About the Exam

Candidates are encouraged to use this document to help prepare for CompTIA A+ Core 2.
In order to receive the CompTIA A+ certification, you must pass two exams: Core 1 (220-1001) and Core 2 (220-1002). CompTIA A+ Core 2 measures the necessary skills for an entry-level IT professional. Successful candidates will have the knowledge required to:

- Assemble components based on customer requirements
- Install, configure, and maintain PCs, mobile devices, and software for end users
- Understand the basics of networking and security forensics
- Properly and safely diagnose, resolve, and document common hardware and software issues
- Apply troubleshooting skills
- Provide appropriate customer support
- Understand the basics of scripting, virtualization, desktop imaging, and deployment

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

EXAM ACCREDITATION

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

EXAM DEVELOPMENT

CompTIA exams result from subject matter expert workshops and industry-wide survey results regarding the skills and knowledge required of an entry-level 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 testing exam objectives. Please know that all related exam preparation materials will still be valid.
TEST DETAILS

Required exam: Core 2
Number of questions: Maximum of 90
Types of questions: Multiple choice and performance-based
Length of test: 90 minutes
Recommended experience: 12 months of experience as an IT support specialist
Passing score: 700 (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 Operating Systems</td>
<td>27%</td>
</tr>
<tr>
<td>2.0 Security</td>
<td>24%</td>
</tr>
<tr>
<td>3.0 Software Troubleshooting</td>
<td>26%</td>
</tr>
<tr>
<td>4.0 Operational Procedures</td>
<td>23%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
1.0 Operating Systems

1.1 Compare and contrast common operating system types and their purposes.

- **32-bit vs. 64-bit**
  - RAM limitations
  - Software compatibility
- **Workstation operating systems**
  - Microsoft Windows
  - Apple Macintosh OS
  - Linux
- **Cell phone/tablet operating systems**
  - Microsoft Windows
  - Android
  - iOS
  - Chrome OS
- **Vendor-specific limitations**
  - End-of-life
  - Update limitations
- **Compatibility concerns between operating systems**

1.2 Compare and contrast features of Microsoft Windows versions.

- **Windows 7**
- **Windows 8**
- **Windows 8.1**
- **Windows 10**
- **Corporate vs. personal needs**
  - Domain access
  - BitLocker
  - Media center
- **BranchCache**
- **EFS**
- **Desktop styles/user interface**

1.3 Summarize general OS installation considerations and upgrade methods.

- **Boot methods**
  - Optical disc (CD-ROM, DVD, Blu-ray)
  - External drive/flash drive (USB/eSATA)
  - Network boot (PXE)
  - Internal fixed disk (HDD/SSD)
  - Internal hard drive (partition)
- **Type of installations**
  - Unattended installation
  - In-place upgrade
  - Clean install
  - Repair installation
  - Multiboot
  - Remote network installation
  - Image deployment
  - Recovery partition
  - Refresh/restore
- **Partitioning**
  - Dynamic
  - Basic
  - Primary
  - Extended
  - Logical
  - GPT
- **File system types/formatting**
  - ExFAT
  - FAT32
  - NTFS
  - CDFS
  - NFS
  - ext3, ext4
  - HFS
  - Swap partition
- **Quick format vs. full format**
- **Load alternate third-party drivers when necessary**
- **Workgroup vs. Domain setup**
- **Time/date/region/language settings**
- **Driver installation, software, and Windows updates**
- **Factory recovery partition**
- **Properly formatted boot drive with the correct partitions/format**
- **Prerequisites/hardware compatibility**
- **Application compatibility**
- **OS compatibility/upgrade path**
1.4 Given a scenario, use appropriate Microsoft command line tools.

- Navigation
  - dir
  - cd
  - ...
- ipconfig
- ping
- tracert
- netstat
- nslookup
- shutdown
- dism
- sfc
- chkdsk
- diskpart
- taskkill
- gpupdate
- gporesult
- format
- copy
- xcopy
- robocopy
- net use
- net user
- [command name] /?
- Commands available with standard privileges vs. administrative privileges

1.5 Given a scenario, use Microsoft operating system features and tools.

- Administrative
  - Computer Management
  - Device Manager
  - Local Users and Groups
  - Local Security Policy
  - Performance Monitor
  - Services
  - System Configuration
  - Task Scheduler
  - Component Services
  - Data Sources
  - Print Management
  - Windows Memory Diagnostics
  - Windows Firewall
  - Advanced Security
  - Event Viewer
  - User Account Management
- MSConfig
  - General
  - Boot
  - Services
  - Startup
  - Tools
- Task Manager
  - Applications
  - Processes
  - Performance
  - Networking
  - Users
- Disk Management
  - Drive status
  - Mounting
  - Initializing
  - Extending partitions
  - Splitting partitions
- Shrink partitions
- Assigning/changing drive letters
- Adding drives
- Adding arrays
- Storage spaces
- System utilities
  - Regedit
  - Command
  - Services.msc
  - MMC
  - MSTSC
  - Notepad
  - Explorer
  - Msinfo32
  - DxDiaq
  - Disk Defragmenter
  - System Restore
  - Windows Update

1.6 Given a scenario, use Microsoft Windows Control Panel utilities.

- Internet Options
  - Connections
  - Security
  - General
  - Privacy
  - Programs
  - Advanced
- Display/Display Settings
  - Resolution
  - Color depth
  - Refresh rate
- User Accounts
- Folder Options
  - View hidden files
  - Hide extensions
  - General options
  - View options
- System
  - Performance (virtual memory)
  - Remote settings
  - System protection
- Windows Firewall
- Power Options
  - Hibernate
  - Power plans
- Sleep/suspend
- Standby
- Credential Manager
- Programs and features
- HomeGroup
- Devices and Printers
- Sound
- Troubleshooting
- Network and Sharing Center
- Device Manager
- BitLocker
- Sync Center
1.7 Summarize application installation and configuration concepts.

- System requirements
  - Drive space
  - RAM
- OS requirements
  - Compatibility
- Methods of installation and deployment
  - Local (CD/USB)
  - Network-based
- Local user permissions
  - Folder/file access for installation
- Security considerations
  - Impact to device
  - Impact to network

1.8 Given a scenario, configure Microsoft Windows networking on a client/desktop.

- HomeGroup vs. Workgroup
- Domain setup
- Network shares/administrative shares/mapping drives
- Printer sharing vs. network printer mapping
- Establish networking connections
  - VPN
  - Dial-ups
  - Wireless
  - Wired
  - WWAN (Cellular)
- Proxy settings
- Remote Desktop Connection
- Remote Assistance
- Home vs. Work vs. Public network settings
- Firewall settings
  - Exceptions
  - Configuration
  - Enabling/disabling Windows Firewall
- Configuring an alternative IP address in Windows
  - IP addressing
  - Subnet mask
- DNS
- Gateway
- Network card properties
  - Half duplex/full duplex/auto speed
  - Wake-on-LAN
  - QoS
  - BIOS (on-board NIC)

1.9 Given a scenario, use features and tools of the Mac OS and Linux client/desktop operating systems.

- Best practices
  - Scheduled backups
  - Scheduled disk maintenance
  - System updates/App Store
  - Patch management
  - Driver/firmware updates
  - Antivirus/Anti-malware updates
- Tools
  - Backup/Time Machine
  - Restore/Snapshot
  - Image recovery
  - Disk maintenance utilities
  - Shell/Terminal
  - Screen sharing
  - Force Quit
- Features
  - Multiple desktops/Mission Control
  - Key Chain
  - Spotlight
  - iCloud
  - Gestures
  - Finder
  - Remote Disc
  - Dock
  - Boot Camp
- Basic Linux commands
  - ls
  - grep
  - cd
  - shutdown
- pwd vs. passwd
- mv
- cp
- rm
- chmod
- chown
- iwconfig/ifconfig
- ps
- su/sudo
- apt-get
- vi
- dd
- kill
2.0 Security

2.1 Summarize the importance of physical security measures.

- Access control vestibule
- Badge reader
- Smart card
- Security guard
- Door lock
- Biometric locks
- Hardware tokens
- Cable locks
- Server locks
- USB locks
- Privacy screen
- Key fobs
- Entry control roster

2.2 Explain logical security concepts.

- Active Directory
  - Login script
  - Domain
  - Group Policy/Updates
  - Organizational Units
  - Home Folder
  - Folder redirection
- Software tokens
- MDM policies
- Port security
- MAC address filtering
- Certificates
- Antivirus/Anti-malware
- Firewalls
- User authentication/strong passwords
- Multifactor authentication
- Directory permissions
- VPN
- DLP
- Access control lists
- Smart card
- Email filtering
- Trusted/untrusted software sources
- Principle of least privilege

2.3 Compare and contrast wireless security protocols and authentication methods.

- Protocols and encryption
  - WEP
  - WPA
  - WPA2
  - TKIP
  - AES
- Authentication
  - Single-factor
  - Multifactor
  - RADIUS
  - TACACS

2.4 Given a scenario, detect, remove, and prevent malware using appropriate tools and methods.

- Malware
  - Ransomware
  - Trojan
  - Keylogger
  - Rootkit
  - Virus
- Tools and methods
  - Antivirus
  - Anti-malware
  - Botnet
  - Worm
  - Spyware
- Recovery console
  - Backup/restore
  - End user education
  - Software firewalls
  - DNS configuration
2.0 Security

2.5 Compare and contrast social engineering, threats, and vulnerabilities.

- Social engineering
  - Phishing
  - Spear phishing
  - Impersonation
  - Shoulder surfing
  - Tailgating
  - Dumpster diving
- DDoS
- DoS
- Zero-day
- On-path attack (previously known as man-in-the-middle attack)
- Brute force
- Dictionary
- Rainbow table
- Spoofing
- Non-compliant systems
- Zombie

2.6 Compare and contrast the differences of basic Microsoft Windows OS security settings.

- User and groups
  - Administrator
  - Power user
  - Guest
  - Standard user
- NTFS vs. share permissions
  - Allow vs. deny
- Moving vs. copying folders and files
  - File attributes
- Shared files and folders
  - Administrative shares vs. local shares
  - Permission propagation
  - Inheritance
  - System files and folders
- User authentication
  - Single sign-on
- Run as administrator vs. standard user
- BitLocker
- BitLocker To Go
- EFS

2.7 Given a scenario, implement security best practices to secure a workstation.

- Password best practices
  - Setting strong passwords
  - Password expiration
  - Screensaver required password
  - BIOS/UEFI passwords
  - Requiring passwords
- Account management
  - Restricting user permissions
  - Logon time restrictions
  - Disabling guest account
  - Failed attempts lockout
  - Timeout/screen lock
  - Change default admin user account/password
  - Basic Active Directory functions
    - Account creation
    - Account deletion
    - Password reset/unlock account
    - Disable account
- Disable autorun
- Data encryption
- Patch/update management
2.8 Given a scenario, implement methods for securing mobile devices.

- Screen locks
  - Fingerprint lock
  - Face lock
  - Swipe lock
  - Passcode lock
- Remote wipes
- Locator applications
- Remote backup applications
- Failed login attempts restrictions
- Antivirus/Anti-malware
- Patching/OS updates
- Biometric authentication
- Full device encryption
- Multifactor authentication
- Authenticator applications
- Trusted sources vs. untrusted sources
- Firewalls
- Policies and procedures
  - BYOD vs. corporate-owned
  - Profile security requirements

2.9 Given a scenario, implement appropriate data destruction and disposal methods.

- Physical destruction
  - Shredder
  - Drill/hammer
  - Electromagnetic (Degaussing)
  - Incineration
  - Certificate of destruction
- Recycling or repurposing best practices
  - Low-level format vs. standard format
  - Overwrite
  - Drive wipe

2.10 Given a scenario, configure security on SOHO wireless and wired networks.

- Wireless-specific
  - Changing default SSID
  - Setting encryption
  - Disabling SSID broadcast
  - Antenna and access point placement
  - Radio power levels
  - WPS
  - Change default usernames and passwords
  - Enable MAC filtering
  - Assign static IP addresses
- Firewall settings
- Port forwarding/mapping
- Disabling ports
- Content filtering/parental controls
- Update firmware
- Physical security
3.0 Software Troubleshooting

3.1 Given a scenario, troubleshoot Microsoft Windows OS problems.

- **Common symptoms**
  - Slow performance
  - Limited connectivity
  - Failure to boot
  - No OS found
  - Application crashes
  - Blue screens
  - Blank screens
  - Printing issues
  - Services fail to start

- **Common solutions**
  - Defragment the hard drive
  - Reboot
  - Kill tasks
  - Restart services
  - Update network settings
  - Reimage/reload OS
  - Roll back/reload OS

- **Common symptoms (continued)**
  - Slow bootup
  - Slow profile load

- **Common solutions (continued)**
  - Roll back devices drivers
  - Apply updates
  - Repair application
  - Update boot order
  - Disable Windows services/applications
  - Disable application startup
  - Safe boot
  - Rebuild Windows profiles

3.2 Given a scenario, troubleshoot and resolve PC security issues.

- **Common symptoms**
  - Pop-ups
  - Browser redirection
  - Security alerts
  - Slow performance
  - Internet connectivity issues
  - PC/OS lockup

- **Common solutions**
  - Application crash
  - OS updates failures
  - Rogue antivirus
  - Spam
  - Renamed system files
  - Disappearing files
  - File permission changes

- **Common symptoms (continued)**
  - Hijacked email
  - Responses from users regarding email
  - Automated replies from unknown sent email
  - Access denied
  - Invalid certificate (trusted root CA)
  - System/application log errors

3.3 Given a scenario, use best practice procedures for malware removal.

1. Identify and research malware symptoms.
2. Quarantine the infected systems.
4. Remediate the infected systems.
   a. Update the anti-malware software.
   b. Scan and use removal techniques (safe mode, pre-installation environment).
5. Schedule scans and run updates.
6. Enable System Restore and create a restore point (in Windows).
7. Educate the end user.
### 3.0 Software Troubleshooting

#### 3.4 Given a scenario, troubleshoot mobile OS and application issues.

<table>
<thead>
<tr>
<th>Common symptoms</th>
<th>Touchscreen non-responsive</th>
<th>Frozen system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dim display</td>
<td></td>
<td>No sound from speakers</td>
</tr>
<tr>
<td>Intermittent wireless</td>
<td>Slow performance</td>
<td>Inaccurate touch screen response</td>
</tr>
<tr>
<td>No wireless connectivity</td>
<td>Unable to decrypt email</td>
<td>System lockout</td>
</tr>
<tr>
<td>No Bluetooth connectivity</td>
<td>Extremely short battery life</td>
<td>App log errors</td>
</tr>
<tr>
<td>Cannot broadcast to external monitor</td>
<td>Overheating</td>
<td></td>
</tr>
<tr>
<td>Touchscreen non-responsive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apps not loading</td>
<td>Slow performance</td>
<td></td>
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</tbody>
</table>

#### 3.5 Given a scenario, troubleshoot mobile OS and application security issues.

<table>
<thead>
<tr>
<th>Common symptoms</th>
<th>Unauthorized account access</th>
<th>Unauthorized location tracking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal drop/weak signal</td>
<td>Unauthorized location tracking</td>
<td>Unauthorized camera/ microphone activation</td>
</tr>
<tr>
<td>Power drain</td>
<td>Unauthorized location tracking</td>
<td>Unauthorized camera/ microphone activation</td>
</tr>
<tr>
<td>Slow data speeds</td>
<td>Unauthorized location tracking</td>
<td>Unauthorized camera/ microphone activation</td>
</tr>
<tr>
<td>Unintended WiFi connection</td>
<td>Unauthorized location tracking</td>
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</tr>
<tr>
<td>Unintended Bluetooth pairing</td>
<td>Unauthorized location tracking</td>
<td>Unauthorized camera/ microphone activation</td>
</tr>
<tr>
<td>Leaked personal files/data</td>
<td>Unauthorized location tracking</td>
<td>Unauthorized camera/ microphone activation</td>
</tr>
<tr>
<td>Data transmission over limit</td>
<td>Unauthorized location tracking</td>
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<td>Unauthorized camera/ microphone activation</td>
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4.0 Operational Procedures

4.1 Compare and contrast best practices associated with types of documentation.

- Network topology diagrams
- Knowledge base/articles
- Incident documentation
- Regulatory and compliance policy
- Acceptable use policy
- Password policy
- Inventory management
  - Asset tags
  - Barcodes

4.2 Given a scenario, implement basic change management best practices.

- Documented business processes
- Purpose of the change
- Scope the change
- Risk analysis
- Plan for change
- End-user acceptance
- Change board
  - Approvals
  - Backout plan
  - Document changes

4.3 Given a scenario, implement basic disaster prevention and recovery methods.

- Backup and recovery
  - Image level
  - File level
  - Critical applications
- Backup testing
- UPS
- Surge protector
- Cloud storage vs. local storage backups
- Account recovery options

4.4 Explain common safety procedures.

- Equipment grounding
- Proper component handling and storage
  - Antistatic bags
  - ESD straps
  - ESD mats
  - Self-grounding
- Toxic waste handling
  - Batteries
- Toner
- CRT
- Cell phones
- Tablets
- Personal safety
  - Disconnect power before repairing PC
  - Remove jewelry
  - Lifting techniques
- Weight limitations
- Electrical fire safety
- Cable management
- Safety goggles
- Air filter mask
- Compliance with government regulations

CompTIA A+ Certification Exam: Core 2 Objectives Version 5.0 (Exam Number: Core 2)
4.0 Operational Procedures

4.5 Explain environmental impacts and appropriate controls.
- MSDS documentation for handling and disposal
- Temperature, humidity level awareness, and proper ventilation
- Power surges, under-voltage events, and power loss
- Battery backup
- Surge suppressor
- Protection from airborne particles
- Enclosures
- Air filters/mask
- Dust and debris
- Compressed air
- Vacuums
- Compliance to government regulations

4.6 Explain the processes for addressing prohibited content/activity, and privacy, licensing, and policy concepts.
- Incident response
  - First response
  - Identify
  - Report through proper channels
  - Data/device preservation
  - Use of documentation/documentation changes
  - Chain of custody
  - Tracking of evidence/documenting process
- Licensing/DRM/EULA
  - Open-source vs. commercial license
  - Personal license vs. enterprise licenses
- Regulated data
  - PII
  - PCI
  - GDPR
  - PHI
- Follow all policies and security best practices

4.7 Given a scenario, use proper communication techniques and professionalism.
- Use proper language and avoid jargon, acronyms, and slang, when applicable
- Maintain a positive attitude/project confidence
- Actively listen (taking notes) and avoid interrupting the customer
- Be culturally sensitive
  - Use appropriate professional titles, when applicable
- Be on time (if late, contact the customer)
- Avoid distractions
  - Personal calls
  - Texting/social media sites
  - Talking to coworkers while interacting with customers
  - Personal interruptions
- Dealing with difficult customers or situations
  - Do not argue with customers and/or be defensive
  - Avoid dismissing customer problems
  - Avoid being judgmental
  - Clarify customer statements (ask open-ended questions to narrow the scope of the problem, restate the issue, or question to verify understanding)
  - Do not disclose experiences via social media outlets
- Set and meet expectations/timeline and communicate status with the customer
  - Offer different repair/replacement options, if applicable
  - Provide proper documentation on the services provided
  - Follow up with customer/user at a later date to verify satisfaction
- Deal appropriately with customers’ confidential and private materials
  - Located on a computer, desktop, printer, etc.
4.8 Identify the basics of scripting.

- Script file types
  - .bat
  - .ps1
  - .vbs
  - .sh
  - .py
  - .js

- Environment variables
- Comment syntax
- Basic script constructs
  - Basic loops
  - Variables

- Basic data types
  - Integers
  - Strings

4.9 Given a scenario, use remote access technologies.

- RDP
- Telnet
- SSH
- Third-party tools
  - Screen share feature
  - File share
- Security considerations of each access method
The following is a list of acronyms that appear on the CompTIA A+ exams. 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>AC</td>
<td>Alternating Current</td>
<td>CGA</td>
<td>Computer Graphics and Applications</td>
</tr>
<tr>
<td>ACL</td>
<td>Access Control List</td>
<td>CIDR</td>
<td>Classless Inter-Domain Routing</td>
</tr>
<tr>
<td>ACPI</td>
<td>Advanced Configuration Power Interface</td>
<td>CIFS</td>
<td>Common Internet File System</td>
</tr>
<tr>
<td>ADF</td>
<td>Automatic Document Feeder</td>
<td>CMOS</td>
<td>Complementary Metal-Oxide Semiconductor</td>
</tr>
<tr>
<td>ADSL</td>
<td>Asymmetrical Digital Subscriber Line</td>
<td>CNR</td>
<td>Communications and Networking Riser</td>
</tr>
<tr>
<td>AES</td>
<td>Advanced Encryption Standard</td>
<td>COMx</td>
<td>Communication port (x=port number)</td>
</tr>
<tr>
<td>AHCI</td>
<td>Advanced Host Controller Interface</td>
<td>CPU</td>
<td>Central Processing Unit</td>
</tr>
<tr>
<td>AP</td>
<td>Access Point</td>
<td>CRT</td>
<td>Cathode-Ray Tube</td>
</tr>
<tr>
<td>APIPA</td>
<td>Automatic Private Internet Protocol Addressing</td>
<td>DaaS</td>
<td>Data as a Service</td>
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CompTIA A+ Certification Exam: Core 2 Objectives Version 5.0 (Exam Number: Core 2)
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<td>-------------------------------------------------</td>
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<td>-------------------------------------------------</td>
</tr>
<tr>
<td>ROM</td>
<td>Read-Only Memory</td>
<td>TLS</td>
<td>Transport Layer Security</td>
</tr>
<tr>
<td>RPO</td>
<td>Recovery Point Objective</td>
<td>TN</td>
<td>Twisted Nematic</td>
</tr>
<tr>
<td>RTC</td>
<td>Real-Time Clock</td>
<td>TPM</td>
<td>Trusted Platform Module</td>
</tr>
<tr>
<td>RTO</td>
<td>Recovery Time Objective</td>
<td>UAC</td>
<td>User Account Control</td>
</tr>
<tr>
<td>SaaS</td>
<td>Software as a Service</td>
<td>UDF</td>
<td>User Defined Functions or Universal Disk Format</td>
</tr>
<tr>
<td>SAN</td>
<td>Storage Area Network</td>
<td>UDP</td>
<td>User Datagram Protocol</td>
</tr>
<tr>
<td>SAS</td>
<td>Serial Attached SCSI</td>
<td>UEFI</td>
<td>Unified Extensible Firmware Interface</td>
</tr>
<tr>
<td>SATA</td>
<td>Serial Advanced Technology Attachment</td>
<td>UNC</td>
<td>Universal Naming Convention</td>
</tr>
<tr>
<td>SC</td>
<td>Subscription Channel</td>
<td>UPnP</td>
<td>Universal Plug and Play</td>
</tr>
<tr>
<td>SCP</td>
<td>Secure Copy Protection</td>
<td>UPS</td>
<td>Uninterruptible Power Supply</td>
</tr>
<tr>
<td>SCSI</td>
<td>Small Computer System Interface</td>
<td>URL</td>
<td>Uniform Resource Locator</td>
</tr>
<tr>
<td>SCSI ID</td>
<td>Small Computer System Interface Identifier</td>
<td>USB</td>
<td>Universal Serial Bus</td>
</tr>
<tr>
<td>SD card</td>
<td>Secure Digital Card</td>
<td>USMT</td>
<td>User State Migration Tool</td>
</tr>
<tr>
<td>SEC</td>
<td>Single Edge Connector</td>
<td>UTM</td>
<td>Unified Threat Management</td>
</tr>
<tr>
<td>SFC</td>
<td>System File Checker</td>
<td>UTP</td>
<td>Unshielded Twisted Pair</td>
</tr>
<tr>
<td>SFF</td>
<td>Small Form Factor</td>
<td>UXGA</td>
<td>Ultra Extended Graphics Array</td>
</tr>
<tr>
<td>SFTP</td>
<td>Secure File Transfer Protocol</td>
<td>VA</td>
<td>Vertical Alignment</td>
</tr>
<tr>
<td>SIM</td>
<td>Subscriber Identity Module</td>
<td>VDC</td>
<td>Volts DC</td>
</tr>
<tr>
<td>SIMM</td>
<td>Single In-Line Memory Module</td>
<td>VDI</td>
<td>Virtual Desktop Infrastructure</td>
</tr>
<tr>
<td>SLI</td>
<td>Scalable Link Interface or System Level</td>
<td>VESA</td>
<td>Video Electronics Standards Association</td>
</tr>
<tr>
<td>S.M.A.R.T.</td>
<td>Self-Monitoring, Analysis, and Reporting Technology</td>
<td>VFAT</td>
<td>Virtual File Allocation Table</td>
</tr>
<tr>
<td>SMB</td>
<td>Server Message Block</td>
<td>VGA</td>
<td>Video Graphics Array</td>
</tr>
<tr>
<td>SMTP</td>
<td>Simple Mail Transfer Protocol</td>
<td>VLAN</td>
<td>Virtual LAN</td>
</tr>
<tr>
<td>SNMP</td>
<td>Simple Network Management Protocol</td>
<td>VM</td>
<td>Virtual Machine</td>
</tr>
<tr>
<td>SoDIMM</td>
<td>Small Outline Dual Inline Memory Module</td>
<td>VNC</td>
<td>Virtual Network Computer</td>
</tr>
<tr>
<td>SOHO</td>
<td>Small Office/Home Office</td>
<td>VoIP</td>
<td>Voice over Internet Protocol</td>
</tr>
<tr>
<td>SP</td>
<td>Service Pack</td>
<td>VPN</td>
<td>Virtual Private Network</td>
</tr>
<tr>
<td>SPDIF</td>
<td>Sony-Philips Digital Interface Format</td>
<td>VRAM</td>
<td>Video Random Access Memory</td>
</tr>
<tr>
<td>SPGA</td>
<td>Staggered Pin Grid Array</td>
<td>WAN</td>
<td>Wide Area Network</td>
</tr>
<tr>
<td>SRAM</td>
<td>Static Random Access Memory</td>
<td>WAP</td>
<td>Wireless Access Protocol/Wireless Access Point</td>
</tr>
<tr>
<td>SSD</td>
<td>Solid State Drive</td>
<td>WEP</td>
<td>Wired Equivalent Privacy</td>
</tr>
<tr>
<td>SSH</td>
<td>Secure Shell</td>
<td>WIFI</td>
<td>Wireless Fidelity</td>
</tr>
<tr>
<td>SSID</td>
<td>Service Set Identifier</td>
<td>WINS</td>
<td>Windows Internet Name Service</td>
</tr>
<tr>
<td>SSL</td>
<td>Secure Sockets Layer</td>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
</tr>
<tr>
<td>SSO</td>
<td>Single Sign-on</td>
<td>WMN</td>
<td>Wireless Mesh Network</td>
</tr>
<tr>
<td>ST</td>
<td>Straight Tip</td>
<td>WPA</td>
<td>Wireless Protected Access</td>
</tr>
<tr>
<td>STP</td>
<td>Shielded Twisted Pair</td>
<td>WPA2</td>
<td>WiFi Protected Access 2</td>
</tr>
<tr>
<td>SXGA</td>
<td>Super Extended Graphics Array</td>
<td>WPS</td>
<td>WiFi Protected Setup</td>
</tr>
<tr>
<td>TACACS</td>
<td>Terminal Access Controller Access-Control System</td>
<td>WUXGA</td>
<td>Wide Ultra Extended Graphics Array</td>
</tr>
<tr>
<td>TCP</td>
<td>Transmission Control Protocol</td>
<td>WWAN</td>
<td>Wireless Wide Area Network</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>Transmission Control Protocol/Internet Protocol</td>
<td>XGA</td>
<td>Extended Graphics Array</td>
</tr>
<tr>
<td>TDR</td>
<td>Time Domain Reflectometer</td>
<td>ZIF</td>
<td>Zero-Insertion-Force</td>
</tr>
<tr>
<td>TFTP</td>
<td>Trivial File Transfer Protocol</td>
<td>ZIP</td>
<td>Zigzag Inline Package</td>
</tr>
</tbody>
</table>
A+ Proposed Hardware and Software List

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

**EQUIPMENT**
- Apple tablet/smartphone
- Android tablet/smartphone
- Windows tablet/Smartphone
- Chromebook
- Windows laptop/Mac laptop/Linux laptop
- Windows desktop/Mac desktop/Linux desktop
- Windows Server w/Active Directory and Print Management
- Monitors
- Projectors
- SOHO router/switch
- Access point
- VoIP phone
- Printer
  - Laser/inkjet
  - Wireless
  - 3D printer
- Surge suppressor
- UPS
- VR headset
- Smart devices (IoT devices)

**SPARE PARTS/HARDWARE**
- Motherboards
- RAM
- Hard drives
- Power supplies
- Video cards
- Sounds cards
- Network cards
- Wireless NICs
- Fans/cooling devices/heat sink

**SOFTWARE**
- Operating systems
  - Linux
  - Chrome OS
  - Microsoft Windows
  - Mac OS
  - Android
  - iOS
- PE Disk/Live CD
- Antivirus software
- Virtualization software
- Anti-malware
- Driver software

**TOOLS**
- Screw drivers
- Multimeter
- Wire cutters
- Punchdown tool
- Crimper
- Power supply tester
- Cable stripper
- Standard technician toolkit
- ESD strap
- Thermal paste
- Cable tester
- Cable toner
- WiFi analyzer
- SATA to USB connectors