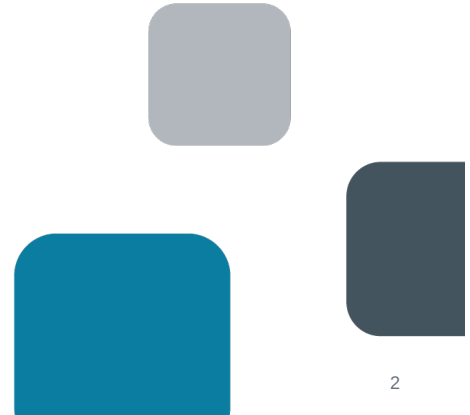


# Basic Hardware Problems

- Look for simple solutions first.
  - Find out if anything has changed.
  - Eliminate hardware issues as a cause first.
  - Try one thing at a time.
  - Take care to ensure that a user's data is backed up before proceeding.
- Observable symptoms
  - Indicator lights.
  - Alerts.
  - Overheating.
  - Loud noises.
  - Visible damage.

# Power Problems (Slide 1 of 2)

- Computer that won't start.
- Computer that suddenly turns off or restarts.
- Indicators that computer is not getting power:
  - No LEDs on front panel light up.
  - No sound of fans or hard drive spinning.
- Fault might lie with:
  - PSU.
  - Incoming mains electricity supply.
  - Power cables or connectors.
  - Fuses.



# Power Problems (Slide 2 of 2)

## No Power

- Check that other equipment in the area is working; there may be a blackout.
- Check that the PSU cabling is connected to the PC and the wall socket correctly and that all switches are in the "on" position.
- Try another power cable—there may be a problem with the plug or fuse.
  - Check that all of the wires are connected to the correct terminals in the plug.
  - Check the fuse resistance with a multimeter.
- Try plugging another piece of "known-good" equipment (such as a lamp) into the wall socket.
- Try disconnecting extra devices, such as optical drives.

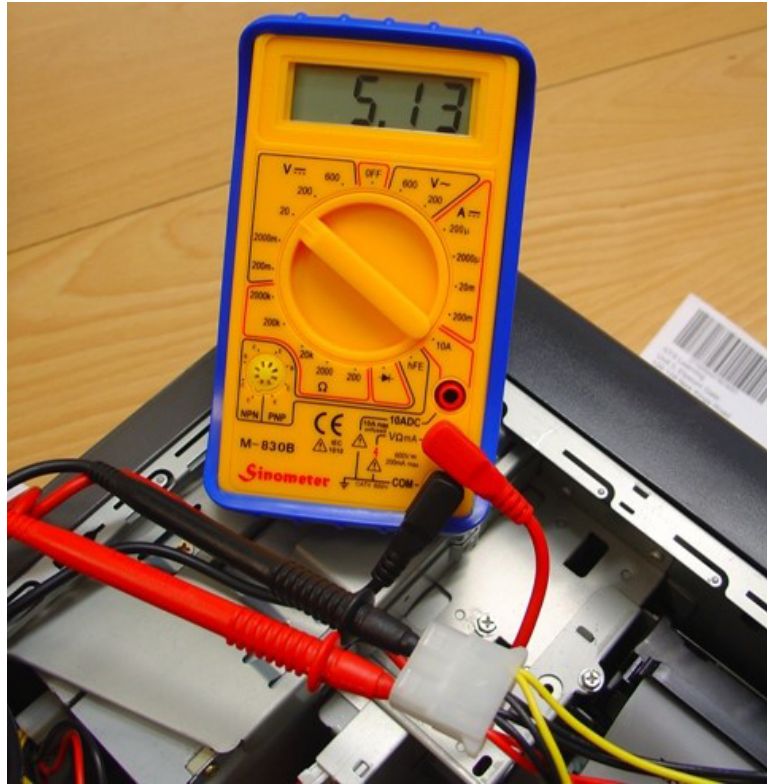
# Multimeter Use (Slide 1 of 3)



**Multimeter:** An electrical meter capable of measuring voltage, resistance, and current.

- To test a fuse, set the multimeter to measure resistance and touch the probes to each end of the fuse.
  - A good fuse should have virtually zero Ohms of resistance.
  - A blown fuse will have virtually infinite resistance.
  - Power supply problems can be indicated by otherwise inexplicable system lockups or unprompted reboots.
- PC power supplies are NOT user-serviceable.
  - Do NOT attempt any maintenance beyond the simple tests described.
  - Never remove the cover of a power supply.

# Multimeter Use (Slide 2 of 3)



# Multimeter Use (Slide 2 of 3)

Supply Line	Color Code	Tolerance	Min. Voltage	Max. Voltage
<b>+5 V</b>	Red	±5%	+4.75 V	+5.25 V
<b>+12 V</b>	Yellow	±5%	+11.4 V	+12.6 V
<b>-12 V</b>	Blue	±10%	-10.8 V	-13.2 V
<b>+3.3 V</b>	Orange	±5%	+3.135 V	+3.465 V
<b>+5 V Standby</b>	Purple	±5%	+4.75 V	+5.25 V
<b>PSU On</b>	Green	Higher than +3 V when PC is off; less than 0.9 V when the PC is on.		
<b>Power Good</b>	Gray	Less than 0.9 V when the PC is off; higher than 2.5 V when the PC is on.		
<b>Ground</b>	Black	-	-	-

# Power Supply Tester



**Power Supply Tester:** A type of meter designed specifically to test PSUs.

- Typically include ports for:
  - 20/24-pin P1
  - Molex
  - SATA
  - 8-pin connectors
  - 6-pin connectors
  - 4-pin connectors
- Each pin on each port has LED



# POST and Boot Problems (Slide 1 of 6)



**Power-On Self-Test (POST):** A hardware checking routine built into the PC firmware. This test sequentially monitors the state of the memory chips, the processor, system clock, display, and firmware itself.

1. POST locates video card firmware at memory address C000.
  - If found, card is initialized from its own firmware.
2. Startup screen is displayed.
  - More tests are performed, including RAM.
  - Any errors are indicated by displaying text messages.
3. If desired, access system setup routine at this point.
4. Most computers boot silently, but some may emit a single beep to indicate system checks have been successfully completed.



# POST and Boot Problems (Slide 2 of 6)

5. PC searches for interfaces with additional firmware chips.
6. Firmware may display system configuration summary screen.
7. Operating system load sequence starts.

## POST Not Running

- If you ensure power is available but computer does not start, screen remains black, and there are no beeps, POST likely is not executing.
  - Verify monitor cable is connected and undamaged and that the monitor is turned on and set to the correct input type.
  - If possible, try another monitor if there is still no image.
  - Check for faulty cables, damaged or mismatched CPU, or motherboard issues.

# POST and Boot Problems (Slide 3 of 6)

## POST Not Running (continued):

- Try these tests and solutions:
  - If the system firmware has been flashed and the PC has not booted since, the system firmware update may have failed. Use the reset procedure.
  - Check cabling and connections. Correct any errors, reset adapter cards, and then reboot the PC.
  - Check for faulty interfaces and devices. Try removing one device at a time to see if this solves the problem.
  - Check the PSU for a fault that is preventing the Power Good signal from being sent to the CPU, preventing POST.
  - Check for logic errors—POST test adapter cards can interpret the debug codes given by the firmware
  - Check for a faulty CPU or system firmware.
  - Check motherboard jumper settings.

# POST and Boot Problems (Slide 4 of 6)

## POST Beep Codes

Code	Meaning
1 short beep	Normal POST—System is OK
2 short beeps	POST error—Error code is shown on screen
No beep	Power supply or motherboard problem
Continuous beep	Power supply, motherboard, or system memory problem
Repeating short beeps	Power supply, motherboard, or keyboard problem
1 long, 1 short beep	Motherboard problem
1 long, 2 or 3 short beeps	Display adapter error
3 long beeps	3270 keyboard card

# POST and Boot Problems (Slide 5 of 6)

## BIOS Time and Settings Reset

- Modern computers don't rely on CMOS battery to store settings.
- Computers that lose the correct time might have a failed Real Time Clock battery.
- Older computers that have a failed battery may result in system setup settings being lost or corrupted.
  - CMOS Checksum error might be displayed.
- To replace a CMOS battery:
  1. Obtain coin cell battery compatible with the motherboard.
  2. Unclip old battery and remove it.
  3. Plug in new battery.
  4. Switch on computer.

# POST and Boot Problems (Slide 6 of 6)

## Operating System Search/Boots to Incorrect Device

- After POST tests, firmware searches devices in specified boot sequence.
- If first drive is not found, it moves to the next drive.
- If no disk-based boot device is found, it might try to boot from a network.
- If no boot device is found, an error message is displayed, and the boot process is halted.

# OS Boot Troubleshooting and Log Entries (Slide 1 of 2)

- When boot device is located, code from boot sector is loaded into memory.
- Code from boot sectors takes over from system firmware to load the rest of the OS into system memory.
- Error messages after this point are usually software or driver problems.

## OS Boot Issues

- If system tries to boot to the wrong device, verify removable media is not in a drive or connected that might interfere with the boot process.
- Verify boot device order is correctly configured.
- Examine log entries:
  - In Windows, use Event Viewer to analyze System and Applications logs.
  - In Linux, review boot messages using `dmesg | less` command.

# OS Boot Troubleshooting and Log Entries (Slide 2 of 2)

```
input1
[ 1.636419] hv_netvsc: hv_netvsc channel opened successfully
[ 1.766872] hv_netvsc umbus_13: Send section size: 6144, Section count:2560
[ 1.769041] hv_netvsc umbus_13: Device MAC 00:15:5d:01:ca:5a link state up
[ 1.777406] scsi host0: storvsc_host_t
[ 1.778415] scsi 0:0:0:0: Direct-Access      Msft      Virtual Disk      1.0 PQ: 0 ANSI: 5
[ 1.779643] scsi 0:0:0:1: CD-ROM              Msft      Virtual DVD-ROM   1.0 PQ: 0 ANSI: 0
[ 1.789213] sd 0:0:0:0: Attached scsi generic sg0 type 0
[ 1.789967] sd 0:0:0:0: [sda] 41943040 512-byte logical blocks: (21.5 GB/20.0 GiB)
[ 1.790414] sd 0:0:0:0: [sda] 4096-byte physical blocks
[ 1.791047] sr 0:0:0:1: [sr0] scsi3-mmc drive: 0x/0x caddy
[ 1.791482] cdrom: Uniform CD-ROM driver Revision: 3.20
[ 1.792458] sr 0:0:0:1: Attached scsi generic sg1 type 5
[ 1.793480] sd 0:0:0:0: [sda] Write Protect is off
[ 1.794084] sd 0:0:0:0: [sda] Write cache: enabled, read cache: enabled, doesn't support DPO or FUA
[ 1.798697] sda: sda1 sda2 sda3
[ 1.800587] sd 0:0:0:0: [sda] Attached SCSI disk
Begin: Loading essential drivers ... [ 1.861814] md: linear personality registered for level -1
[ 1.864173] md: multipath personality registered for level -4
[ 1.866534] md: raid0 personality registered for level 0
[ 1.871199] md: raid1 personality registered for level 1
[ 1.940016] raid6: sse2x1   gen() 12301 MB/s
[ 2.008040] raid6: sse2x1   xor()   9205 MB/s
[ 2.076026] raid6: sse2x2   gen() 15006 MB/s
[ 2.144014] raid6: sse2x2   xor()  10562 MB/s
[ 2.212015] raid6: sse2x4   gen() 16943 MB/s
[ 2.280010] raid6: sse2x4   xor()  11358 MB/s
[ 2.348011] raid6: avx2x1   gen() 23304 MB/s
[ 2.416035] raid6: avx2x2   gen() 22984 MB/s
[ 2.484041] raid6: avx2x4   gen() 28541 MB/s
[ 2.485496] raid6: using algorithm avx2x4 gen() 28541 MB/s
[ 2.486022] raid6: using avx2x2 recovery algorithm
[ 2.488086] xor: automatically using best checksumming function:
[ 2.528013]   avx      : 30708.000 MB/sec
[ 2.531380] async_tx: api initialized (async)
[ 2.540377] md: raid6 personality registered for level 6
[ 2.540758] md: raid5 personality registered for level 5
[ 2.541212] md: raid4 personality registered for level 4
[ 2.545457] md: raid10 personality registered for level 10
done.
Begin: Running /scripts/init-premount ... done.
Begin: Mounting root file system ... Begin: Running /scripts/local-top ...   lvm2 is not active yet, using direct activation
during sysinit
      lvm2 is not active yet, using direct activation during sysinit
done.
Begin: Running /scripts/local-premount ... [ 2.810161] Btrfs loaded
Scanning for Btrfs filesystems
```

# Motherboard Component Problems (Slide 1 of 4)



**Distended capacitors:** Capacitors that are swollen or bulging or emitting residue indicates that they have been damaged or could have failed due to a manufacturing defect.

**Chip creep:** Cards can work free from a slot over time, though this is not common.

- Could be damaged by ESD, power spikes, overheating.
  - Blown components can leave scorch marks.
  - Look for distended capacitors.
- Pins on integrated components can be damaged from improper plug insertion.
- Dirty systems can cause temperature changes.

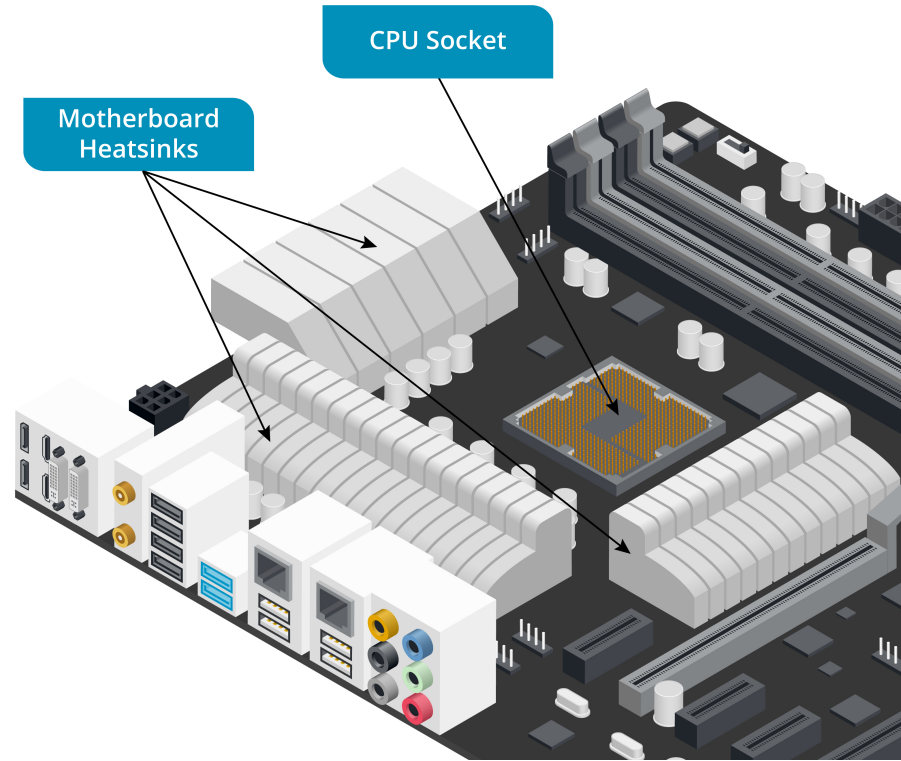


# Motherboard Component Problems (Slide 2 of 4)

- For intermittent device failure, determine that it is not caused by software, disk problems, or malware.
  - See if there is a pattern to the failure.
  - If the PC has been on for some time, it could be a thermal or power issue.
- For physical damage, use diagnostic software to run tests.
- Insufficient cooling is the main cause of processor, memory, and motherboard issues.
  - Thermal faults are often cyclic as powering down allows processors and components to cool down.

# Motherboard Component Problems (Slide 3 of 4)

- Visually inspect for physical damage.
  - Pins are not bent.
  - Dirty contacts on connectors.
  - Chips and boards are properly seated.
  - Scorch marks and distended capacitors.



# Motherboard Component Problems (Slide 4 of 4)

- Determine if intermittent problems have a pattern.
- Verify power supply provides stable voltages to the computer.
- Check for overheating issues. Ensure that:
  - CPU fan is working.
  - Heatsink is properly fitted.
  - Empty slots have blanking plates installed.
  - Processor is running at the correct speed.
  - Environment is not too hot or dirty.

# Activity



## Discussing System Component Troubleshooting

# Activity



## Diagnosing Power Problems

<https://www.youtube.com/watch?v=TdUK6RPdIrA>

# Activity



## Diagnosing System Errors

# Client Personal Computers (Slide 1 of 2)



**Standard (thick) client:** A business computer that performs most or all computing functions on its own. Also referred to as a standard client or a fat client

**User accounts:** Each user who wishes to access a Windows computer will need a logon ID, referred to as a user account.

**Thin client:** A business computer that relies heavily on another system, typically a server, to run most of its programs, processes, and services.

**VDI:** (Virtual Desktop Infrastructure) Hosting user desktops as virtual machines on a centralized server or cloud infrastructure. The desktop OS plus applications software is delivered to the client device (often a thin client) over the network as an image.

# Client Personal Computers (Slide 2 of 2)

- Windows 10 Account Types
  - Administrator
  - Standard User
  - Guest account
  - Child account
  - Microsoft account
  - Local account
  - Domain user account
- Linux Account Types
  - root
  - standard user
- macOS Account Types
  - Administrator
  - Standard
  - Managed with Parental Controls
  - Sharing Only



# Business Workstations (Slide 1 of 5)



**Workstation:** A client device that connects to the network.

- Runs more demanding applications than standard office suites.
- Compared to standard desktops, workstations typically have:
  - Faster processors.
  - More memory.
  - Faster and larger drives.
  - Multiple monitors.
- Might have RAID implemented.
- Often used to process critical data.

# Business Workstations (Slide 2 of 5)



**IDE:** (Integrated Development Environment) A GUI programming environment that includes features such as a code editor, code interpreter or compiler, and the ability to find coding errors.

**Virtualization:** Software allowing a single computer (the host) to run multiple guest OSs or VMs.

- Programming, development, and virtualization workstations:
  - Run one or more IDE environments.
  - May also run local database server application for testing.
  - Development is likely to require virtualization for multiple OSes.

# Business Workstations (Slide 3 of 5)



**DTP:** (Desktop Publishing) An application similar to word processing but with more emphasis on the formatting and layout of documents than on editing the text.

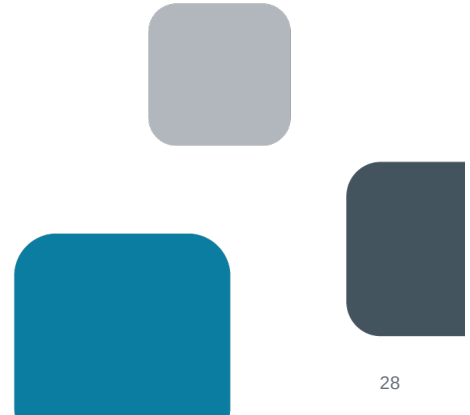
**CAD:** (Computer Aided Design) Software that makes technical drawings and schematics easier to produce and revise.

**CAM:** (Computer Aided Manufacturing) Software that can control machine tools found in manufacturing environments.

- Design workstations:
  - Configured to support graphic design, engineering, and other design-driven jobs.
  - High CPU, GPU, and RAM requirements.
  - Fast storage and retrieval also needed, so SSDs are commonly used.

# Business Workstations (Slide 4 of 5)

- Applications include:
  - Image editing and illustration tools.
  - DTP
  - CAD
  - CAM
- Peripheral hardware might include digitizer and stylus.



# Business Workstations (Slide 5 of 5)

- Audio/Video Editing Workstations
  - Designed to:
    - Edit A/V files
    - Create animations
    - Produce music
  - Professional videos include:
    - Special effects
    - CGI
  - In addition to large amounts of RAM and fast processing:
    - Consider using SSD drives
    - Will likely need specialized adapters to capture audio and video from various sources

# Computers for Home Use (Slide 1 of 6)



**Media center:** A computer used for media streaming, often connected to surround sound speakers, and capable of recording TV shows.

**Gaming rig:** A computer used for standalone or online gaming, often connected to surround sound speakers or headphones, sometimes integrated with virtual reality goggles. May use specialized gaming equipment such as gaming controllers, joysticks, gaming mouse and keyboard.

- Fast video, storage, and network connections needed for streaming media and for gaming.

# Computers for Home Use (Slide 2 of 6)



**HTPC:** (home theater PC) A PC used in place of consumer appliances such as a PVR to watch and record TV broadcasts and play movies and music.

**PVR:** (personal video recorder) Software installed on a home theater PC (HTPC) to record and watch TV broadcasts.

- HTPC:
  - Replaces PVR.
  - Watch and record TV broadcasts.
    - Requires a TV tuner card to be installed.
  - Play music and movies from local files or streaming Internet services.
  - Typically controlled with wireless keyboard, mouse, and remote control.
  - Computer is typically located near the TV and has an aesthetically pleasing form factor.
  - Often designed to run more quietly than other computers.

# Computers for Home Use (Slide 3 of 6)



**Home server PC:** Either a HTPC with a slightly expanded role or a repurposed desktop or low-end PC server used primarily for file storage, media streaming, and printer sharing.

- Home server PC:
  - Might be an HTPC, a desktop, or low-end PC server.
  - Primary use is for file storage, media streaming, and printer sharing.
  - Not typically very powerful systems, but does need a good, reliable network link.
  - Consider using RAID.
  - Older OS, Windows Home Server, was able to stream media files to wireless speakers or IP-enabled TVs.
  - Compared to file servers, streaming media servers have higher demand for:
    - CPU
    - Memory
    - Bandwidth



# Computers for Home Use (Slide 4 of 6)



**NAS:** (Network Attached Storage) A storage device with an embedded OS that supports typical network file access protocols.

- NAS appliance:
  - Hard drive or RAID array with reduced functionality server board.
  - Often runs a version of Linux.
  - Has network access with various file-sharing protocols.
  - Typically uses a web-based management interface.
  - Can use a wired Ethernet port or Wi-Fi.
  - Can often share printers as well as files.
  - Can be used to make files available over the Internet:
    - Uses HTTP or FTP.
    - Be sure to secure devices and the router/firewall.

# Computers for Home Use (Slide 5 of 6)

The screenshot shows the TP-Link Archer VR900 web interface. The top navigation bar includes the TP-Link logo, the device name 'Archer VR900', and tabs for 'Quick Setup', 'Basic', and 'Advanced'. There are also 'Logout' and 'Reboot' buttons. The left sidebar contains menu items: Network Map, Internet, Wireless, Guest Network, USB Settings (highlighted), Folder Sharing, Print Server, 3G/4G Settings, Parental Control, and IPTV.

The main content area is titled 'Device Settings' and includes a 'Scan' button. Below this, it shows a Seagate Portable drive with a 'Safely Remove' button. A table displays the drive's details:

ID	Volume	Capacity	Free Space	Active
1	sda1	232.9 GB	7.0 GB	

The 'Sharing Settings' section shows the 'Network/Media Server Name' set to 'Archer\_VR900' with a 'Save' button. The 'Folder Sharing' section has two toggle switches: 'Share All' (checked) and 'Enable Authentication' (unchecked). A 'Refresh' button is located at the bottom right of the sharing settings.

# Computers for Home Use (Slide 6 of 6)

- Gaming PCs:
  - Built around latest graphics adapter technology.
  - PC games feature media assets that are loaded to memory, so require fast drives such as SSD.
  - Typically have surround sound audio and high quality display.
  - Fast systems used for long periods, so consider one with liquid cooling systems.
  - Hardware peripherals can include:
    - Specialized gaming mouse and keyboard.
    - Steering wheel.
    - 3D glasses.
    - Specialized mouse pads.
    - Specialized audio systems.
    - PC video camera.

# Guidelines for Selecting Components for a Custom PC (Slide 1 of 2)

- Verify that the computer meets or exceeds the OS and application requirements, including the fastest and most reliable:
  - RAM
  - CPU
  - Storage subsystem
  - Video subsystem, including a fast refresh rate on the monitor
- Verify you know what the main use of the computer will be. Different requirements for:
  - CAD/CAM
  - A/V editing
  - Watching TV and movies
  - Gaming

# Guidelines for Selecting Components for a Custom PC (Slide 2 of 2)

- Custom computers require better performance than the average PC.
- Each type of custom PC will likely have specific requirements that should be verified with the end user.
- Consider installing additional cooling mechanisms to keep the system from overheating.
- Verify that the network card, the router, and the network cabling or Wi-Fi signal are all capable of the highest possible speed.
- Consider purchasing specialized devices for the work that will be performed on the custom computer.
- Implement a RAID system to help ensure data is not lost. This should be in addition to performing regular backups that are securely stored off site.

# Activity



Discussing Custom PC Configuration (Last section in 4)

# Activity



## Selecting Components for Custom Workstations

# Activity

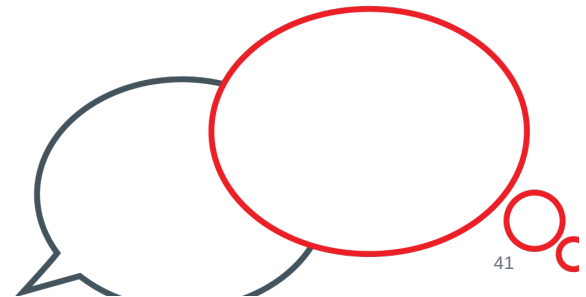


## Selecting Components for Custom Personal Computers



# Reflective Questions

1. Which system firmware have you worked with, if any? What types of configuration did you perform?
2. What types of custom client setups do you think you will encounter the most in your role as an A+ technician?



# Reflective Questions

**Read:** Chapters 4-6

**Practice Tests:** <https://www.examcompass.com/>

