CompTIA A+ Certification
Exam: Core 1 Objectives

EXAM NUMBER: CORE 1 (220-1001)
About the Exam

Candidates are encouraged to use this document to help prepare for CompTIA A+ Core 1. 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 1 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 1
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: 675 (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 Mobile Devices</td>
<td>14%</td>
</tr>
<tr>
<td>2.0 Networking</td>
<td>20%</td>
</tr>
<tr>
<td>3.0 Hardware</td>
<td>27%</td>
</tr>
<tr>
<td>4.0 Virtualization and Cloud Computing</td>
<td>12%</td>
</tr>
<tr>
<td>5.0 Hardware and Network Troubleshooting</td>
<td>27%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>
### 1.0 Mobile Devices

#### 1.1 Given a scenario, install and configure laptop hardware and components.

<table>
<thead>
<tr>
<th>Hardware/device replacement</th>
<th>- Keyboard</th>
<th>- Wireless card/Bluetooth module</th>
<th>- Plastics/frames</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Hard drive</td>
<td>- Hard drive</td>
<td>- Cellular card</td>
<td>- Speaker</td>
</tr>
<tr>
<td>- SSD vs. hybrid vs. magnetic disk</td>
<td>- SSD vs. hybrid vs. magnetic disk</td>
<td>- Video card</td>
<td>- System board</td>
</tr>
<tr>
<td>- 1.8in vs. 2.5in</td>
<td>- Memory</td>
<td>- Mini PCIe</td>
<td>- CPU</td>
</tr>
<tr>
<td>- Memory</td>
<td>- Smart card reader</td>
<td>- Screen</td>
<td></td>
</tr>
<tr>
<td>- Smart card reader</td>
<td>- Optical drive</td>
<td>- DC jack</td>
<td></td>
</tr>
<tr>
<td>- Optical drive</td>
<td></td>
<td>- Battery</td>
<td></td>
</tr>
</tbody>
</table>

| Memory                        | - Touchpad | |

#### 1.2 Given a scenario, install components within the display of a laptop.

<table>
<thead>
<tr>
<th>Types</th>
<th>- Webcam</th>
<th>- Microphone</th>
</tr>
</thead>
<tbody>
<tr>
<td>- LCD</td>
<td>- Webcam</td>
<td>- Microphone</td>
</tr>
<tr>
<td>- OLED</td>
<td>- Microphone</td>
<td>- Inverter</td>
</tr>
<tr>
<td>- WiFi antenna connector/placement</td>
<td>- Inverter</td>
<td>- Digitizer/touchscreen</td>
</tr>
</tbody>
</table>

#### 1.3 Given a scenario, use appropriate laptop features.

<table>
<thead>
<tr>
<th>Special function keys</th>
<th>- Screen orientation</th>
<th>- Docking station</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Dual displays</td>
<td>- Media options (fast forward/rewind)</td>
<td>- Port replicator</td>
</tr>
<tr>
<td>- Wireless (on/off)</td>
<td>- GPS (on/off)</td>
<td>- Physical laptop lock and cable lock</td>
</tr>
<tr>
<td>- Cellular (on/off)</td>
<td>- Airplane mode</td>
<td>- Rotating/removable screens</td>
</tr>
<tr>
<td>- Volume settings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Screen brightness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Bluetooth (on/off)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Keyboard backlight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Touchpad (on/off)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 1.4 Compare and contrast characteristics of various types of other mobile devices.

<table>
<thead>
<tr>
<th>Tablets</th>
<th>- Wearable technology devices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- Smart watches</td>
</tr>
<tr>
<td></td>
<td>- Fitness monitors</td>
</tr>
<tr>
<td></td>
<td>- VR/AR headsets</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smartphones</th>
<th>- E-readers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>- GPS</td>
</tr>
</tbody>
</table>

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CompTIA A+ Certification Exam: Core 1 Objectives Version 3.0 (Exam Number: Core 1)
1.5 Given a scenario, connect and configure accessories and ports of other mobile devices.

- **Connection types**
  - Wired
  - Micro-USB/Mini-USB/USB-C
  - Lightning
  - Tethering
  - Proprietary vendor-specific ports (communication/power)
  - Wireless
  - NFC
  - Bluetooth
  - IR
  - Hotspot

- **Accessories**
  - Headsets
  - Speakers
  - Game pads
  - Extra battery packs/battery chargers
  - Protective covers/waterproofing
  - Credit card readers
  - Memory/MicroSD

1.6 Given a scenario, configure basic mobile device network connectivity and application support.

- **Wireless/cellular data network (enable/disable)**
  - Hotspot
  - Tethering
  - Airplane mode

- **Bluetooth**
  - Enable Bluetooth
  - Enable pairing
  - Find a device for pairing
  - Enter the appropriate pin code
  - Test connectivity

- **Corporate and ISP email configuration**
  - POP3
  - IMAP
  - Port and SSL settings
  - S/MIME

- **Integrated commercial provider email configuration**
  - iCloud
  - Google/Inbox
  - Exchange Online
  - Yahoo

- **PRI updates/PRL updates/baseband updates**
  - Radio firmware
  - IMEI vs. IMSI
  - VPN

1.7 Given a scenario, use methods to perform mobile device synchronization.

- **Synchronization methods**
  - Synchronize to the cloud
  - Synchronize to the desktop
  - Synchronize to the automobile

- **Types of data to synchronize**
  - Contacts
  - Applications
  - Email
  - Pictures
  - Music
  - Videos

- **Connection types to enable synchronization**
  - Calendar
  - Bookmarks
  - Documents
  - Location data
  - Social media data
  - E-books
  - Passwords
  - Mutual authentication for multiple services (SSO)
  - Software requirements to install the application on the PC
2.0 Networking

2.1 Compare and contrast TCP and UDP ports, protocols, and their purposes.

- **Ports and protocols**
  - 21 – FTP
  - 22 – SSH
  - 23 – Telnet
  - 25 – SMTP
  - 53 – DNS
  - 80 – HTTP
  - 110 – POP3
  - 143 – IMAP
  - 443 – HTTPS
  - 3389 – RDP
  - 137-139 – NetBIOS/NetBT
  - 445 – SMB/CIFS
  - 427 – SLP
  - 548 – AFP
  - 67/68 – DHCP
  - 389 – LDAP
  - 161/162 – SNMP
  - TCP vs. UDP

2.2 Compare and contrast common networking hardware devices.

- **Routers**
- **Switches**
  - Managed
  - Unmanaged
- **Access points**
- **Cloud-based network controller**
- **Firewall**
- **Network interface card**
- **Repeater**
- **Hub**
- **Cable/DSL modem**
- **Bridge**
- **Patch panel**
- **Power over Ethernet (PoE)**
  - Injectors
  - Switch
- **Ethernet over Power**

2.3 Given a scenario, install and configure a basic wired/wireless SOHO network.

- **Router/switch functionality**
- **Access point settings**
- **IP addressing**
- **NIC configuration**
  - Wired
  - Wireless
- **End-user device configuration**
- **IoT device configuration**
  - Thermostat
- **Light switches**
- **Security cameras**
- **Door locks**
- **Voice-enabled, smart speaker/digital assistant**
- **Cable/DSL modem configuration**
- **Firewall settings**
  - DMZ
  - Port forwarding
- **NAT**
- **UPnP**
- **Whitelist/blacklist**
- **MAC filtering**
- **QoS**
- **Wireless settings**
  - Encryption
  - Channels
  - QoS

2.4 Compare and contrast wireless networking protocols.

- **802.11a**
- **802.11b**
- **802.11g**
- **802.11n**
- **802.11ac**
- **Frequencies**
  - 2.4Ghz
  - 5Ghz
- **Channels**
  - 1–11
- **Bluetooth**
- **NFC**
- **RFID**
- **Zigbee**
- **Z-Wave**
- **3G**
- **4G**
- **5G**
- **LTE**
2.5 Summarize the properties and purposes of services provided by networked hosts.

- Server roles
  - Web server
  - File server
  - Print server
  - DHCP server
  - DNS server
- Proxy server
- Mail server
- Authentication server
- syslog
- Internet appliance
  - UTM
  - IDS
  - IPS
  - End-point management server
  - Legacy/embedded systems

2.6 Explain common network configuration concepts.

- IP addressing
  - Static
  - Dynamic
  - APIPA
  - Link local
- DNS
  - DHCP
  - Reservations
  - IPv4 vs. IPv6
  - Subnet mask
- Gateway
  - VPN
  - VLAN
  - NAT

2.7 Compare and contrast Internet connection types, network types, and their features.

- Internet connection types
  - Cable
  - DSL
  - Dial-up
  - Fiber
  - Satellite
- ISDN
  - Cellular
  - Tethering
  - Mobile hotspot
  - Line-of-sight wireless Internet service
- Network types
  - LAN
  - WAN
  - PAN
  - MAN
  - WMN

2.8 Given a scenario, use appropriate networking tools.

- Crimper
- Cable stripper
- Multimeter
- Tone generator and probe
- Cable tester
- Loopback plug
- Punchdown tool
- WiFi analyzer
3.0 Hardware

3.1 Explain basic cable types, features, and their purposes.
- Network cables
  - Ethernet
  - Cat 5
  - Cat 5e
  - Cat 6
  - Plenum
  - Shielded twisted pair
  - Unshielded twisted pair
  - 568A/B
  - Fiber
  - Coaxial
  - Speed and transmission limitations
- Video cables
  - VGA
  - HDMI
  - Mini-HDMI
  - DisplayPort
  - DVI (DVI-D/DVI-I)
- Multipurpose cables
  - Lightning
  - Thunderbolt
  - USB
  - USB-C
  - USB 2.0
  - USB 3.0
- Peripheral cables
  - Serial
- Hard drive cables
  - SATA
  - IDE
  - SCSI
- Adapters
  - DVI to HDMI
  - USB to Ethernet
  - DVI to VGA

3.2 Identify common connector types.
- RJ-11
- RJ-45
- RS-232
- BNC
- RG-59
- RG-6
- USB
- Micro-USB
- Mini-USB
- USB-C
- DB-9
- Lightning
- SCSI
- eSATA
- Molex

3.3 Given a scenario, install RAM types.
- RAM types
  - SODIMM
  - DDR2
  - DDR3
  - DDR4
  - Single channel
  - Dual channel
  - Triple channel
  - Error correcting
  - Parity vs. non-parity
3.0 Hardware

### 3.4 Given a scenario, select, install and configure storage devices.

- **Optical drives**
  - CD-ROM/CD-RW
  - DVD-ROM/DVD-RW/DVD-RW DL
  - Blu-ray
  - BD-R
  - BD-RE

- **Solid-state drives**
  - M2 drives
  - NVME
  - SATA 2.5

- **Magnetic hard drives**
  - 5,400rpm
  - 7,200rpm
  - 10,000rpm
  - 15,000rpm
  - Sizes:
    - 2.5
    - 3.5

- **Hybrid drives**
- **Flash**
  - SD card
  - CompactFlash
  - Micro-SD card
  - Mini-SD card
  - xD

- **Configurations**
  - RAID 0, 1, 5, 10
  - Hot swappable

### 3.5 Given a scenario, install and configure motherboards, CPUs, and add-on cards.

- **Motherboard form factor**
  - ATX
  - mATX
  - ITX
  - mITX

- **Motherboard connectors types**
  - PCI
  - PCIe
  - Riser card
  - Socket types
  - SATA
  - IDE
  - Front panel connector
  - Internal USB connector

- **BIOS/UEFI settings**
  - Boot options
  - Firmware updates

- **Security settings**
- **Interface configurations**
- **Security**
  - Passwords
  - Drive encryption
  - TPM
  - LoJack
  - Secure boot

- **CMOS battery**
- **CPU features**
  - Single-core
  - Multicore
  - Virtualization
  - Hyperthreading
  - Speeds
  - Overclocking
  - Integrated GPU

- **Compatibility**
  - AMD
  - Intel

- **Cooling mechanism**
  - Fans
  - Heat sink
  - Liquid
  - Thermal paste

- **Expansion cards**
  - Video cards
  - Onboard
  - Add-on card
  - Sound cards
  - Network interface card
  - USB expansion card
  - eSATA card

### 3.6 Explain the purposes and uses of various peripheral types.

- **Printer**
- **ADF/flatbed scanner**
- **Barcode scanner/QR scanner**
- **Monitors**
- **VR headset**
- **Optical drive types**
- **Mouse**
- **Keyboard**
- **Touchpad**

- **Signature pad**
- **Game controllers**
- **Camera/webcam**
- **Microphone**
- **Speakers**
- **Headset**
- **Projector**
  - Lumens/brightness
- **External storage drives**

- **KVM**
- **Magnetic reader/chip reader**
- **NFC/tap pay device**
- **Smart card reader**
3.7 Summarize power supply types and features.
- Input 115V vs. 220V
- Output 5V vs. 12V
- 24-pin motherboard adapter
- Wattage rating
- Number of devices/types of devices to be powered

3.8 Given a scenario, select and configure appropriate components for a custom PC configuration to meet customer specifications or needs.
- Graphic/CAD/CAM design workstation
  - SSD
  - High-end video
  - Maximum RAM
- Audio/video editing workstation
  - Specialized audio and video card
  - Large, fast hard drive
  - Dual monitors
- Virtualization workstation
  - Maximum RAM and CPU cores
- Gaming PC
  - SSD
  - High-end video/specialized GPU
  - High-definition sound card
  - High-end cooling
- Network attached storage device
  - Media streaming
  - File sharing
  - Gigabit NIC
  - RAID array
  - Hard drive
- Standard thick client
  - Desktop applications
  - Meets recommended requirements for selected OS
- Thin client
  - Basic applications
  - Meets minimum requirements for selected OS
  - Network connectivity

3.9 Given a scenario, install and configure common devices.
- Desktop
  - Thin client
  - Thick client
  - Account setup/settings
- Laptop/common mobile devices
  - Touchpad configuration
  - Touchscreen configuration
  - Application installations/configurations
  - Synchronization settings
  - Account setup/settings
  - Wireless settings

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Given a scenario, configure SOHO multifunction devices/printers and settings.

- Use appropriate drivers for a given operating system
  - Configuration settings
  - Duplex
  - Collate
  - Orientation
  - Quality
- Device sharing
  - Wired
  - USB
  - Serial
  - Ethernet
  - Wireless
  - Bluetooth
  - 802.11(a, b, g, n, ac)
  - Infrastructure vs. ad hoc
  - Integrated print server (hardware)
  - Cloud printing/remote printing
- Public/shared devices
  - Sharing local/networked device via operating system settings
  - TCP/Bonjour/AirPrint
  - Data privacy
  - User authentication on the device
  - Hard drive caching

Given a scenario, install and maintain various print technologies.

- Laser
  - Imaging drum, fuser assembly, transfer belt, transfer roller, pickup rollers, separate pads, duplexing assembly
  - Imaging process: processing, charging, exposing, developing, transferring, fusing, and cleaning
  - Maintenance: Replace toner, apply maintenance kit, calibrate, clean
- Inkjet
  - Ink cartridge, print head, roller, feeder, duplexing assembly, carriage, and belt
  - Calibrate
  - Maintenance: Clean heads, replace cartridges, calibrate, clear jams
- Thermal
  - Feed assembly, heating element
  - Special thermal paper
  - Maintenance: Replace paper, clean heating element, remove debris
- Impact
  - Print head, ribbon, tractor feed
  - Impact paper
  - Maintenance: Replace ribbon, replace print head, replace paper
- Virtual
  - Print to file
  - Print to PDF
  - Print to XPS
  - Print to image
- 3D printers
  - Plastic filament
4.0 Virtualization and Cloud Computing

4.1 Compare and contrast cloud computing concepts.

• Common cloud models
  - IaaS
  - SaaS
  - PaaS
  - Public vs. private vs. hybrid vs. community

• Shared resources
  - Internal vs. external

• Rapid elasticity
• On-demand
• Resource pooling

• Measured service
• Metered
• Off-site email applications
• Cloud file storage services
  - Synchronization apps
• Virtual application streaming/cloud-based applications
  - Applications for cell phones/tablets
  - Applications for laptops/desktops
• Virtual desktop
  - Virtual NIC

4.2 Given a scenario, set up and configure client-side virtualization.

• Purpose of virtual machines
• Resource requirements
• Emulator requirements
• Security requirements
• Network requirements
• Hypervisor
5.0 Hardware and Network Troubleshooting

5.1 Given a scenario, use the best practice methodology to resolve problems.

1. Identify the problem
   - Question the user and identify user changes to computer and perform backups before making changes
   - Inquire regarding environmental or infrastructure changes
   - Review system and application logs

2. Establish a theory of probable cause (question the obvious)
   - If necessary, conduct external or internal research based on symptoms

3. Test the theory to determine cause
   - Once the theory is confirmed, determine the next steps to resolve problem
   - If theory is not confirmed re-establish new theory or escalate

4. Establish a plan of action to resolve the problem and implement the solution

5. Verify full system functionality and, if applicable, implement preventive measures

6. Document findings, actions, and outcomes

5.2 Given a scenario, troubleshoot problems related to motherboards, RAM, CPUs, and power.

- **Common symptoms**
  - Unexpected shutdowns
  - System lockups
  - POST code beeps
  - Blank screen on bootup
  - BIOS time and setting resets
  - Attempts to boot to incorrect device
  - Continuous reboots
  - No power
  - Overheating
  - Loud noise
  - Intermittent device failure
  - Fans spin – no power to other devices
  - Indicator lights
  - Smoke
  - Burning smell
  - Proprietary crash screens (BSOD/pin wheel)
  - Distended capacitors
  - Log entries and error messages

5.3 Given a scenario, troubleshoot hard drives and RAID arrays.

- **Common symptoms**
  - Read/write failure
  - Slow performance
  - Loud clicking noise
  - Failure to boot
  - Drive not recognized
  - OS not found
  - RAID not found
  - RAID stops working
  - Proprietary crash screens (BSOD/pin wheel)
  - S.M.A.R.T. errors
  - Log entries and error messages
5.0 Hardware and Network Troubleshooting

**5.4 Given a scenario, troubleshoot video, projector, and display issues.**

- **Common symptoms**
  - VGA mode
  - No image on screen
  - Overheat shutdown
  - Dead pixels
  - Artifacts
  - Incorrect color patterns
  - Dim image
  - Flickering image
  - Distorted image
  - Distorted geometry
  - Burn-in
  - Oversized images and icons

**5.5 Given a scenario, troubleshoot common mobile device issues while adhering to the appropriate procedures.**

- **Common symptoms**
  - No display
  - Dim display
  - Flickering display
  - Sticking keys
  - Intermittent wireless
  - Battery not charging
  - Ghost cursor/pointer drift
  - No power
  - Num lock indicator lights
  - No wireless connectivity
  - No Bluetooth connectivity
  - Cannot display to external monitor
  - Touchscreen non-responsive
  - Apps not loading
  - Slow performance
  - Unable to decrypt email
  - Extremely short battery life
  - Overheating
  - Frozen system
  - No sound from speakers
  - GPS not functioning
  - Swollen battery
  - Disassembling processes for proper reassembly
    - Document and label cable and screw locations
    - Organize parts
    - Refer to manufacturer resources
    - Use appropriate hand tools

**5.6 Given a scenario, troubleshoot printers.**

- **Common symptoms**
  - Streaks
  - Faded prints
  - Ghost images
  - Toner not fused to the paper
  - Creased paper
  - Paper not feeding
  - Paper jam
  - No connectivity
  - Garbled characters on paper
  - Vertical lines on page
  - Backed-up print queue
  - Low memory errors
  - Access denied
  - Printer will not print
  - Color prints in wrong print color
  - Unable to install printer
  - Error codes
  - Printing blank pages
  - No image on printer display
  - Multiple failed jobs in logs

**5.7 Given a scenario, troubleshoot common wired and wireless network problems.**

- **Common symptoms**
  - Limited connectivity
  - Unavailable resources
    - Internet
    - Local resources
      - Shares
      - Printers
      - Email
  - No connectivity
  - APIPA/link local address
  - Intermittent connectivity
  - IP conflict
  - Slow transfer speeds
  - Low RF signal
  - SSID not found
  - Limited connectivity
  - Unavailable resources
    - Internet
    - Local resources
      - Shares
      - Printers
      - Email
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>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>Alternating Current</td>
</tr>
<tr>
<td>ACL</td>
<td>Access Control List</td>
</tr>
<tr>
<td>ACPI</td>
<td>Advanced Configuration Power Interface</td>
</tr>
<tr>
<td>ADF</td>
<td>Automatic Document Feeder</td>
</tr>
<tr>
<td>ADSL</td>
<td>Asymmetrical Digital Subscriber Line</td>
</tr>
<tr>
<td>AES</td>
<td>Advanced Encryption Standard</td>
</tr>
<tr>
<td>AHCI</td>
<td>Advanced Host Controller Interface</td>
</tr>
<tr>
<td>AP</td>
<td>Access Point</td>
</tr>
<tr>
<td>APIPA</td>
<td>Automatic Private Internet Protocol Addressing</td>
</tr>
<tr>
<td>APM</td>
<td>Advanced Power Management</td>
</tr>
<tr>
<td>ARP</td>
<td>Address Resolution Protocol</td>
</tr>
<tr>
<td>ASR</td>
<td>Automated System Recovery</td>
</tr>
<tr>
<td>ATA</td>
<td>Advanced Technology Attachment</td>
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<tr>
<td>ATAPI</td>
<td>Advanced Technology Attachment Packet Interface</td>
</tr>
<tr>
<td>ATM</td>
<td>Asynchronous Transfer Mode</td>
</tr>
<tr>
<td>ATX</td>
<td>Advanced Technology Extended</td>
</tr>
<tr>
<td>AUP</td>
<td>Acceptable Use Policy</td>
</tr>
<tr>
<td>A/V</td>
<td>Audio Video</td>
</tr>
<tr>
<td>BD-R</td>
<td>Blu-ray Disc Recordable</td>
</tr>
<tr>
<td>BIOS</td>
<td>Basic Input/Output System</td>
</tr>
<tr>
<td>BD-RE</td>
<td>Blu-ray Disc Rewritable</td>
</tr>
<tr>
<td>BNC</td>
<td>Bayonet-Neill-Concelman</td>
</tr>
<tr>
<td>BSOD</td>
<td>Blue Screen of Death</td>
</tr>
<tr>
<td>BYOD</td>
<td>Bring Your Own Device</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer-Aided Design</td>
</tr>
<tr>
<td>CAPTCHA</td>
<td>Completely Automated Public Turing test to tell Computers and Humans Apart</td>
</tr>
<tr>
<td>CD</td>
<td>Compact Disc</td>
</tr>
<tr>
<td>CD-ROM</td>
<td>Compact Disc-Read-Only Memory</td>
</tr>
<tr>
<td>CD-RW</td>
<td>Compact Disc Rewritable</td>
</tr>
<tr>
<td>CDFS</td>
<td>Compact Disc File System</td>
</tr>
<tr>
<td>CERT</td>
<td>Computer Emergency Response Team</td>
</tr>
<tr>
<td>CFS</td>
<td>Central File System, Common File System, or Command File System</td>
</tr>
<tr>
<td>CGA</td>
<td>Computer Graphics and Applications</td>
</tr>
<tr>
<td>CIDR</td>
<td>Classless Inter-Domain Routing</td>
</tr>
<tr>
<td>CIFS</td>
<td>Common Internet File System</td>
</tr>
<tr>
<td>CMOS</td>
<td>Complementary Metal-Oxide Semiconductor</td>
</tr>
<tr>
<td>CNR</td>
<td>Communications and Networking Riser</td>
</tr>
<tr>
<td>COMx</td>
<td>Communication port (x=port number)</td>
</tr>
<tr>
<td>CPU</td>
<td>Central Processing Unit</td>
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<tr>
<td>CRT</td>
<td>Cathode-Ray Tube</td>
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<tr>
<td>DaaS</td>
<td>Data as a Service</td>
</tr>
<tr>
<td>DAC</td>
<td>Discretionary Access Control</td>
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<tr>
<td>DB-25</td>
<td>Serial Communications D-Shell Connector, 25 pins</td>
</tr>
<tr>
<td>DB-9</td>
<td>Serial Communications D-Shell Connector, 9 pins</td>
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<td>Database as a Service</td>
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<td>DC</td>
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<td>Distributed Denial of Service</td>
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<tr>
<td>DDR</td>
<td>Double Data Rate</td>
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<tr>
<td>DDR RAM</td>
<td>Double Data Rate Random Access Memory</td>
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<tr>
<td>DFS</td>
<td>Distributed File System</td>
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<tr>
<td>DHCP</td>
<td>Dynamic Host Configuration Protocol</td>
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<td>DIMM</td>
<td>Dual Inline Memory Module</td>
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<tr>
<td>DIN</td>
<td>Deutsche Industrie Norm</td>
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<tr>
<td>DLT</td>
<td>Digital Linear Tape</td>
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<tr>
<td>DLP</td>
<td>Digital Light Processing or Data Loss Prevention</td>
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<tr>
<td>DMA</td>
<td>Direct Memory Access</td>
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<tr>
<td>DMZ</td>
<td>Demilitarized Zone</td>
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<tr>
<td>DNS</td>
<td>Domain Name Service or Domain Name Server</td>
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<td>DoS</td>
<td>Denial of Service</td>
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<tr>
<td>DRAM</td>
<td>Dynamic Random Access Memory</td>
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<td>DRM</td>
<td>Digital Rights Management</td>
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<td>DSL</td>
<td>Digital Subscriber Line</td>
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<td>Digital Versatile Disc</td>
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<tr>
<td>DVD-RAM</td>
<td>Digital Versatile Disc-Random Access Memory</td>
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<tr>
<td>DVD-ROM</td>
<td>Digital Versatile Disc-Read Only Memory</td>
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<tr>
<td>DVD-R</td>
<td>Digital Versatile Disc-Recordable</td>
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<tr>
<td>DVD-RW</td>
<td>Digital Versatile Disc-Rewritable</td>
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<tr>
<td>ACRONYM</td>
<td>SPELLED OUT</td>
</tr>
<tr>
<td>---------</td>
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<tr>
<td>DVI</td>
<td>Digital Visual Interface</td>
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<tr>
<td>DVI-D</td>
<td>Digital Visual Interface–Digital</td>
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<tr>
<td>ECC</td>
<td>Error Correcting Code</td>
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<tr>
<td>ECP</td>
<td>Extended Capabilities Port</td>
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<tr>
<td>EEPROM</td>
<td>Electrically Erasable Programmable Read-Only Memory</td>
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<tr>
<td>EFS</td>
<td>Encrypting File System</td>
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<tr>
<td>EIDE</td>
<td>Enhanced Integrated Drive Electronics</td>
</tr>
<tr>
<td>EMI</td>
<td>Electromagnetic Interference</td>
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<tr>
<td>EMP</td>
<td>Electromagnetic Pulse</td>
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<tr>
<td>EPROM</td>
<td>Erasable Programmable Read-Only Memory</td>
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<tr>
<td>EPP</td>
<td>Enhanced Parallel Port</td>
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<tr>
<td>ERD</td>
<td>Emergency Repair Disk</td>
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<tr>
<td>eSATA</td>
<td>External Serial Advanced Technology Attachment</td>
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<tr>
<td>ESD</td>
<td>Electrostatic Discharge</td>
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<tr>
<td>EULA</td>
<td>End User License Agreement</td>
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<td>EVGA</td>
<td>Extended Video Graphics Adapter/Array</td>
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<tr>
<td>Ext2</td>
<td>Second Extended File System</td>
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<tr>
<td>exFAT</td>
<td>Extended File Allocation Table</td>
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<td>FAT</td>
<td>File Allocation Table</td>
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<td>FAT12</td>
<td>12-bit File Allocation Table</td>
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<td>FAT16</td>
<td>16-bit File Allocation Table</td>
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<tr>
<td>FAT32</td>
<td>32-bit File Allocation Table</td>
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<td>FDD</td>
<td>Floppy Disk Drive</td>
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<td>FPM</td>
<td>Fast Page Mode</td>
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<td>FSB</td>
<td>Front-Side Bus</td>
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<td>FTP</td>
<td>File Transfer Protocol</td>
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<tr>
<td>FQDN</td>
<td>Fully Qualified Domain Name</td>
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<td>GDDR</td>
<td>Graphics Double Data Rate</td>
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<td>GDI</td>
<td>Graphics Device Interface</td>
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<tr>
<td>GUI</td>
<td>Graphical User Interface</td>
</tr>
<tr>
<td>GUID</td>
<td>Globally Unique Identifier</td>
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<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>GPT</td>
<td>GUID Partition Table</td>
</tr>
<tr>
<td>GPU</td>
<td>Graphics Processing Unit</td>
</tr>
<tr>
<td>GSM</td>
<td>Global System for Mobile Communications</td>
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<tr>
<td>HAL</td>
<td>Hardware Abstraction Layer</td>
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<tr>
<td>HAV</td>
<td>Hardware Assisted Virtualization</td>
</tr>
<tr>
<td>HCL</td>
<td>Hardware Compatibility List</td>
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<td>HDCP</td>
<td>High-Bandwidth Digital Content Protection</td>
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<td>HDD</td>
<td>Hard Disk Drive</td>
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<tr>
<td>HDMI</td>
<td>High Definition Media Interface</td>
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<td>HIPS</td>
<td>Host Intrusion Prevention System</td>
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<tr>
<td>HPFS</td>
<td>High Performance File System</td>
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<tr>
<td>HTML</td>
<td>Hypertext Markup Language</td>
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<tr>
<td>HTPC</td>
<td>Home Theater PC</td>
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<tr>
<td>HTTP</td>
<td>Hypertext Transfer Protocol</td>
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<td>HTTPS</td>
<td>Hypertext Transfer Protocol Secure</td>
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<tr>
<td>I/O</td>
<td>Input/Output</td>
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<tr>
<td>IaaS</td>
<td>Infrastructure as a Service</td>
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<tr>
<td>ICMP</td>
<td>Internet Control Message Protocol</td>
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<tr>
<td>ICR</td>
<td>Intelligent Character Recognition</td>
</tr>
<tr>
<td>IDE</td>
<td>Integrated Drive Electronics</td>
</tr>
<tr>
<td>IDS</td>
<td>Intrusion Detection System</td>
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<tr>
<td>IEEE</td>
<td>Institute of Electrical and Electronics Engineers</td>
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<tr>
<td>IIS</td>
<td>Internet Information Services</td>
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<tr>
<td>IMAP</td>
<td>Internet Mail Access Protocol</td>
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<tr>
<td>IMEI</td>
<td>International Mobile Equipment Identity</td>
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<tr>
<td>IMSI</td>
<td>International Mobile Subscriber Identity</td>
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<tr>
<td>IP</td>
<td>Internet Protocol</td>
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<tr>
<td>IPConfig</td>
<td>Internet Protocol Configuration</td>
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<td>IPP</td>
<td>Internet Printing Protocol</td>
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<tr>
<td>IPS</td>
<td>Intrusion Prevention System</td>
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<td>IPsec</td>
<td>Internet Protocol Security</td>
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<tr>
<td>IR</td>
<td>Infrared</td>
</tr>
<tr>
<td>IrDA</td>
<td>Infrared Data Association</td>
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<tr>
<td>IRP</td>
<td>Incident Response Plan</td>
</tr>
<tr>
<td>IRQ</td>
<td>Interrupt Request</td>
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<tr>
<td>ISA</td>
<td>Industry Standard Architecture</td>
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<tr>
<td>ISDN</td>
<td>Integrated Services Digital Network</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization</td>
</tr>
<tr>
<td>ISP</td>
<td>Internet Service Provider</td>
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<tr>
<td>JBOD</td>
<td>Just a Bunch of Disks</td>
</tr>
<tr>
<td>KB</td>
<td>Knowledge Base</td>
</tr>
<tr>
<td>KVM</td>
<td>Kernel-based Virtual Machine</td>
</tr>
<tr>
<td>KVM</td>
<td>Keyboard-Video-Mouse</td>
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<tr>
<td>LAN</td>
<td>Local Area Network</td>
</tr>
<tr>
<td>LBA</td>
<td>Logical Block Addressing</td>
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<tr>
<td>LC</td>
<td>Lucent Connector</td>
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<td>LCD</td>
<td>Liquid Crystal Display</td>
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<tr>
<td>LDAP</td>
<td>Lightweight Directory Access Protocol</td>
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<tr>
<td>LED</td>
<td>Light Emitting Diode</td>
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<tr>
<td>LPD/LPR</td>
<td>Line Printer Daemon/Line Printer Remote</td>
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<td>LPT</td>
<td>Line Printer Terminal</td>
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<tr>
<td>LVD</td>
<td>Low Voltage Differential</td>
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<tr>
<td>MAC</td>
<td>Media Access Control/Mandatory Access Control</td>
</tr>
<tr>
<td>MAN</td>
<td>Metropolitan Area Network</td>
</tr>
<tr>
<td>MAPI</td>
<td>Messaging Application Programming Interface</td>
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<tr>
<td>mATX</td>
<td>Micro Advanced Technology Extended</td>
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<tr>
<td>MAU</td>
<td>Media Access Unit/Media Attachment Unit</td>
</tr>
<tr>
<td>MBR</td>
<td>Master Boot Record</td>
</tr>
<tr>
<td>MBSA</td>
<td>Microsoft Baseline Security Analyzer</td>
</tr>
</tbody>
</table>
ACRONYM | SPELLED OUT
------- | ---------------------
MDM | Mobile Device Management
MFA | Multifactor Authentication
MFD | Multifunction Device
MFP | Multifunction Product
MicroDIMM | Micro Dual Inline Memory Module
MIDI | Musical Instrument Digital Interface
MIME | Multipurpose Internet Mail Extension
MIMO | Multiple Input Multiple Output
MMC | Microsoft Management Console
MP3 | Moving Picture Experts Group Layer 3 Audio
MP4 | Moving Picture Experts Group Layer 4
MPEG | Moving Picture Experts Group
MSConfig | Microsoft Configuration
MSDS | Material Safety Data Sheet
MT-RJ | Mechanical Transfer Registered Jack
MUI | Multilingual User Interface
NaaS | Network as a Service
NAC | Network Access Control
NAS | Network-Attached Storage
NAT | Network Address Translation
NetBIOS | Networked Basic Input/Output System
NetBEUI | Networked Basic Input/Output System Extended User Interface
NFC | Near Field Communication
NFS | Network File System
NIC | Network Interface Card
NiCd | Nickel Cadmium
NiMH | Nickel Metal Hydride
NLX | New Low-profile Extended
NNTP | Network News Transfer Protocol
NTFS | New Technology File System
NTLDR | New Technology Loader
NTP | Network Time Protocol
NTSC | National Transmission Standards Committee
NVMe | Non-volatile Memory Express
OCR | Optical Character Recognition
OEM | Original Equipment Manufacturer
OLED | Organic Light Emitting Diode
OS | Operating System
PaaS | Platform as a Service
PAL | Phase Alternating Line
PAN | Personal Area Network
PAT | Port Address Translation
PC | Personal Computer
PCI | Peripheral Component Interconnect
PCI | Payment Card Industry
PCle | Peripheral Component Interconnect Express
PCIX | Peripheral Component Interconnect Extended
PCL | Printer Control Language
PCMCIA | Personal Computer Memory
Card International Association
PE | Preinstallation Environment
PGA | Pin Grid Array
PGA2 | Pin Grid Array 2
PGP | Pretty Good Protection
PI | Personally Identifiable Information
PIN | Personal Identification Number
PHI | Personal Health Information
PKI | Public Key Infrastructure
PnP | Plug and Play
PoE | Power over Ethernet
POP3 | Post Office Protocol 3
PoS | Point of Sale
POST | Power-On Self-Test
POTS | Plain Old Telephone Service
PPM | Pages Per Minute
PPP | Point-to-Point Protocol
PPTP | Point-to-Point Tunneling Protocol
PRI | Primary Rate Interface
PROM | Programmable Read-Only Memory
PS/2 | Personal System/2 connector
PSTN | Public Switched Telephone Network
PSU | Power Supply Unit
PVA | Patterned Vertical Alignment
PVC | Permanent Virtual Circuit
PXE | Preboot Execution Environment
QoS | Quality of Service
RADIUS | Remote Authentication Dial-In User Server
RAID | Redundant Array of Independent (or Inexpensive) Disks
RAM | Random Access Memory
RAS | Remote Access Service
RDP | Remote Desktop Protocol
RF | Radio Frequency
RFI | Radio Frequency Interference
RFID | Radio Frequency Identification
RGB | Red Green Blue
RIP | Routing Information Protocol
RIS | Remote Installation Service
RISC | Reduced Instruction Set Computer
RJ-11 | Registered Jack Function 11
RJ-45 | Registered Jack Function 45

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<table>
<thead>
<tr>
<th>ACRONYM</th>
<th>SPELLED OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>RMA</td>
<td>Returned Materials Authorization</td>
</tr>
<tr>
<td>ROM</td>
<td>Read-Only Memory</td>
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<tr>
<td>RPO</td>
<td>Recovery Point Objective</td>
</tr>
<tr>
<td>RTC</td>
<td>Real-Time Clock</td>
</tr>
<tr>
<td>RT</td>
<td>Recovery Time Objective</td>
</tr>
<tr>
<td>Saas</td>
<td>Software as a Service</td>
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<td>SAN</td>
<td>Storage Area Network</td>
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<tr>
<td>SAS</td>
<td>Serial Attached SCSI</td>
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<td>SATA</td>
<td>Serial Advanced Technology Attachment</td>
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<td>SC</td>
<td>Subscription Channel</td>
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<td>Secure Copy Protection</td>
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<td>SCSI</td>
<td>Small Computer System Interface</td>
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<td>SCSI ID</td>
<td>Small Computer System Interface Identifier</td>
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<td>Secure Digital Card</td>
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<td>Single Edge Connector</td>
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<td>SFC</td>
<td>System File Checker</td>
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<tr>
<td>SFF</td>
<td>Small Form Factor</td>
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<td>Secure File Transfer Protocol</td>
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<td>SIM</td>
<td>Subscriber Identity Module</td>
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<td>SIMM</td>
<td>Single In-Line Memory Module</td>
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<tr>
<td>SLI</td>
<td>Scalable Link Interface or System Level</td>
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<td>S.M.A.R.T.</td>
<td>Self-Monitoring, Analysis, and Reporting Technology</td>
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<td>Server Message Block</td>
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<td>SMTP</td>
<td>Simple Mail Transfer Protocol</td>
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<td>SNMP</td>
<td>Simple Network Management Protocol</td>
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<td>SoDIMM</td>
<td>Small Outline Dual Inline Memory Module</td>
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<td>SOHO</td>
<td>Small Office/Home Office</td>
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<td>SP</td>
<td>Service Pack</td>
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<td>SPDIF</td>
<td>Sony-Philips Digital Interface Format</td>
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<td>Staggered Pin Grid Array</td>
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<td>SRAM</td>
<td>Static Random Access Memory</td>
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<td>SSD</td>
<td>Solid State Drive</td>
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<td>Secure Shell</td>
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<td>Service Set Identifier</td>
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<td>SSL</td>
<td>Secure Sockets Layer</td>
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<td>SSO</td>
<td>Single Sign-on</td>
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<td>ST</td>
<td>Straight Tip</td>
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<td>STP</td>
<td>Shielded Twisted Pair</td>
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<td>SXGA</td>
<td>Super Extended Graphics Array</td>
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<td>TACACS</td>
<td>Terminal Access Controller Access-Control System</td>
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<td>TCP</td>
<td>Transmission Control Protocol</td>
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<td>TCP/IP</td>
<td>Transmission Control Protocol/Internet Protocol</td>
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<tr>
<td>TDR</td>
<td>Time Domain Reflectometer</td>
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<td>TFTP</td>
<td>Trivial File Transfer Protocol</td>
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<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>TN</td>
<td>Twisted Nematic</td>
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<td>TPM</td>
<td>Trusted Platform Module</td>
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<tr>
<td>UAC</td>
<td>User Account Control</td>
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<tr>
<td>UDF</td>
<td>User Defined Functions or Universal Disk Format or Universal Data Format</td>
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<td>UDP</td>
<td>User Datagram Protocol</td>
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<tr>
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<td>Unified Extensible Firmware Interface</td>
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<tr>
<td>UNC</td>
<td>Universal Naming Convention</td>
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<td>UPnP</td>
<td>Universal Plug and Play</td>
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<td>UPS</td>
<td>Uninterruptible Power Supply</td>
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<tr>
<td>URL</td>
<td>Uniform Resource Locator</td>
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<td>USB</td>
<td>Universal Serial Bus</td>
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<td>User State Migration Tool</td>
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<td>Unified Threat Management</td>
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<td>Unshielded Twisted Pair</td>
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<td>Ultra Extended Graphics Array</td>
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<td>Vertical Alignment</td>
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<td>VDC</td>
<td>Volts DC</td>
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<td>Virtual Desktop Infrastructure</td>
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<td>VESA</td>
<td>Video Electronics Standards Association</td>
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<td>VFAT</td>
<td>Virtual File Allocation Table</td>
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<td>Video Graphics Array</td>
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<td>Virtual LAN</td>
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<td>Virtual Machine</td>
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<td>Virtual Network Computer</td>
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<td>Voice over Internet Protocol</td>
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<td>Virtual Private Network</td>
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<td>Video Random Access Memory</td>
</tr>
<tr>
<td>WAN</td>
<td>Wide Area Network</td>
</tr>
<tr>
<td>WAP</td>
<td>Wireless Access Memory/Wireless Access Point</td>
</tr>
<tr>
<td>WEP</td>
<td>Wired Equivalent Privacy</td>
</tr>
<tr>
<td>WiFi</td>
<td>Wireless Fidelity</td>
</tr>
<tr>
<td>WINS</td>
<td>Windows Internet Name Service</td>
</tr>
<tr>
<td>WLAN</td>
<td>Wireless Local Area Network</td>
</tr>
<tr>
<td>WMN</td>
<td>Wireless Mesh Network</td>
</tr>
<tr>
<td>WPA</td>
<td>Wireless Protected Access</td>
</tr>
<tr>
<td>WPA2</td>
<td>WiFi Protected Access 2</td>
</tr>
<tr>
<td>WPS</td>
<td>WiFi Protected Setup</td>
</tr>
<tr>
<td>WUXGA</td>
<td>Wide Ultra Extended Graphics Array</td>
</tr>
<tr>
<td>WWAN</td>
<td>Wireless Wide Area Network</td>
</tr>
<tr>
<td>XGA</td>
<td>Extended Graphics Array</td>
</tr>
<tr>
<td>ZIF</td>
<td>Zero-Insertion-Force</td>
</tr>
<tr>
<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
- CPUs
- Assorted connectors/cables
  - USB
  - HDMI
  - Etc.
- Adapters
- Network cables
- Unterminated network cables/connectors
- AC adapters
- Optical drives
- Screws/stand-offs
- Cases
- Maintenance kit
- Mice/keyboards
- KVM
- Console cable

**SOFTWARE**
- Operating systems
  - Linux
  - Chrome OS
  - Microsoft Windows
  - Mac OS
  - Android
  - iOS
- PE Disk/Live CD
- Anti-virus 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
CompTIA A+ Certification Exam: Core 2 Objectives

EXAM NUMBER: CORE 2 (220-1002)
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.

CompTIA AUTHORIZED MATERIALS USE POLICY

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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
- gpretupdate
- 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
  - Dxdiag
  - 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 settings**
  - Remote Desktop Connection
  - Remote Assistance
- **Remote and Public network settings**
  - 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
  - Spot Light
  - 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.

- Mantrap
- 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
- 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
- Botnet
- Worm
- Spyware
- Tools and methods
  - Antivirus
  - Anti-malware
- 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
- Man-in-the-middle
- 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
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

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

- 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

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
  - Black screens
  - Printing issues
  - Services fail to start
- Common solutions
  - Slow bootup
  - Slow profile load
  - Defragment the hard drive
  - Reboot
  - Kill tasks
  - Restart services
  - Update network settings
  - Reimage/reload OS
  - Roll back updates
  - 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
  - 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.
Given a scenario, troubleshoot mobile OS and application issues.

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

### 3.5 Common symptoms
- Signal drop/weak signal
- Power drain
- Slow data speeds
- Unintended WiFi connection
- Unintended Bluetooth pairing
- Leaked personal files/data
- Data transmission over limit
- Unauthorized account access
- Unauthorized location tracking
- Unauthorized camera/microphone activation
- High resource utilization
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
  - Weight limitations
  - Electrical fire safety
  - Cable management
  - Safety goggles
  - Air filter mask
  - Compliance with government regulations

CompTIA A+ Certification Exam: Core 2 Objectives Version 3.0 (Exam Number: Core 2)
4.5 Explain environmental impacts and appropriate controls.

- MSDS documentation for handling and disposal
- Temperature, humidity level awareness, and proper ventilation
- Power surges, brownouts, and blackouts
  - 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.
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

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>
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<tr>
<td>APIPA</td>
<td>Automatic Private Internet Protocol Addressing</td>
<td>DaaS</td>
<td>Data as a Service</td>
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<td>APM</td>
<td>Advanced Power Management</td>
<td>DAC</td>
<td>Discretionary Access Control</td>
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<td>ARP</td>
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<td>Digital Light Processing or Data Loss Prevention</td>
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<td>Bring Your Own Device</td>
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<td>Just a Bunch of Disks</td>
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<td>Virtual Machine</td>
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<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>WINNS</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>WXGA</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

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