Introduction
In order to receive CompTIA A+ certification a candidate must pass two exams. The first exam is CompTIA A+ 220-901 Certification Exam. The CompTIA A+ 220-901 examination measures necessary competencies for an entry-level IT professional with the equivalent knowledge of at least 12 months of hands-on experience in the lab or field.

Successful candidates will have the knowledge required to:
- Assemble components based on customer requirements
- Install, configure and maintain devices, PCs 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 virtualization, desktop imaging, and deployment

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. The following CompTIA A+ 220-901 exam objectives result from subject matter expert workshops and industry-wide survey results regarding the skills and knowledge required of an entry-level IT professional. The percentages in this document represent the relative importance of the subject areas (domains) in the associated body of knowledge, and together establish the foundation of an entry-level IT professional.

This examination blueprint includes domain weighting, test objectives, and example content. Example topics and concepts are included to clarify the test objectives and should not be construed as a comprehensive listing of all the content of this examination.

Candidates are encouraged to use this document to guide their studies. The table below lists the domains measured by this examination and the extent to which they are represented. The CompTIA A+ 220-901 exam is based on these objectives.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Percentage of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Hardware</td>
<td>34%</td>
</tr>
<tr>
<td>2.0 Networking</td>
<td>21%</td>
</tr>
<tr>
<td>3.0 Mobile Devices</td>
<td>17%</td>
</tr>
<tr>
<td>4.0 Hardware &amp; Network Troubleshooting</td>
<td>28%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
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</table>

CompTIA A+ 220-901 Certification Exam Objectives version1

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Or verify against this list: http://certification.comptia.org/Training/testingcenters/policies/unauthorized.aspx

**Note: The lists of examples provided in bulleted format below each objective are not exhaustive lists. Other examples of technologies, processes or tasks pertaining to each objective may also be included on the exam although not listed or covered in this objectives document.

CompTIA is constantly reviewing the content of our exams and updating test questions to be sure our exams are current and the security of the questions is protected. When necessary, we will publish updated exams based on existing exam objectives. Please know that all related exam preparation materials will still be valid.

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1.0 Hardware

1.1 Given a scenario, configure settings and use BIOS/UEFI tools on a PC.
   - Firmware upgrades – flash BIOS
   - BIOS component information
     - RAM
     - Hard drive
     - Optical drive
     - CPU
   - BIOS configurations
     - Boot sequence
     - Enabling and disabling devices
     - Date/time
     - Clock speeds
     - Virtualization support
     - BIOS security (passwords, drive encryption: TPM, lo-jack, secure boot)
   - Built-in diagnostics
   - Monitoring
     - Temperature monitoring
     - Fan speeds
     - Intrusion detection/notification
     - Voltage
     - Clock
     - Bus speed

1.2 Explain the importance of motherboard components, their purpose, and properties.
   - Sizes
     - ATX
     - Micro-ATX
     - Mini-ITX
     - ITX
   - Expansion slots
     - PCI
     - PCI-X
     - PCIe
     - miniPCI
   - RAM slots
   - CPU sockets
   - Chipsets
     - North Bridge
     - South Bridge
   - CMOS battery
   - Power connections and types
   - Fan connectors
   - Front/Top panel connectors
     - USB
     - Audio
     - Power button
     - Power light
1.3 Compare and contrast various RAM types and their features.
- Types
  - DDR
  - DDR2
  - DDR3
  - SODIMM
  - DIMM
  - Parity vs. non-parity
  - ECC vs. non-ECC
  - RAM configurations
    - Single channel vs. dual channel vs. triple channel
  - Single sided vs. double sided
  - Buffered vs. unbuffered
- RAM compatibility

1.4 Install and configure PC expansion cards.
- Sound cards
- Video cards
- Network cards
- USB cards
- Firewire cards
- Thunderbolt cards
- Storage cards
- Modem cards
- Wireless/cellular cards
- TV tuner cards
- Video capture cards
- Riser cards

1.5 Install and configure storage devices and use appropriate media.
- Optical drives
  - CD-ROM / CD-RW
  - DVD-ROM / DVD-RW / DVD-RW DL
  - Blu-Ray
  - BD-R
  - BD-RE
- Magnetic hard disk drives
  - 5400 rpm
  - 7200 rpm
  - 10,000 rpm
- Hot swappable drives
- Solid state/flash drives
  - Compact flash
  - SD
  - Micro-SD
  - Mini-SD
  - Xd
  - SSD
  - Hybrid
CompTIA A+ 220-901 Certification Exam Objectives version1

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o RF
o IR
o NFC

• Characteristics
  o Analog
  o Digital
  o Distance limitations
  o Data transfer speeds
  o Quality
  o DRM
  o Frequencies

1.8 Install a power supply based on given specifications.
  • Connector types and their voltages
    o SATA
    o Molex
    o 4/8-pin 12v
    o PCIe 6/8-pin
    o 20-pin
    o 24-pin
  • Specifications
    o Wattage
    o Dual rail
    o Size
    o Number of connectors
    o ATX
    o Micro-ATX
    o Dual voltage options

1.9 Given a scenario, select the appropriate components for a custom PC configuration, to meet customer specifications or needs.
  • Graphic / CAD / CAM design workstation
    o Multicore processor
    o High-end video
    o Maximum RAM
  • Audio/Video editing workstation
    o Specialized audio and video card
    o Large fast hard drive
    o Dual monitors
  • Virtualization workstation
    o Maximum RAM and CPU cores
  • Gaming PC
    o Multicore processor
    o High-end video/specialized GPU
    o High definition sound card
    o High-end cooling
  • Home Theater PC
    o Surround sound audio
    o HDMI output
    o HTPC compact form factor
    o TV tuner
  • Standard thick client
    o Desktop applications
    o Meets recommended requirements for selected OS
  • Thin client

CompTIA A+ 220-901 Certification Exam Objectives version1

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Basic applications
- Meets minimum requirements for selected OS
- Network connectivity

Home Server PC
- Media streaming
- File sharing
- Print sharing
- Gigabit NIC
- RAID array

1.10 Compare and contrast types of display devices and their features.
- Types
  - LCD
    - TN vs. IPS
    - Fluorescent vs. LED backlighting
  - Plasma
  - Projector
  - OLED
- Refresh / frame rates
- Resolution
- Native resolution
- Brightness/lumens
- Analog vs. digital
- Privacy/antiglare filters
- Multiple displays
- Aspect ratios
  - 16:9
  - 16:10
  - 4:3

1.11 Identify common PC connector types and associated cables.
- Display connector types
  - DVI-D
  - DVI-I
  - DVI-A
  - DisplayPort
  - RCA
  - HD15 (i.e. DE15 or DB15)
  - BNC
  - miniHDMI
  - miniDin-6
- Display cable types
  - HDMI
  - DVI
  - VGA
  - Component
  - Composite
  - Coaxial
- Device cables and connectors
  - SATA
  - eSATA
  - USB
  - Firewire (IEEE1394)
  - PS/2
1.12 Install and configure common peripheral devices.

- Input devices
  - Mouse
  - Keyboard
  - Scanner
  - Barcode reader
  - Biometric devices
  - Game pads
  - Joysticks
  - Digitizer
  - Motion sensor
  - Touch pads
  - Smart card readers
  - Digital cameras
  - Microphone
  - Webcam
  - Camcorder
  - MIDI enabled devices

- Output devices
  - Printers
  - Speakers
  - Display devices

- Input & Output devices
  - Touch screen
  - KVM
  - Smart TV
  - Set-Top Box

1.13 Install SOHO multifunction device / printers and configure appropriate 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. adhoc
  - Integrated print server (hardware)
1.14 Compare and contrast differences between the various print technologies and the associated imaging process.

- 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
- Inkjet
  - Ink cartridge, print head, roller, feeder, duplexing assembly, carriage and belt
  - Calibration
- Thermal
  - Feed assembly, heating element
  - Special thermal paper
- Impact
  - Print head, ribbon, tractor feed
  - Impact paper
- Virtual
  - Print to file
  - Print to PDF
  - Print to XPS
  - Print to image

1.15 Given a scenario, perform appropriate printer maintenance.

- Laser
  - Replacing toner, applying maintenance kit, calibration, cleaning
- Thermal
  - Replace paper, clean heating element, remove debris
- Impact
  - Replace ribbon, replace print head, replace paper
- Inkjet
  - Clean heads, replace cartridges, calibration, clear jams

2.0 Networking

2.1 Identify the various types of network cables and connectors.

- Fiber
  - Connectors: SC, ST and LC
- Twisted Pair
  - Connectors: RJ-11, RJ-45
  - Wiring standards: T568A, T568B
- Coaxial
  - Connectors: BNC, F-connector

2.2 Compare and contrast the characteristics of connectors and cabling.

- Fiber
2.3 **Explain the properties and characteristics of TCP/IP.**
- IPv4 vs. IPv6
- Public vs. private vs. APIPA/link local
- Static vs. dynamic
- Client-side DNS settings
- Client-side DHCP
- Subnet mask vs. CIDR
- Gateway

2.4 **Explain common TCP and UDP ports, protocols, and their purpose.**
- **Ports**
  - 21 – FTP
  - 22 – SSH
  - 23 – TELNET
  - 25 – SMTP
  - 53 – DNS
  - 80 – HTTP
  - 110 – POP3
  - 143 – IMAP
  - 443 – HTTPS
  - 3389 – RDP
  - 137-139, 445 – SMB
  - 548 or 427 – AFP
- **Protocols**
  - DHCP
  - DNS
  - LDAP
  - SNMP
  - SMB
  - CIFS
  - SSH
  - AFP
- TCP vs. UDP

2.5 **Compare and contrast various WiFi networking standards and encryption types.**
- **Standards**
  - 802.11 a/b/g/n/ac
  - Speeds, distances and frequencies
- **Encryption types**
  - WEP, WPA, WPA2, TKIP, AES

2.6 **Given a scenario, install and configure SOHO wireless/wired router and apply appropriate settings.**
- **Channels**
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

2.8 Compare and contrast network architecture devices, their functions, and features.

- Hub
- Switch
- Router
- Access point
- Bridge
- Modem
- Firewall
- Patch panel
- Repeaters/extenders
- Ethernet over Power
- Power over Ethernet injector

2.9 Given a scenario, use appropriate networking tools.

- Crimper
- Cable stripper
- Multimeter
- Tone generator & probe
- Cable tester
- Loopback plug
- Punchdown tool
- WiFi analyzer

3.0 Mobile Devices

3.1 Install and configure laptop hardware and components.

- Expansion options
3.2 Explain the function of components within the display of a laptop.

- Types
  - LCD
    - TTL vs. IPS
    - Fluorescent vs. LED backlighting
  - OLED
- Wi-Fi antenna connector/placement
- Webcam
- Microphone
- Inverter
- Digitizer

3.3 Given a scenario, use appropriate laptop features.

- Special function keys
  - Dual displays
  - Wireless (on/off)
  - Cellular (on/off)
  - Volume settings
  - Screen brightness
  - Bluetooth (on/off)
  - Keyboard backlight
  - Touch pad (on/off)
  - Screen orientation
  - Media options (fast forward/rewind)
  - GPS (on/off)
3.4 Explain the characteristics of various types of other mobile devices.
   - Tablets
   - Smart phones
   - Wearable technology devices
     - Smart watches
     - Fitness monitors
     - Glasses and headsets
   - Phablets
   - e-Readers
   - Smart camera
   - GPS

3.5 Compare and contrast accessories & ports of other mobile devices.
   - Connection types
     - NFC
     - Proprietary vendor specific ports (communication/power)
     - microUSB/miniUSB
     - Lightning
     - Bluetooth
     - IR
     - Hotspot / tethering
   - Accessories
     - Headsets
     - Speakers
     - Game pads
     - Docking stations
     - Extra battery packs/battery chargers
     - Protective covers / water proofing
     - Credit card readers
     - Memory/MicroSD

4.0 Hardware and Network Troubleshooting

4.1 Given a scenario, troubleshoot common problems related to motherboards, RAM, CPU and power with appropriate tools.
   - Common symptoms
     - Unexpected shutdowns
     - System lockups
     - POST code beeps
     - Blank screen on bootup
     - BIOS time and settings 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

**Tools**
- Multimeter
- Power supply tester
- Loopback plugs
- POST card / USB

4.2 **Given a scenario, troubleshoot hard drives and RAID arrays with appropriate tools.**

- **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

- **Tools**
  - Screwdriver
  - External enclosures
  - CHKDSK
  - FORMAT
  - File recovery software
  - Bootrec
  - Diskpart
  - Defragmentation tool

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

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

4.4 **Given a scenario, troubleshoot wired and wireless networks with appropriate tools.**

- **Common symptoms**
  - No connectivity
  - APIPA/link local address
  - Limited connectivity
  - Local connectivity
  - Intermittent connectivity
  - IP conflict
○ Slow transfer speeds
○ Low RF signal
○ SSID not found

• Hardware tools
  ○ Cable tester
  ○ Loopback plug
  ○ Punch down tools
  ○ Tone generator and probe
  ○ Wire strippers
  ○ Crimper
  ○ Wireless locator

• Command line tools
  ○ PING
  ○ IPCONFIG/IFCONFIG
  ○ TRACERT
  ○ NETSTAT
  ○ NBTSTAT
  ○ NET
  ○ NETDOM
  ○ NSLOOKUP

4.5 Given a scenario, troubleshoot and repair 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 re-assembly
    ○ Document and label cable and screw locations
    ○ Organize parts
    ○ Refer to manufacturer resources
    ○ Use appropriate hand tools

4.6 Given a scenario, troubleshoot printers with appropriate tools

  • Common symptoms
    ○ Streaks
CompTIA A+ Acronyms

Introduction
The following is a list of acronyms which 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>Definition</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>ACT</td>
<td>activity</td>
</tr>
<tr>
<td>ADSL</td>
<td>asymmetrical digital subscriber line</td>
</tr>
<tr>
<td>AGP</td>
<td>accelerated graphics port</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>
</tr>
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<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>AV</td>
<td>Audio Video</td>
</tr>
<tr>
<td>BIOS</td>
<td>basic input/output system</td>
</tr>
<tr>
<td>BNC</td>
<td>Bayonet-Neill-Concelman or British Naval Connector</td>
</tr>
<tr>
<td>BTX</td>
<td>balanced technology extended</td>
</tr>
<tr>
<td>CAPTCHA</td>
<td>Completely Automated Public Turing Test To Tell Computers and Humans Apart</td>
</tr>
<tr>
<td>CCFL</td>
<td>Cold Cathode Fluorescent Lamp</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>CIFS</td>
<td>Central File System, Common File System, Command 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>
</tr>
<tr>
<td>CRT</td>
<td>cathode-ray tube</td>
</tr>
<tr>
<td>DAC</td>
<td>discretionary access control</td>
</tr>
<tr>
<td>DB-25</td>
<td>serial communications D-shell connector, 25 pins</td>
</tr>
<tr>
<td>DB-9</td>
<td>9 pin D shell connector</td>
</tr>
<tr>
<td>DC</td>
<td>direct current</td>
</tr>
<tr>
<td>DDOS</td>
<td>distributed denial of service</td>
</tr>
<tr>
<td>DDR</td>
<td>double data-rate</td>
</tr>
<tr>
<td>DDR RAM</td>
<td>double data-rate random access memory</td>
</tr>
<tr>
<td>DDR SDRAM</td>
<td>double data-rate synchronous dynamic random access memory</td>
</tr>
<tr>
<td>DFS</td>
<td>distributed file system</td>
</tr>
<tr>
<td>DHCP</td>
<td>dynamic host configuration protocol</td>
</tr>
<tr>
<td>DIMM</td>
<td>dual inline memory module</td>
</tr>
<tr>
<td>DIN</td>
<td>Deutsche Industrie Norm</td>
</tr>
<tr>
<td>DLT</td>
<td>digital linear tape</td>
</tr>
<tr>
<td>DLP</td>
<td>digital light processing</td>
</tr>
<tr>
<td>DMA</td>
<td>direct memory access</td>
</tr>
<tr>
<td>DMZ</td>
<td>demilitarized zone</td>
</tr>
<tr>
<td>DNS</td>
<td>domain name service or domain name server</td>
</tr>
<tr>
<td>DOS</td>
<td>denial of service</td>
</tr>
<tr>
<td>DRAM</td>
<td>dynamic random access memory</td>
</tr>
<tr>
<td>DRM</td>
<td>Digital Rights Management</td>
</tr>
<tr>
<td>DSL</td>
<td>digital subscriber line</td>
</tr>
<tr>
<td>DVD</td>
<td>digital video disc or digital versatile disc</td>
</tr>
</tbody>
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<thead>
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<tr>
<td>DVD-RAM</td>
<td>digital video disc-random access memory</td>
</tr>
<tr>
<td>DVD-ROM</td>
<td>digital video disc-read only memory</td>
</tr>
<tr>
<td>DVD-R</td>
<td>digital video disc-recordable</td>
</tr>
<tr>
<td>DVD-RW</td>
<td>digital video disc-rewritable</td>
</tr>
<tr>
<td>DVI</td>
<td>digital visual interface</td>
</tr>
<tr>
<td>ECC</td>
<td>error correcting code/error checking and correction</td>
</tr>
<tr>
<td>ECP</td>
<td>extended capabilities port</td>
</tr>
<tr>
<td>EEPROM</td>
<td>electrically erasable programmable read-only memory</td>
</tr>
<tr>
<td>EFS</td>
<td>encrypting file system</td>
</tr>
<tr>
<td>EIDE</td>
<td>enhanced integrated drive electronics</td>
</tr>
<tr>
<td>EMI</td>
<td>electromagnetic interference</td>
</tr>
<tr>
<td>EMP</td>
<td>electromagnetic pulse</td>
</tr>
<tr>
<td>EPROM</td>
<td>erasable programmable read-only memory</td>
</tr>
<tr>
<td>EPP</td>
<td>enhanced parallel port</td>
</tr>
<tr>
<td>ERD</td>
<td>emergency repair disk</td>
</tr>
<tr>
<td>ESD</td>
<td>electrostatic discharge</td>
</tr>
<tr>
<td>EULA</td>
<td>End User License Agreement</td>
</tr>
<tr>
<td>EVGA</td>
<td>extended video graphics adapter/array</td>
</tr>
<tr>
<td>EVDO</td>
<td>evolution data optimized or evolution data only</td>
</tr>
<tr>
<td>FAT</td>
<td>file allocation table</td>
</tr>
<tr>
<td>FAT12</td>
<td>12-bit file allocation table</td>
</tr>
<tr>
<td>FAT16</td>
<td>16-bit file allocation table</td>
</tr>
<tr>
<td>FAT32</td>
<td>32-bit file allocation table</td>
</tr>
<tr>
<td>FDD</td>
<td>floppy disk drive</td>
</tr>
<tr>
<td>Fn</td>
<td>Function (referring to the function key on a laptop)</td>
</tr>
<tr>
<td>FPM</td>
<td>fast page-mode</td>
</tr>
<tr>
<td>FRU</td>
<td>field replaceable unit</td>
</tr>
<tr>
<td>FSB</td>
<td>Front Side Bus</td>
</tr>
<tr>
<td>FTP</td>
<td>file transfer protocol</td>
</tr>
<tr>
<td>FQDN</td>
<td>fully qualified domain name</td>
</tr>
<tr>
<td>Gb</td>
<td>gigabit</td>
</tr>
<tr>
<td>GB</td>
<td>gigabyte</td>
</tr>
<tr>
<td>GDI</td>
<td>graphics device interface</td>
</tr>
<tr>
<td>GHz</td>
<td>gigahertz</td>
</tr>
<tr>
<td>GUI</td>
<td>graphical user interface</td>
</tr>
<tr>
<td>GPS</td>
<td>global positioning system</td>
</tr>
<tr>
<td>GSM</td>
<td>global system for mobile communications</td>
</tr>
<tr>
<td>HAL</td>
<td>hardware abstraction layer</td>
</tr>
<tr>
<td>HAV</td>
<td>Hardware Assisted Virtualization</td>
</tr>
<tr>
<td>HCL</td>
<td>hardware compatibility list</td>
</tr>
<tr>
<td>HDD</td>
<td>hard disk drive</td>
</tr>
<tr>
<td>HDMI</td>
<td>high definition media interface</td>
</tr>
<tr>
<td>HPFS</td>
<td>high performance file system</td>
</tr>
<tr>
<td>HTML</td>
<td>hypertext markup language</td>
</tr>
</tbody>
</table>
HTPC  home theater PC
HTTP  hypertext transfer protocol
HTTPS hypertext transfer protocol over secure sockets layer
I/O   input/output
ICMP internet control message protocol
ICR   intelligent character recognition
IDE   integrated drive electronics
IDS   Intrusion Detection System
IEEE  Institute of Electrical and Electronics Engineers
IIS   Internet Information Services
IMAP  internet mail access protocol
IMEI  International Mobile Equipment Identity
IMSI  International Mobile Subscriber Identity
IP    internet protocol
IPCONFIG internet protocol configuration
IPP   internet printing protocol
IPS   In-plane Switching
IPSEC Internet Protocol Security
IR    Infrared
IrDA  Infrared Data Association
IRP   Incident Response Plan
IRQ   Interrupt Request
ISDN  Integrated Services Digital Network
ISO   International Organization for Standardization/Industry Standards
ISP   Internet Service Provider
JBOD Just a Bunch of Disks
Kb    Kilobit
KB    Kilobyte or Knowledge Base
LAN   Local Area Network
LBA   Logical Block Addressing
LC    Lucent Connector
LCD   liquid Crystal Display
LDAP  lightweight directory access protocol
LED   light emitting diode
Li-on lithium-ion
LPD/LPR line printer daemon / line printer remote
LPT   line printer terminal
LVD   low voltage differential
MAC   media access control / mandatory access control
MAPI messaging application programming interface
MAU   media access unit, media attachment unit
Mb    megabit
MB    megabyte
MBR   master boot record

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<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>MBSA</td>
<td>Microsoft Baseline Security Analyzer</td>
</tr>
<tr>
<td>MFD</td>
<td>multi-function device</td>
</tr>
<tr>
<td>MFP</td>
<td>multi-function product</td>
</tr>
<tr>
<td>MHz</td>
<td>megahertz</td>
</tr>
<tr>
<td>MicroDIMM</td>
<td>micro dual inline memory module</td>
</tr>
<tr>
<td>MIDI</td>
<td>musical instrument digital interface</td>
</tr>
<tr>
<td>MIME</td>
<td>multipurpose internet mail extension</td>
</tr>
<tr>
<td>MIMO</td>
<td>Multiple Input Multiple Output</td>
</tr>
<tr>
<td>MMC</td>
<td>Microsoft management console</td>
</tr>
<tr>
<td>MP3</td>
<td>Moving Picture Experts Group Layer 3 Audio</td>
</tr>
<tr>
<td>MP4</td>
<td>Moving Picture Experts Group Layer 4</td>
</tr>
<tr>
<td>MPEG</td>
<td>Moving Picture Experts Group</td>
</tr>
<tr>
<td>MSConfig</td>
<td>Microsoft configuration</td>
</tr>
<tr>
<td>MSDS</td>
<td>material safety data sheet</td>
</tr>
<tr>
<td>MUI</td>
<td>multilingual user interface</td>
</tr>
<tr>
<td>NAC</td>
<td>network access control</td>
</tr>
<tr>
<td>NAS</td>
<td>network-attached storage</td>
</tr>
<tr>
<td>NAT</td>
<td>network address translation</td>
</tr>
<tr>
<td>NetBIOS</td>
<td>networked basic input/output system</td>
</tr>
<tr>
<td>NetBEUI</td>
<td>networked basic input/output system extended user interface</td>
</tr>
<tr>
<td>NFS</td>
<td>network file system</td>
</tr>
<tr>
<td>NIC</td>
<td>network interface card</td>
</tr>
<tr>
<td>NiCd</td>
<td>nickel cadmium</td>
</tr>
<tr>
<td>NiMH</td>
<td>nickel metal hydride</td>
</tr>
<tr>
<td>NLX</td>
<td>new low-profile extended</td>
</tr>
<tr>
<td>NNTP</td>
<td>network news transfer protocol</td>
</tr>
<tr>
<td>NTFS</td>
<td>new technology file system</td>
</tr>
<tr>
<td>NTLDR</td>
<td>new technology loader</td>
</tr>
<tr>
<td>NTP</td>
<td>Network Time Protocol</td>
</tr>
<tr>
<td>OCR</td>
<td>optical character recognition</td>
</tr>
<tr>
<td>OEM</td>
<td>original equipment manufacturer</td>
</tr>
<tr>
<td>OLED</td>
<td>Organic Light Emitting Diode</td>
</tr>
<tr>
<td>OS</td>
<td>operating system</td>
</tr>
<tr>
<td>PAN</td>
<td>personal area network</td>
</tr>
<tr>
<td>PATA</td>
<td>parallel advanced technology attachment</td>
</tr>
<tr>
<td>PC</td>
<td>personal computer</td>
</tr>
<tr>
<td>PCI</td>
<td>peripheral component interconnect</td>
</tr>
<tr>
<td>PCIe</td>
<td>peripheral component interconnect express</td>
</tr>
<tr>
<td>PCIX</td>
<td>peripheral component interconnect extended</td>
</tr>
<tr>
<td>PCL</td>
<td>printer control language</td>
</tr>
<tr>
<td>PCMCIA</td>
<td>Personal Computer Memory Card International Association</td>
</tr>
<tr>
<td>PE</td>
<td>Preinstallation Environment</td>
</tr>
<tr>
<td>PGA</td>
<td>pin grid array</td>
</tr>
<tr>
<td>PGA2</td>
<td>pin grid array 2</td>
</tr>
</tbody>
</table>

CompTIA A+ 220-901 Certification Exam Objectives version 1

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PII  Personally Identifiable Information
PIN  personal identification number
PKI  public key infrastructure
PnP  plug and play
POP3 post office protocol 3
PoS  Point of Sale
POST power-on self test
POTS plain old telephone service
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
PVC  permanent virtual circuit
PXE  preboot execution environment
QoS  quality of service
RAID redundant array of independent (or inexpensive) discs
RAM  random access memory
RAS  remote access service
RDP  Remote Desktop Protocol
RF   radio frequency
RFI  radio frequency interference
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
RMA  returned materials authorization
ROM  read only memory
RTC  real-time clock
SAN  storage area network
SAS  Serial Attached SCSI
SATA serial advanced technology attachment
SC   subscription channel
SCP  secure copy protection
SCSI small computer system interface
SCSI ID small computer system interface identifier
SD card secure digital card
SDRAM synchronous dynamic random access memory
SEC  single edge connector
SFC  system file checker
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>SFF</td>
<td>Small Form Factor</td>
</tr>
<tr>
<td>SLI</td>
<td>scalable link interface or system level integration or scanline interleave mode</td>
</tr>
<tr>
<td>S.M.A.R.T.</td>
<td>self-monitoring, analysis, and reporting technology</td>
</tr>
<tr>
<td>SMB</td>
<td>server message block or small to midsize business</td>
</tr>
<tr>
<td>SMTP</td>
<td>simple mail transfer protocol</td>
</tr>
<tr>
<td>SNMP</td>
<td>simple network management protocol</td>
</tr>
<tr>
<td>SoDIMM</td>
<td>small outline dual inline memory module</td>
</tr>
<tr>
<td>SOHO</td>
<td>small office/home office</td>
</tr>
<tr>
<td>SP</td>
<td>service pack</td>
</tr>
<tr>
<td>SPDIF</td>
<td>Sony-Philips digital interface format</td>
</tr>
<tr>
<td>SPGA</td>
<td>staggered pin grid array</td>
</tr>
<tr>
<td>SRAM</td>
<td>static random access memory</td>
</tr>
<tr>
<td>SSH</td>
<td>secure shell</td>
</tr>
<tr>
<td>SSID</td>
<td>service set identifier</td>
</tr>
<tr>
<td>SSL</td>
<td>secure sockets layer</td>
</tr>
<tr>
<td>ST</td>
<td>straight tip</td>
</tr>
<tr>
<td>STP</td>
<td>shielded twisted pair</td>
</tr>
<tr>
<td>SXGA</td>
<td>super extended graphics array</td>
</tr>
<tr>
<td>TB</td>
<td>terabyte</td>
</tr>
<tr>
<td>TCP</td>
<td>transmission control protocol</td>
</tr>
<tr>
<td>TCP/IP</td>
<td>transmission control protocol/internet protocol</td>
</tr>
<tr>
<td>TDR</td>
<td>time domain reflectometer</td>
</tr>
<tr>
<td>TFTP</td>
<td>trivial file transfer protocol</td>
</tr>
<tr>
<td>TKIP</td>
<td>Temporal Key Integrity Protocol</td>
</tr>
<tr>
<td>TPM</td>
<td>trusted platform module</td>
</tr>
<tr>
<td>UAC</td>
<td>user account control</td>
</tr>
<tr>
<td>UDF</td>
<td>user defined functions or universal disk format or universal data format</td>
</tr>
<tr>
<td>UDP</td>
<td>user datagram protocol</td>
</tr>
<tr>
<td>UEFI</td>
<td>Unified Extensible Firmware Interface</td>
</tr>
<tr>
<td>UNC</td>
<td>universal naming convention</td>
</tr>
<tr>
<td>UPS</td>
<td>uninterruptible power supply</td>
</tr>
<tr>
<td>URL</td>
<td>uniform resource locator</td>
</tr>
<tr>
<td>USB</td>
<td>universal serial bus</td>
</tr>
<tr>
<td>USMT</td>
<td>user state migration tool</td>
</tr>
<tr>
<td>UTP</td>
<td>unshielded twisted pair</td>
</tr>
<tr>
<td>UXGA</td>
<td>ultra extended graphics array</td>
</tr>
<tr>
<td>VESA</td>
<td>Video Electronics Standards Association</td>
</tr>
<tr>
<td>VFAT</td>
<td>virtual file allocation table</td>
</tr>
<tr>
<td>VGA</td>
<td>video graphics array</td>
</tr>
<tr>
<td>VM</td>
<td>Virtual Machine</td>
</tr>
<tr>
<td>VoIP</td>
<td>voice over internet protocol</td>
</tr>
<tr>
<td>VPN</td>
<td>virtual private network</td>
</tr>
<tr>
<td>VRAM</td>
<td>video random access memory</td>
</tr>
<tr>
<td>WAN</td>
<td>wide area network</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 who wish to create a lab component to their training offering. The bulleted lists below each topic are a sample list and not exhaustive.**

**Equipment**

- Apple tablet / Smart phone
- Android tablet / Smart phone
- Windows tablet / Smart phone
- Windows Laptop / Mac Laptop / Linux Laptop
- Windows Desktop / Mac Desktop / Linux Desktop
- Monitors
- Projectors
- SOHO Router/switch
- Access point
- VoIP phone
- Printer
  - Laser / Inkjet
  - Wireless
- Surge suppressor
- UPS

**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 cable / connectors
- AC adapters
- Optical drives
- Screws/stand-offs
- Cases
- Maintenance kit
- Mice/keyboards

**Tools**

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

**Software**

- Operating system disks
- Antivirus software

CompTIA A+ 220-901 Certification Exam Objectives version1

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• Virtualization software
• Antimalware
• Driver software
CompTIA A+ Certification Exam objectives

Exam Number: 220-902

Introduction

In order to receive CompTIA A+ certification a candidate must pass two exams. The first exam is the CompTIA A+ 220-902 Certification Exam. The CompTIA A+ 220-902 Certification Exam is the second exam required in order for CompTIA A+ certification candidates to complete their certification.

The CompTIA A+ 220-902 examination measures necessary competencies for an entry-level IT professional with the equivalent knowledge of at least 12 months of hands-on experience in the lab or field.

Successful candidates will have the knowledge required to:

- Assemble components based on customer requirements
- Install, configure and maintain devices, PCs 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 virtualization, desktop imaging, and deployment.

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. The following CompTIA A+ 220-902 certification exam objectives result from subject matter expert workshops and industry-wide survey results regarding the skills and knowledge required of an entry-level IT professional. The percentages in this document represent the relative importance of the subject areas (domains) in the associated body of knowledge, and together establish the foundation of an entry-level IT professional.

This examination blueprint includes domain weighting, test objectives, and example content. Example topics and concepts are included to clarify the test objectives and should not be construed as a comprehensive listing of all the content of this examination.

Candidates are encouraged to use this document to guide their studies. The table below lists the domains measured by this examination and the extent to which they are represented. The CompTIA A+ 220-902 certification exam is based on these objectives.

<table>
<thead>
<tr>
<th>Domain</th>
<th>Percentage of Examination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 Windows Operating Systems</td>
<td>29%</td>
</tr>
<tr>
<td>2.0 Other Operating Systems &amp; Technologies</td>
<td>12%</td>
</tr>
<tr>
<td>3.0 Security</td>
<td>22%</td>
</tr>
<tr>
<td>4.0 Software Troubleshooting</td>
<td>24%</td>
</tr>
<tr>
<td>5.0 Operational Procedures</td>
<td>13%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

CompTIA A+ 220-901 Certification Exam Objectives version 1

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Please review all CompTIA policies before beginning the study process for any CompTIA exam. Candidates will be required to abide by the CompTIA Candidate Agreement (http://certification.comptia.org/Training/testingcenters/policies/agreement.aspx) at the time of exam delivery.

If a candidate has a question as to whether study materials are considered unauthorized (aka brain dumps), he/she should perform a search using CertGuard's engine, found here: http://www.certguard.com/search.asp

Or verify against this list: http://certification.comptia.org/Training/testingcenters/policies/unauthorized.aspx

**Note: The lists of examples provided in bulleted format below each objective are not exhaustive lists. Other examples of technologies, processes or tasks pertaining to each objective may also be included on the exam although not listed or covered in this objectives document.

CompTIA is constantly reviewing the content of our exams and updating test questions to be sure our exams are current and the security of the questions is protected. When necessary, we will publish updated exams based on existing exam objectives. Please know that all related exam preparation materials will still be valid.
1.0 Windows Operating Systems

1.1 Compare and contrast various features and requirements of Microsoft Operating Systems (Windows Vista, Windows 7, Windows 8, Windows 8.1).
   - Features:
     - 32-bit vs. 64-bit
     - Aero, gadgets, user account control, bit-locker, shadow copy, system restore, ready boost, sidebar, compatibility mode, virtual XP mode, easy transfer, administrative tools, defender, Windows firewall, security center, event viewer, file structure and paths, category view vs. classic view, previous versions.
     - Side by side apps, Metro UI, Pinning, One Drive, Windows store, Multimonitor task bars, Charms, Start Screen, Power Shell, Live sign in, Action Center.
   - Upgrade paths – differences between in place upgrades, compatibility tools, Windows upgrade OS advisor

1.2 Given a scenario, install Windows PC operating systems using appropriate methods.
   - Boot methods
     - USB
     - CD-ROM
     - DVD
     - PXE
     - Solid state/flash drives
     - Netboot
     - External/hot swappable drive
     - Internal hard drive (partition)
   - Type of installations
     - Unattended installation
     - 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

CompTIA A+ 220-901 Certification Exam Objectives version1

Copyright © 2015 by the Computing Technology Industry Association. All rights reserved. The CompTIA A+ 220-901 Objectives are subject to change without notice.
1.3 Given a scenario, apply appropriate Microsoft command line tools.
- TASKKILL
- BOOTREC
- SHUTDOWN
- TASKLIST
- MD
- RD
- CD
- DEL
- FORMAT
- COPY
- XCOPY
- ROBOCOPY
- DISKPART
- SFC
- CHKDSK
- GPUPDATE
- GPRESULT
- DIR
- EXIT
- HELP
- EXTRACT
- [command name] /?
- Commands available with standard privileges vs. administrative privileges.

1.4 Given a scenario, use appropriate Microsoft operating system features and tools.
- Administrative
  - Computer management
  - Device manager
  - Users and groups
  - Local security policy
  - Performance monitor
  - Services
  - System configuration
  - Task scheduler
  - Component services
  - Data sources
  - Print management
  - Windows memory diagnostics
  - Windows firewall
1.5 Given a scenario, use Windows Control Panel utilities.

- Internet options
  - Connections
  - Security
  - General
  - Privacy
  - Programs
  - Advanced

- Display/Display Settings
  - Resolution
  - Color depth
1.6 Given a scenario, install and configure 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
  - Dialups
  - 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)

1.7 Perform common preventive maintenance procedures using the appropriate Windows OS tools.
- Best practices
  - Scheduled backups
  - Scheduled disk maintenance
  - Windows updates
  - Patch management
  - Driver/firmware updates
  - Antivirus/ Antimalware updates
- Tools
  - Backup
    - System restore
    - Recovery image
    - Disk maintenance utilities

2.0 Other Operating Systems and Technologies

2.1 Identify common features and functionality of the Mac OS and Linux operating systems.
- Best practices
  - Scheduled backups
  - Scheduled disk maintenance
  - System updates/App store
  - Patch management
  - Driver/firmware updates
  - Antivirus/ Antimalware updates
- Tools
  - Backup/Time Machine
  - Restore/snapshot
  - Image recovery
  - Disk maintenance utilities
  - Shell/Terminal
  - Screen sharing
  - Force Quit
- Features
  - Multiple desktops/Mission Controls
  - Key Chain
  - Spotlight
  - iCloud
  - Gestures
  - Finder
  - Remote Disk
  - Dock
  - Boot Camp
- Basic Linux commands
  - ls
  - grep
  - cd
2.2 Given a scenario, setup and use client-side virtualization.
- Purpose of virtual machines
- Resource requirements
- Emulator requirements
- Security requirements
- Network requirements
- Hypervisor

2.3 Identify basic cloud concepts.
- SaaS
- IaaS
- Paas
- Public vs. Private vs. Hybrid vs. Community
- Rapid Elasticity
- On-demand
- Resource pooling
- Measured service

2.4 Summarize the properties and purpose of services provided by networked hosts.
- Server roles
  - Web server
  - File server
  - Print server
  - DHCP server
  - DNS server
  - Proxy server
  - Mail server
  - Authentication server
- Internet appliance
  - UTM
  - IDS
  - IPS
- Legacy / embedded systems

2.5 Identify basic features of mobile operating systems.
- Android vs. iOS vs. Windows
2.6 Install and configure basic mobile device network connectivity and email.

- Wireless / cellular data network (enable/disable)
  - Hotspot
  - Tethering
  - Airplane mode
- Bluetooth
  - Enable Bluetooth
  - Enable pairing
  - Find device for pairing
  - Enter appropriate pin code
  - Test connectivity
- Corporate and ISP email configuration
  - POP3
  - IMAP
  - Port and SSL settings
  - Exchange, S/MIME
- Integrated commercial provider email configuration
  - Google/Inbox
  - Yahoo
  - Outlook.com
  - iCloud
- PRI updates/PRL updates/Baseband updates
- Radio firmware
- IMEI vs. IMSI
- VPN

2.7 Summarize methods and data related to mobile device synchronization.

- Types of data to synchronize
  - Contacts
  - Programs
  - Email
  - Pictures
  - Music
  - Videos
  - Calendar
  - Bookmarks
  - Documents
  - Location data
  - Social media data
  - eBooks
• Synchronization methods
  o Synchronize to the Cloud
  o Synchronize to the Desktop
• Mutual authentication for multiple services
• Software requirements to install the application on the PC
• Connection types to enable synchronization

3.0 Security

3.1 Identify common security threats and vulnerabilities.
• Malware
  o Spyware
  o Viruses
  o Worms
  o Trojans
  o Rootkits
  o Ransomware
• Phishing
• Spear phishing
• Spoofing
• Social engineering
• Shoulder surfing
• Zero day attack
• Zombie/botnet
• Brute forcing
• Dictionary attacks
• Non-compliant systems
• Violations of security best practices
• Tailgating
• Man-in-the-middle

3.2 Compare and contrast common prevention methods.
• Physical security
  o Lock doors
  o Mantrap
  o Cable locks
  o Securing physical documents/passwords/shredding
  o Biometrics
  o ID badges
  o Key fobs
  o RFID badge
  o Smart card
  o Tokens
  o Privacy filters
  o Entry control roster
• Digital security
  o Antivirus/Antimalware
  o Firewalls
  o User authentication/strong passwords
  o Multifactor authentication
• Directory permissions
• VPN
• DLP
• Disabling ports
• Access control lists
• Smart card
• Email filtering
• Trusted/untrusted software sources

• User education/AUP
• Principle of least privilege

3.3 Compare and contrast differences of basic Windows OS security settings.

• User and groups
  o Administrator
  o Power user
  o Guest
  o Standard user

• NTFS vs. Share permissions
  o Allow vs. deny
  o Moving vs. copying folders and files
  o File attributes

• Shared files and folders
  o Administrative shares vs. local shares
  o Permission propagation
  o Inheritance

• System files and folders

• User authentication
  o Single sign-On

• Run as administrator vs. standard user
• Bitlocker
• Bitlocker-To-Go
• EFS

3.4 Given a scenario, deploy and enforce security best practices to secure a workstation.

• Password best practices
  o Setting strong passwords
  o Password expiration
  o Changing default user names/passwords
  o Screensaver required password
  o BIOS/UEFI passwords
  o Requiring passwords

• Account management
  o Restricting user permissions
  o Login time restrictions
  o Disabling guest account
  o Failed attempts lockout
  o Timeout/screen lock

• Disable autorun
• Data encryption
• Patch/update management

3.5 Compare and contrast various methods for securing mobile devices.
• Screen locks
  o Fingerprint lock
  o Face lock
  o Swipe lock
  o Passcode lock
• Remote wipes
• Locator applications
• Remote backup applications
• Failed login attempts restrictions
• Antivirus/Antimalware
• Patching/OS updates
• Biometric authentication
• Full device encryption
• Multifactor authentication
• Authenticator applications
• Trusted sources vs. untrusted sources
• Firewalls
• Policies and procedures
  o BYOD vs. corporate owned
  o Profile security requirements

3.6 Given a scenario, use appropriate data destruction and disposal methods.
• Physical destruction
  o Shredder
  o Drill / Hammer
  o Electromagnetic (Degaussing)
  o Incineration
  o Certificate of destruction
• Recycling or repurposing best practices
  o Low level format vs. standard format
  o Overwrite
  o Drive wipe

3.7 Given a scenario, secure SOHO wireless and wired networks.
• Wireless specific
  o Changing default SSID
  o Setting encryption
  o Disabling SSID broadcast
  o Antenna and access point placement
  o Radio power levels
  o WPS
• Change default user-names and passwords
• Enable MAC filtering
• Assign static IP addresses
• Firewall settings
• Port forwarding/mapping
• Disabling ports
• Content filtering / parental controls
• Update firmware
• Physical security
4.0 Software Troubleshooting

4.1 Given a scenario, troubleshoot PC operating system problems with appropriate tools.

- **Common symptoms**
  - Proprietary crash screens (BSOD/pin wheel)
  - Failure to boot
  - Improper shutdown
  - Spontaneous shutdown/restart
  - Device fails to start/detected
  - Missing dll message
  - Services fails to start
  - Compatibility error
  - Slow system performance
  - Boots to safe mode
  - File fails to open
  - Missing NTLDR
  - Missing Boot.ini
  - Missing operating system
  - Missing Graphical Interface
  - Missing GRUB/LILO
  - Kernel panic
  - Graphical Interface fails to load
  - Multiple monitor misalignment/orientation

- **Tools**
  - BIOS/UEFI
  - SFC
  - Logs
  - Recovery console
  - Repair disks
  - Pre-installation environments
  - MSCONFIG
  - DEFRAG
  - REGSRV32
  - REGEDIT
  - Event viewer
  - Safe mode
  - Command prompt
  - Emergency repair disk
  - Automated system recovery
  - Uninstall/reinstall/repair

4.2 Given a scenario, troubleshoot common PC security issues with appropriate tools and best practices.

- **Common symptoms**
  - Pop-ups
  - Browser redirection
  - Security alerts
  - Slow performance
  - Internet connectivity issues
  - PC/OS lock up
  - Application crash
  - OS updates failures
- Rogue antivirus
- Spam
- Renamed system files
- Files disappearing
- File permission changes
- Hijacked email
  - Responses from users regarding email
  - Automated replies from unknown sent email
- Access denied
- Invalid certificate (trusted root CA)

- Tools
  - Antivirus software
  - Antimalware software
  - Recovery console
  - Terminal
  - System restore/Snapshot
  - Pre-installation environments
  - Event viewer o Refresh/restore
  - MS CONFIG/Safe boot

- Best practice procedure for malware removal
  1. Identify malware symptoms
  2. Quarantine infected system
  3. Disable system restore (in Windows)
  4. Remediate infected systems
    a. Update antimalware software
    b. Scan and removal techniques (safe mode, pre-installation environment)
  5. Schedule scans and run updates
  6. Enable system restore and create restore point (in Windows)
  7. Educate end user

4.3 Given a scenario, troubleshoot common mobile OS and application issues with appropriate tools.

- 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

- Tools
  - Hard reset
  - Soft reset
  - Close running applications
4.4 Given a scenario, troubleshoot common mobile OS and application security issues with appropriate tools

- Common symptoms
  - Signal drop/weak signal
  - Power drain
  - Slow data speeds
  - Unintended WiFi connection
  - Unintended Bluetooth pairing
  - Leaked personal files/data
  - Data transmission overlimit
  - Unauthorized account access
  - Unauthorized root access
  - Unauthorized location tracking
  - Unauthorized camera/microphone activation
  - High resource utilization

- Tools
  - Antimalware
  - App scanner
  - Factory reset/Clean install
  - Uninstall/reinstall apps
  - WiFi analyzer
  - Force stop
  - Cell tower analyzer
  - Backup/restore
    - iTunes/iCloud/Apple Configurator
    - Google sync
    - One Drive

5.0 Operational Procedures

5.1 Given a scenario, use appropriate safety procedures.

- Equipment grounding
- Proper component handling and storage
  - Antistatic bags
  - ESD straps
  - ESD mats
  - Self-grounding
- Toxic waste handling
  - Batteries
  - Toner
  - CRT
- Personal safety
  - Disconnect power before repairing PC
  - Remove jewelry
  - Lifting techniques
  - Weight limitations
  - Electrical fire safety
5.2 Given a scenario with potential environmental impacts, apply the appropriate controls.
- MSDS documentation for handling and disposal
- Temperature, humidity level awareness and proper ventilation
- Power surges, brownouts, blackouts
  - Battery backup
  - Surge suppressor
- Protection from airborne particles
  - Enclosures
  - Air filters/Mask
- Dust and debris
  - Compressed air
  - Vacuums
- Compliance to local government regulations

5.3 Summarize the process of addressing prohibited content/activity, and explain 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
- Personally Identifiable Information
- Follow corporate end-user policies and security best practices

5.4 Demonstrate proper communication techniques and professionalism.
- Use proper language – avoid jargon, acronyms, 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 co-workers while interacting with customers
  - Personal interruptions
- Dealing with difficult customer or situation
  - Do not argue with customers and/or be defensive
  - Avoid dismissing customer problems
  - Avoid being judgmental
5.5 **Given a scenario, explain the troubleshooting theory.**

- Always consider corporate policies, procedures and impacts before implementing changes.

1. **Identify the problem**
   - Question the user and identify user changes to computer and perform backups before making changes

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 theory is confirmed determine 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**
CompTIA A+ Acronyms

Introduction
The following is a list of acronyms which 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>Definition</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>ACT</td>
<td>activity</td>
</tr>
<tr>
<td>ADSL</td>
<td>asymmetrical digital subscriber line</td>
</tr>
<tr>
<td>AGP</td>
<td>accelerated graphics port</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>
</tr>
<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>BIOS</td>
<td>basic input/output system</td>
</tr>
<tr>
<td>BNC</td>
<td>Bayonet-Neill-Concelman or British Naval Connector</td>
</tr>
<tr>
<td>BTX</td>
<td>balanced technology extended</td>
</tr>
<tr>
<td>CAPTCHA</td>
<td>Completely Automated Public Turing Test To Tell Computers and Humans Apart</td>
</tr>
<tr>
<td>CCFL</td>
<td>Cold Cathode Fluorescent Lamp</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>
</tbody>
</table>

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CFS Central File System, Common File System, Command File System
CIFS Common Internet File System
CMOS complementary metal-oxide semiconductor
CNR Communications and Networking Riser
COMx communication port (x=port number)
CPU central processing unit
CRT cathode-ray tube
DAC discretionary access control
DB-25 serial communications D-shell connector, 25 pins
DB-9 9 pin D shell connector
DC direct current
DDOS distributed denial of service
DDR double data-rate
DDR RAM double data-rate random access memory
DDR double data-rate synchronous dynamic random access memory
DFS distributed file system
DHCP dynamic host configuration protocol
DIMM dual inline memory module
DIN Deutsche Industrie Norm
DLT digital linear tape
DLP digital light processing
DMA direct memory access
DMZ demilitarized zone
DNS domain name service or domain name server
DOS denial of service
DRAM dynamic random access memory
DSL digital subscriber line
DVD digital video disc or digital versatile disc
DVD-RAM digital video disc-random access memory
DVD-ROM digital video disc-read only memory
DVD-R digital video disc-recordable
DVD-RW digital video disc-rewritable
DVI digital visual interface
ECC error correcting code/error checking and correction
ECP extended capabilities port
EEPROM electrically erasable programmable read-only memory
EFS encrypting file system
EIDE enhanced integrated drive electronics
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM erasable programmable read-only memory
EPP enhanced parallel port
ERD  emergency repair disk
ESD  electrostatic discharge
EVGA  extended video graphics adapter/array
EVDO  evolution data optimized or evolution data only
FAT  file allocation table
FAT12  12-bit file allocation table
FAT16  16-bit file allocation table
FAT32  32-bit file allocation table
FDD  floppy disk drive
Fn  Function (referring to the function key on a laptop)
FPM  fast page-mode
FRU  field replaceable unit
FSB  Front Side Bus
FTP  file transfer protocol
FQDN  fully qualified domain name
Gb  gigabit
GB  gigabyte
GDI  graphics device interface
GHz  gigahertz
GUI  graphical user interface
GPS  global positioning system
GSM  global system for mobile communications
HAL  hardware abstraction layer
HAV  Hardware Assisted Virtualization
HCL  hardware compatibility list
HDD  hard disk drive
HDMI  high definition media interface
HPFS  high performance file system
HTML  hypertext markup language
HTPC  home theater PC
HTTP  hypertext transfer protocol
HTTPS  hypertext transfer protocol over secure sockets layer
I/O  input/output
ICMP  internet control message protocol
ICR  intelligent character recognition
IDE  integrated drive electronics
IDS  Intrusion Detection System
IEEE  Institute of Electrical and Electronics Engineers
IIS  Internet Information Services
IMAP  internet mail access protocol
IP  internet protocol
IPCONFIG  internet protocol configuration
IPP  internet printing protocol

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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPSEC</td>
<td>internet protocol security</td>
</tr>
<tr>
<td>IR</td>
<td>infrared</td>
</tr>
<tr>
<td>IrDA</td>
<td>Infrared Data Association</td>
</tr>
<tr>
<td>IRQ</td>
<td>interrupt request</td>
</tr>
<tr>
<td>ISDN</td>
<td>integrated services digital network</td>
</tr>
<tr>
<td>ISO</td>
<td>International Organization for Standardization/Industry Standards Organization</td>
</tr>
<tr>
<td>ISP</td>
<td>internet service provider</td>
</tr>
<tr>
<td>JBOD</td>
<td>just a bunch of disks</td>
</tr>
<tr>
<td>Kb</td>
<td>kilobit</td>
</tr>
<tr>
<td>KB</td>
<td>Kilobyte or knowledge base</td>
</tr>
<tr>
<td>LAN</td>
<td>local area network</td>
</tr>
<tr>
<td>LBA</td>
<td>logical block addressing</td>
</tr>
<tr>
<td>LC</td>
<td>Lucent connector</td>
</tr>
<tr>
<td>LCD</td>
<td>liquid crystal display</td>
</tr>
<tr>
<td>LDAP</td>
<td>lightweight directory access protocol</td>
</tr>
<tr>
<td>LED</td>
<td>light emitting diode</td>
</tr>
<tr>
<td>Li-on</td>
<td>lithium-ion</td>
</tr>
<tr>
<td>LPD/LPR</td>
<td>line printer daemon / line printer remote</td>
</tr>
<tr>
<td>LPT</td>
<td>line printer terminal</td>
</tr>
<tr>
<td>LVD</td>
<td>low voltage differential</td>
</tr>
<tr>
<td>MAC</td>
<td>media access control / mandatory access control</td>
</tr>
<tr>
<td>MAPI</td>
<td>messaging application programming interface</td>
</tr>
<tr>
<td>MAU</td>
<td>media access unit, media attachment unit</td>
</tr>
<tr>
<td>Mb</td>
<td>megabit</td>
</tr>
<tr>
<td>MB</td>
<td>megabyte</td>
</tr>
<tr>
<td>MBR</td>
<td>master boot record</td>
</tr>
<tr>
<td>MBSA</td>
<td>Microsoft Baseline Security Analyzer</td>
</tr>
<tr>
<td>MFD</td>
<td>multi-function device</td>
</tr>
<tr>
<td>MFP</td>
<td>multi-function product</td>
</tr>
<tr>
<td>MHr</td>
<td>megahertz</td>
</tr>
<tr>
<td>MicroDIMM</td>
<td>micro dual inline memory module</td>
</tr>
<tr>
<td>MicroDIMM</td>
<td>micro dual inline memory module</td>
</tr>
<tr>
<td>MIDI</td>
<td>musical instrument digital interface</td>
</tr>
<tr>
<td>MIME</td>
<td>multipurpose internet mail extension</td>
</tr>
<tr>
<td>MIMO</td>
<td>Multiple Input Multiple Output</td>
</tr>
<tr>
<td>MMC</td>
<td>Microsoft management console</td>
</tr>
<tr>
<td>MP3</td>
<td>Moving Picture Experts Group Layer 3 Audio</td>
</tr>
<tr>
<td>MP4</td>
<td>Moving Picture Experts Group Layer 4</td>
</tr>
<tr>
<td>MPEG</td>
<td>Moving Picture Experts Group</td>
</tr>
<tr>
<td>MSCONFIG</td>
<td>Microsoft configuration</td>
</tr>
<tr>
<td>MSDS</td>
<td>material safety data sheet</td>
</tr>
<tr>
<td>MUI</td>
<td>multilingual user interface</td>
</tr>
<tr>
<td>NAC</td>
<td>network access control</td>
</tr>
</tbody>
</table>

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NAS  network-attached storage
NAT  network address translation
NetBIOS  networked basic input/output system
NetBEUI  networked basic input/output system extended user interface
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
OCR  optical character recognition
OEM  original equipment manufacturer
OLED  Organic Light Emitting Diode
OS  operating system
PAN  personal area network
PATA  parallel advanced technology attachment
PC  personal computer
PCI  peripheral component interconnect
PCIe  peripheral component interconnect express
PCIX  peripheral component interconnect extended
PCL  printer control language
PCMCIA  Personal Computer Memory Card International Association
PGA  pin grid array
PGA2  pin grid array 2
PII  Personally Identifiable Information
PIN  personal identification number
PKI  public key infrastructure
PhP  plug and play
POP3  post office protocol 3
PoS  Point of Sale
POST  power-on self test
POTS  plain old telephone service
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
PVC  permanent virtual circuit
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>PXE</td>
<td>preboot execution environment</td>
</tr>
<tr>
<td>QoS</td>
<td>quality of service</td>
</tr>
<tr>
<td>RAID</td>
<td>redundant array of independent (or inexpensive) discs</td>
</tr>
<tr>
<td>RAM</td>
<td>random access memory</td>
</tr>
<tr>
<td>RAS</td>
<td>remote access service</td>
</tr>
<tr>
<td>RDF</td>
<td>Remote Desktop Protocol</td>
</tr>
<tr>
<td>RF</td>
<td>radio frequency</td>
</tr>
<tr>
<td>K-T</td>
<td>radio frequency interference</td>
</tr>
<tr>
<td>RGB</td>
<td>red green blue</td>
</tr>
<tr>
<td>RIP</td>
<td>routing information protocol</td>
</tr>
<tr>
<td>RIS</td>
<td>remote installation service</td>
</tr>
<tr>
<td>RISC</td>
<td>reduced instruction set computer</td>
</tr>
<tr>
<td>RJ-11</td>
<td>registered jack function 11</td>
</tr>
<tr>
<td>RJ-45</td>
<td>registered jack function 45</td>
</tr>
<tr>
<td>RMA</td>
<td>returned materials authorization</td>
</tr>
<tr>
<td>ROM</td>
<td>read only memory</td>
</tr>
<tr>
<td>RTC</td>
<td>real-time clock</td>
</tr>
<tr>
<td>SAN</td>
<td>storage area network</td>
</tr>
<tr>
<td>SAS</td>
<td>Serial Attached SCSI</td>
</tr>
<tr>
<td>SATA</td>
<td>serial advanced technology attachment</td>
</tr>
<tr>
<td>SC</td>
<td>subscription channel</td>
</tr>
<tr>
<td>SCP</td>
<td>secure copy protection</td>
</tr>
<tr>
<td>SCSI</td>
<td>small computer system interface</td>
</tr>
<tr>
<td>SCSI ID</td>
<td>small computer system interface identifier</td>
</tr>
<tr>
<td>SD card</td>
<td>secure digital card</td>
</tr>
<tr>
<td>SDRAM</td>
<td>synchronous dynamic random access memory</td>
</tr>
<tr>
<td>SEC</td>
<td>single edge connector</td>
</tr>
<tr>
<td>SFC</td>
<td>system file checker</td>
</tr>
<tr>
<td>SFF</td>
<td>Small Form Factor</td>
</tr>
<tr>
<td>SLI</td>
<td>scalable link interface or system level integration or scanline interleave mode</td>
</tr>
<tr>
<td>S.M.A.R.T.</td>
<td>self-monitoring, analysis, and reporting technology</td>
</tr>
<tr>
<td>SMB</td>
<td>server message block or small to midsize business</td>
</tr>
<tr>
<td>SMTP</td>
<td>simple mail transfer protocol</td>
</tr>
<tr>
<td>SNMP</td>
<td>simple network management protocol</td>
</tr>
<tr>
<td>SoDIMM</td>
<td>small outline dual inline memory module</td>
</tr>
<tr>
<td>SOHO</td>
<td>small office/home office</td>
</tr>
<tr>
<td>SP</td>
<td>service pack</td>
</tr>
<tr>
<td>SPDIF</td>
<td>Sony-Philips digital interface format</td>
</tr>
<tr>
<td>SPGA</td>
<td>staggered pin grid array</td>
</tr>
<tr>
<td>SRAM</td>
<td>static random access memory</td>
</tr>
<tr>
<td>SSH</td>
<td>secure shell</td>
</tr>
<tr>
<td>SSID</td>
<td>service set identifier</td>
</tr>
<tr>
<td>SSL</td>
<td>secure sockets layer</td>
</tr>
</tbody>
</table>
ST  straight tip
STP  shielded twisted pair
SXGA  super extended graphics array
TB  terabyte
TCP  transmission control protocol
TCP/IP  transmission control protocol/internet protocol
TDR  time domain reflectometer
TFTP  trivial file transfer protocol
TKIP  Temporal Key Integrity Protocol
TPM  trusted platform module
UAC  user account control
UDF  user defined functions or universal disk format or universal data format
UDP  user datagram protocol
UEFI  Unified Extensible Firmware Interface
UNC  universal naming convention
UPS  uninterruptible power supply
URL  uniform resource locator
USB  universal serial bus
USMT  user state migration tool
UTP  unshielded twisted pair
UXGA  ultra extended graphics array
VESA  Video Electronics Standards Association
VFAT  virtual file allocation table
VGA  video graphics array
VM  Virtual Machine
VoIP  voice over internet protocol
VPN  virtual private network
VRAM  video random access memory
WAN  wide area network
WAP  wireless access protocol/wireless access point
WEP  wired equivalent privacy
WiFi  wireless fidelity
WINS  windows internet name service
WLAN  wireless local area network
WPA  wireless protected access
WPS  WiFi Protected Setup
WUXGA  wide ultra extended graphics array
XGA  extended graphics array
ZIF  zero-insertion-force
ZIP  zigzag inline package
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 who wish to create a lab component to their training offering. The bulleted lists below each topic are a sample list and not exhaustive.

**Equipment**

- Apple tablet / Smart phone
- Android tablet / Smart phone
- Windows tablet / Smart phone
- Windows Laptop / Mac Laptop / Linux Laptop
- Windows Desktop / Mac Desktop / Linux Desktop
- Monitors
- Projectors
- SOHO Router/switch
- Access point
- VoIP phone
- Printer
  - Laser / Inkjet
  - Wireless
- Surge suppressor
- UPS

**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 cable / connectors
- AC adapters
- Optical drives
- Screws/stand-offs
- Cases
- Maintenance kit
- Mice/keyboards

Tools

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

Software

- Operating system disks
- Antivirus software
- Virtualization software
- Antimalware
- Driver software
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