service  IDEA  International Data Encryption Algorithm
DRP  Disaster Recovery Plan  IDP  Identity Provider
DSA  Digital Signature Algorithm  IDS  Intrusion Detection System
DSL  Digital Subscriber Line  IEEE  Institute of Electrical and Electronic Engineers
DSU  Data Service Unit  IIS  Internet Information System
EAP  Extensible Authentication Protocol  IKE  Internet Key Exchange
ECB  Electronic Code Book  IM  Instant Messaging
ECC  Elliptic Curve Cryptography  IPSec  Internet Protocol Security
ECDHE  Elliptic Curve Diffie-Hellman Ephemeral  IR  Incident Response
ECDSA  Elliptic Curve Digital Signature Algorithm  IRF  Internet Relay Chat
EDR  End of Life  IRP  Incident Response Plan
EF  Exposure Factor  ISP  Internet Service Provider
EFS  Encrypted File System  ISISO  Information Systems Security Officer
EMI  Electromagnetic Interference  ITCP  IT Contingency Plan
EMC  Electronic Code Book  IV  Initialization Vector
EMP  Electro Magnetic Pulse  KDC  Key Distribution Center
EOL  End of Life  KEK  Key Encryption Key
ERP  Enterprise Resource Planning  L2TP  Layer 2 Tunneling Protocol
ESN  Electronic Serial Number  LAN  Local Area Network
EULA  End User License Agreement  LEAP  Lightweight Extensible Authentication Protocol
FACL  File System Access Control List  MaaS  Monitoring as a Service
FAI  False Acceptance Rate  MAC  Mandatory Access Control
FAI  False Acceptance Rate  MAC  Message Authentication Code
FDE  Full Disk Encryption  MAN  Metropolitan Area Network
FRR  False Rejection Rate  MBR  Master Boot Record
FTP  File Transfer Protocol  MBR  Main Boot Record
FTPS  Secure File Transfer Protocol  MDM  Message Digest 5
GCM  Galois Counter Mode  MDF  Main Distribution Frame
GPG  Gnu Privacy Guard  MFA  Multi-Function Authentication
GPO  Group Policy Object  MFD  Multi-Function Device
GPS  Global Positioning System  MIME  Multipurpose Internet Mail Exchange
GPU  Graphic Processing Unit  MITM  Man-in-the-Middle
GRE  Generic Routing Encapsulation  MMS  Multimedia Message Service
HA  High Availability  MOA  Memorandum of Agreement
HDD  Hard Disk Drive  MOTD  Message of the Day
HIDS  Host-based Intrusion Detection System  MOB  Mobile Device Management
HIPS  Host-based Intrusion Prevention System  MFA  Multi-Factor Authentication
HMAC  Hashed Message Authentication Code  MFD  Multi-Function Device
HOTP  HMAC-based One-Time Password  MIME  Multipurpose Internet Mail Exchange
HSM  Hardware Security Module  MITM  Man-in-the-Middle
HTML  Hypertext Markup Language  MMS  Multimedia Message Service
HTTP  Hypertext Transfer Protocol  MOTD  Message of the Day
HTTPS  Hypertext Transfer Protocol over SSL/TLS  MTA  Multi-Transport Authentication
HVAC  Heating, Ventilation and Air Conditioning  MFA  Multi-Factor Authentication
IaaS  Infrastructure as a Service  MFD  Multi-Function Device
<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
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<tbody>
<tr>
<td>MOU</td>
<td>Memorandum of Understanding</td>
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<tr>
<td>MPLS</td>
<td>Multi-protocol Label Switching</td>
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<tr>
<td>MSCHAP</td>
<td>Microsoft Challenge Handshake Authentication Protocol</td>
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<td>MSP</td>
<td>Managed Service Provider</td>
</tr>
<tr>
<td>MTBF</td>
<td>Mean Time Between Failures</td>
</tr>
<tr>
<td>MTTF</td>
<td>Mean Time to Failure</td>
</tr>
<tr>
<td>MTTR</td>
<td>Mean Time to Recover or Mean Time to Repair</td>
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<tr>
<td>MTU</td>
<td>Maximum Transmission Unit</td>
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<td>NAC</td>
<td>Network Access Control</td>
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<tr>
<td>NAT</td>
<td>Network Address Translation</td>
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<tr>
<td>NDA</td>
<td>Non-disclosure Agreement</td>
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<td>NFC</td>
<td>Near Field Communication</td>
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<td>NGAC</td>
<td>Next Generation Access Control</td>
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<td>NIDS</td>
<td>Network-based Intrusion Detection System</td>
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<tr>
<td>NIPS</td>
<td>Network-based Intrusion Prevention System</td>
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<td>NIST</td>
<td>National Institute of Standards &amp; Technology</td>
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<td>NTFS</td>
<td>New Technology File System</td>
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<td>NTLm</td>
<td>New Technology LAN Manager</td>
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<td>NTP</td>
<td>Network Time Protocol</td>
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<td>OAuth</td>
<td>Open Authorization</td>
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<tr>
<td>OCSP</td>
<td>Online Certificate Status Protocol</td>
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<td>OID</td>
<td>Object Identifier</td>
</tr>
<tr>
<td>OS</td>
<td>Operating System</td>
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<td>OTA</td>
<td>Over The Air</td>
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<td>OVAL</td>
<td>Open Vulnerability Assessment Language</td>
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<td>P12</td>
<td>PKCS #12</td>
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<td>P2P</td>
<td>Peer to Peer</td>
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<td>Platform as a Service</td>
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<td>PAC</td>
<td>Proxy Auto Configuration</td>
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<td>Pluggable Authentication Modules</td>
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<td>Password Authentication Protocol</td>
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<td>PAT</td>
<td>Port Address Translation</td>
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<td>PBKDF2</td>
<td>Password-based Key Derivation Function 2</td>
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<td>Private Branch Exchange</td>
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<td>PCAP</td>
<td>Packet Capture</td>
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<td>PEAP</td>
<td>Protected Extensible Authentication Protocol</td>
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<tr>
<td>PED</td>
<td>Personal Electronic Device</td>
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<tr>
<td>PEM</td>
<td>Privacy-enhanced Electronic Mail</td>
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<td>PFS</td>
<td>Perfect Forward Secrecy</td>
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<tr>
<td>PFX</td>
<td>Personal Exchange Format</td>
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<td>PGP</td>
<td>Pretty Good Privacy</td>
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<tr>
<td>PHI</td>
<td>Personal Health Information</td>
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<tr>
<td>PII</td>
<td>Personally Identifiable Information</td>
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<tr>
<td>PIV</td>
<td>Personal Identity Verification</td>
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<tr>
<td>PKI</td>
<td>Public Key Infrastructure</td>
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<tr>
<td>POODLE</td>
<td>Padding Oracle on Downgrade Legacy Encryption</td>
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<td>POP</td>
<td>Post Office Protocol</td>
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<tr>
<td>POTS</td>
<td>Plain Old Telephone Service</td>
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<tr>
<td>PPP</td>
<td>Point-to-Point Protocol</td>
</tr>
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<td>PPTP</td>
<td>Point-to-Point Tunneling Protocol</td>
</tr>
<tr>
<td>PSK</td>
<td>Pre-shared Key</td>
</tr>
<tr>
<td>PTZ</td>
<td>Pan-Tilt-Zoom</td>
</tr>
<tr>
<td>RA</td>
<td>Recovery Agent</td>
</tr>
<tr>
<td>RA</td>
<td>Registration Authority</td>
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<tr>
<td>RAD</td>
<td>Rapid Application Development</td>
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<tr>
<td>RADIUS</td>
<td>Remote Authentication Dial-in User Server</td>
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<td>RAID</td>
<td>Redundant Array of Inexpensive Disks</td>
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<td>RAS</td>
<td>Remote Access Server</td>
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<td>RAT</td>
<td>Remote Access Trojan</td>
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<td>RBAC</td>
<td>Role-based Access Control</td>
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<td>RBAC</td>
<td>Rule-based Access Control</td>
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<td>Rivest Cipher version 4</td>
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<td>Remote Desktop Protocol</td>
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<td>Representational State Transfer</td>
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<td>Radio Frequency Identifier</td>
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<td>RACE Integrity Primitives</td>
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<td>ROI</td>
<td>Return on Investment</td>
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<td>RMF</td>
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<td>RPO</td>
<td>Recovery Point Objective</td>
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<tr>
<td>RSA</td>
<td>Rivest, Shamir, &amp; Adleman</td>
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<tr>
<td>RTBH</td>
<td>Remotely Triggered Black Hole</td>
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<tr>
<td>RTO</td>
<td>Recovery Time Objective</td>
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<td>RTOS</td>
<td>Real-time Operating System</td>
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<td>RTP</td>
<td>Real-time Transport Protocol</td>
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<td>S/MIME</td>
<td>Secure/Multipurpose Internet Mail Extensions</td>
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<td>Saas</td>
<td>Software as a Service</td>
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<td>SAML</td>
<td>Security Assertions Markup Language</td>
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<td>SAN</td>
<td>Storage Area Network</td>
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<tr>
<td>SAN</td>
<td>Subject Alternative Name</td>
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<td>SCADA</td>
<td>System Control and Data Acquisition</td>
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<td>SCAP</td>
<td>Security Content Automation Protocol</td>
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<td>SCEP</td>
<td>Simple Certificate Enrollment Protocol</td>
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<td>SCP</td>
<td>Secure Copy</td>
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<td>SCSI</td>
<td>Small Computer System Interface</td>
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<td>SDK</td>
<td>Software Development Kit</td>
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<td>SDLc</td>
<td>Software Development Life Cycle</td>
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<td>Software Development Life Cycle Methodology</td>
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<td>Software Defined Network</td>
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<td>SED</td>
<td>Self-encrypting Drive</td>
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<td>SEH</td>
<td>Structured Exception Handler</td>
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<tr>
<td>ACRONYM</td>
<td>SPELLED OUT</td>
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<td>-------------------------------------------------</td>
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<tr>
<td>SFTP</td>
<td>Secured File Transfer Protocol</td>
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<tr>
<td>SHA</td>
<td>Secure Hashing Algorithm</td>
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<tr>
<td>SHTTP</td>
<td>Secure Hypertext Transfer Protocol</td>
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<tr>
<td>SIEM</td>
<td>Security Information and Event Management</td>
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<tr>
<td>SIM</td>
<td>Subscriber Identity Module</td>
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<tr>
<td>SIP</td>
<td>Session Initiation Protocol</td>
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<tr>
<td>SIPS</td>
<td>Session Initiation Protocol Secure</td>
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<td>SLA</td>
<td>Service Level Agreement</td>
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<tr>
<td>SLE</td>
<td>Single Loss Expectancy</td>
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<td>SMB</td>
<td>Server Message Block</td>
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<td>SMS</td>
<td>Short Message Service</td>
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<td>SMTP</td>
<td>Simple Mail Transfer Protocol</td>
</tr>
<tr>
<td>SMTPS</td>
<td>Simple Mail Transfer Protocol Secure</td>
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<td>SNMP</td>
<td>Simple Network Management Protocol</td>
</tr>
<tr>
<td>SOAP</td>
<td>Simple Object Access Protocol</td>
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<td>SoC</td>
<td>System on Chip</td>
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<td>SPF</td>
<td>Sender Policy Framework</td>
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<td>SPIM</td>
<td>Spam over Internet Messaging</td>
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<td>SPoF</td>
<td>Single Point of Failure</td>
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<td>Structured Query Language</td>
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<td>Solid State Drive</td>
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<td>Secure Shell</td>
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<td>SSID</td>
<td>Service Set Identifier</td>
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<td>Secure Sockets Layer</td>
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<td>Single Sign-on</td>
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<td>SSP</td>
<td>System Security Plan</td>
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<td>STP</td>
<td>Shielded Twisted Pair</td>
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<td>TACACS+</td>
<td>Terminal Access Controller Access</td>
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<tr>
<td>TCO</td>
<td>Total Cost of Ownership</td>
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<td>TCP/IP</td>
<td>Transmission Control Protocol/Internet Protocol</td>
</tr>
<tr>
<td>TGT</td>
<td>Ticket Granting Ticket</td>
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<tr>
<td>TKIP</td>
<td>Temporal Key Integrity Protocol</td>
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<td>TLS</td>
<td>Transport Layer Security</td>
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<tr>
<td>TOTP</td>
<td>Time-based One-time Password</td>
</tr>
<tr>
<td>TPM</td>
<td>Trusted Platform Module</td>
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<tr>
<td>TSIG</td>
<td>Transaction Signature</td>
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<tr>
<td>UAT</td>
<td>User Acceptance Testing</td>
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<tr>
<td>UAV</td>
<td>Unmanned Aerial Vehicle</td>
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<tr>
<td>UDP</td>
<td>User Datagram Protocol</td>
</tr>
<tr>
<td>UEFI</td>
<td>Unified Extensible Firmware Interface</td>
</tr>
<tr>
<td>UPS</td>
<td>Uninterruptable Power Supply</td>
</tr>
<tr>
<td>URI</td>
<td>Uniform Resource Identifier</td>
</tr>
<tr>
<td>URL</td>
<td>Universal Resource Locator</td>
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<tr>
<td>USB</td>
<td>Universal Serial Bus</td>
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</table>
Security+ Proposed Hardware and Software List

CompTIA has included this sample list of hardware and software to assist candidates as they prepare for the Security+ exam. This list may also be helpful for training companies who wish to create a lab component to their training offering. The bulleted lists below each topic are a sample list and not exhaustive.

**EQUIPMENT**
- Router
- Firewall
- Access point
- Switch
- IDS/IPS
- Server
- Content filter
- Client
- Mobile device
- VPN concentrator
- UTM
- Enterprise security managers/SIEM suite
- Load balancer
- Proxies
- DLP appliance
- ICS or similar systems
- Network access control servers
- DDoS mitigation hardware

**HARDWARE TOOLS**
- WiFi analyzers
- Hardware debuggers

**SOFTWARE TOOLS AND SOFTWARE TOOLS**
- Exploitation distributions (e.g., Kali)
- Proxy server
- Virtualization software
- Virtualized appliances
- Wireshark
- tcpdump
- NMAP
- OpenVAS
- Metasploit/Metaspoitable2
- Back Orifice
- Cain & Abel
- John the Ripper
- pfSense
- Security Onion
- Roo
- Any UTM

**SPARE PARTS/HARDWARE**
- Keyboards
- Mice
- Network cables
- Monitors
- Wireless and Bluetooth dongles

**OTHER**
- SourceForge