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**CompTIA A+ Certification  
801 Support Skills**

Instructor Edition  
Study Notes

G183Teng ver033

## Acknowledgements

Course Developer..... gtslearning



[www.gtslearning.com](http://www.gtslearning.com)

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## About This Course

gtslearning's CompTIA A+ Support Skills courses are intended for students wishing to qualify with CompTIA A+ Certification. A+ certification is designed to help students become entry-level IT technicians.

*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 while applying troubleshooting skills. Successful candidates will also provide appropriate customer support and understand the basics of virtualization, desktop imaging, and deployment.*

*CompTIA A+ syllabus*

This course is designed to prepare you for the 220-801 A+ exam. It focuses on PC, laptop, printer, and network hardware technologies and support procedures.



*To obtain CompTIA A+ Certification, you must pass **both** the 801 exam **and** the 220-802 exam. You must complete the 802 Support Skills course to prepare for the 802 exam. The 802 exam focuses on supporting Microsoft Windows and on troubleshooting.*

## What are the Course Prerequisites?

Ideally, you should have successfully completed gtslearning's "PC Fundamentals with CompTIA Strata" course or have some basic experience of using a PC and Windows, and browsing the web. Specifically, it is recommended that you have the following skills and knowledge before starting this course:

- Use a keyboard and mouse.
- Recognize the main components of a PC and different data media such as USB drives and DVD.
- Start the computer and navigate the desktop.
- Use Windows Explorer to create directories and subdirectories and manage files.
- Use Internet Explorer to view websites.

Optionally, you can take a prerequisites test to check that you have the knowledge required to study this course at the [gtslearning Freestyle](#) site accompanying this study guide (see below for details on registering).



## Course Outcomes

This practical "hands-on" course will teach you the fundamental principles of supporting desktop and portable computers and networks. As a PC technician, you will be expected to support old and new systems, so it is important that you have a full understanding of legacy hardware and software, as well as the latest technologies.

On course completion, you will be able to:

- Identify types and characteristics of PC and laptop components, including motherboard, CPU, memory, and storage, input, and output devices.
- Install and configure peripheral devices and system components.
- Install and configure print devices.
- Install and configure wired and wireless LAN links and internet access devices.
- Perform basic PC maintenance while working safely and responsibly.
- Communicate effectively with customers.

### How Certification Helps Your Career

Certification proves you have the knowledge and skill to solve business problems in virtually any business environment. Certifications are highly valued credentials that qualify you for jobs, increased compensation, and promotion.

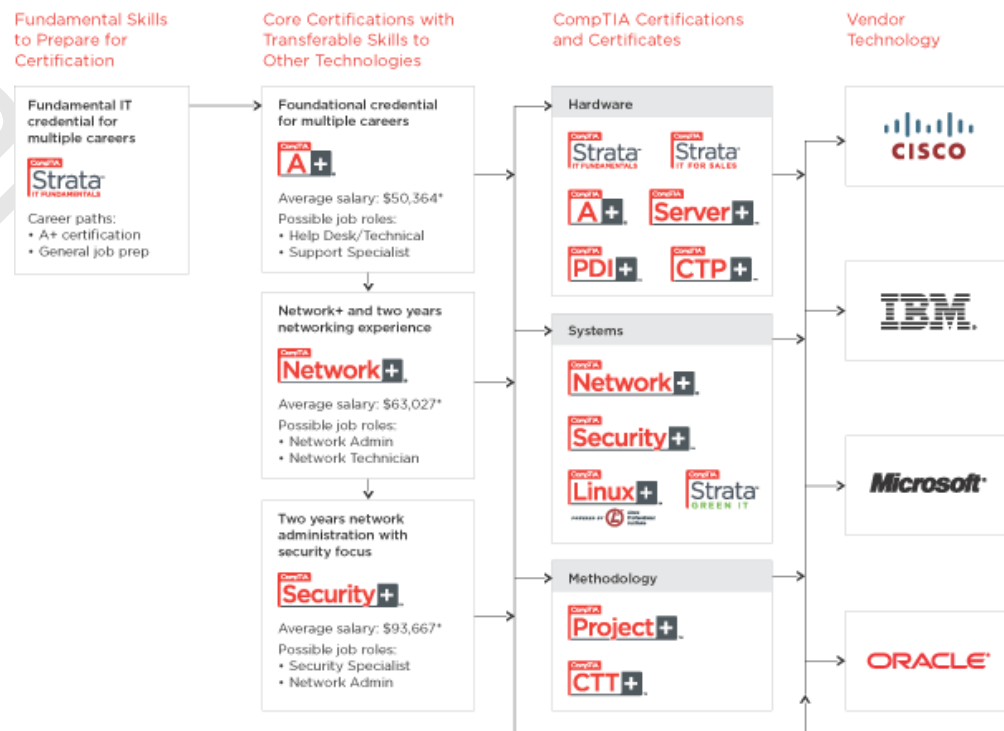


CompTIA A+ certification is held by many IT staff in organizations. Worldwide, more than 800,000 individuals are CompTIA A+ certified and 31% of IT staff within a random sampling of US organizations within a cross section of industry verticals hold A+ Certification.

Indeed, A+ Certification is often a prerequisite qualification for employment and is mandated or recommended by many leading computer manufacturers and vendors, such as Cisco and HP and Ricoh, the US State Department, and US government contractors such as EDS, General Dynamics, and Northrop Grumman.

## CompTIA Career Pathway

Completing this course will help you to pursue a career in computer and network support. This course will particularly benefit you in pursuing a career in supporting desktop personal computer users, in job roles such as Support Engineer, Maintenance Engineer, Desktop Engineer, Computer Administrator, or PC Support Analyst. CompTIA offers a number of credentials that form a foundation for your career in technology and allow you to pursue specific areas of concentration. Depending on the path you choose to take, CompTIA certifications help you build upon your skills and knowledge, supporting learning throughout your entire career.



\*Source: Computerworld Salary Survey 2010—U.S. salaries only

Study of the course can also help to prepare you for other, similar technical support qualifications and act as groundwork for more advanced training. Other qualifications available include:

- **CompTIA Network+** - a foundation-level certification of competency in network installation and configuration.
- **CompTIA Server+** - validates the skills of advanced IT technicians (individuals with 18-24 months' experience with Industry Standard Server Architecture [ISSA]).
- **CompTIA Security+** - validates knowledge of communication security, infrastructure security, cryptography, operational security, and general security concepts.
- **Cisco Certified Network Associate (CCNA)** - a foundation-level certification of competency in Cisco networking appliance installation and configuration.
- **Microsoft Certified Solutions Expert (MCSE)** - Windows-specific qualifications covering support and design of client and server infrastructure, as well as other Microsoft technologies.

## About the Course Material

The course material has been prepared as an aid for your use throughout the training course. We hope you will also find the course material useful for future reference.

The course comes in two parts. This "Study Notes" volume contains the main text of the book for you to refer to in class and to review at home as you prepare for the exam. The course text is divided into several **modules**, each covering a different subject area. Each module is split into a series of **units** containing related topics for study. Each unit has a set of review questions designed to test your knowledge of the topics covered in the unit. At the back of the "Study Notes" volume there is an index to help you look up key terms and concepts from the course.

The accompanying "Labs and References" volume contains a list of the CompTIA **certification objectives** (and where in the study notes you can find useful material to prepare for each objective), tips for taking the CompTIA exams, the practical **labs** for you to complete in class, **answers** to the end of unit review questions, and a **glossary** of terms and concepts used in computer support.



*If you are viewing this course as an ebook, the "Labs and References" volume is located after the index - use the bookmarks panel to navigate between sections.*

## Integrated Video Training from Professor Messer

Professor Messer has long been a web hero for CompTIA certification students. With professionally-produced lessons covering the full exam objectives and online forums, Professor Messer is a trusted online source for exam information. Professor Messer uses gtslearning's CompTIA certification courseware to develop and record his popular video training sessions. Now you can easily follow along with his video presentations using the links provided in this course book. You can use the links in three ways:

- 1) If you have an ebook, just click the link to open the video in your browser.
- 2) If you have a QR code scanner, point your camera at the code to open it in your phone or tablet's browser.
- 3) If you have a printed book but no scanner, enter `gtsgo.to/` followed by the code printed under the QR graphic into your browser. For example, to access the code shown above and open gtslearning's home page, enter `gtsgo.to/pk28w`.








*We do endeavor to keep the video links up-to-date, but if you come across a broken link, please email the link code (for example "pk28w") to [support@gtslearning.com](mailto:support@gtslearning.com) and we will update it.*

## Course Conventions and Icons

The following conventions have been used in this course. These are especially useful for following the practical lab exercises.

- Bullet and number lists - steps for you to follow in the course of completing a task or hands-on exercise and review questions are indicated by *numbered* bullet points. *Other* bullet points indicate learning objectives and feature lists.
- File and command selection - in the labs, files, applets, dialogs and other information that is displayed on the screen by the computer is shown in sans serif bold. For example: Click **OK**, Select **Control Panel**, and so on.
- Sequences of commands - in the labs, a sequence of steps to follow to open a file or activate a command are shown in bold with arrows. For example, if you need to access the system properties in Windows, this would be shown in the text by: **Start > Control Panel > System**.
- Commands - commands or information that you must enter using the keyboard are shown in Courier New Bold. For example: Type **webadmin@somewhere.com**. Courier New Bold-Italic represents some sort of variable, such as your student number. For example, if your student number is "5", you would follow the instruction **ping 10.0.0.x** by entering **ping 10.0.0.5**.
- Using the mouse - when instructed to click, use the main mouse button; when instructed to alt-click, use the secondary button (that is, the button on the right-hand side of the mouse, assuming right-handed use). Sometimes you need to use both the keyboard and the mouse - for example, **Ctrl+click** means hold down the **Ctrl** key and click the main mouse button.

The following symbols are used to indicate different features in the course book:

Icon	Meaning
	A tip or warning about a feature or topic.
	A reference to another unit, where more information on a topic can be found.
 pk28w	A link to a Professor Messer video presentation. Click or use a QR scanner to open the link or enter <b>gtsgo.to/</b> followed by the code printed under the QR graphic into your browser.
	Review questions to help test what you have learned.
	A hands-on exercise for you to practice skills learned during the lesson.

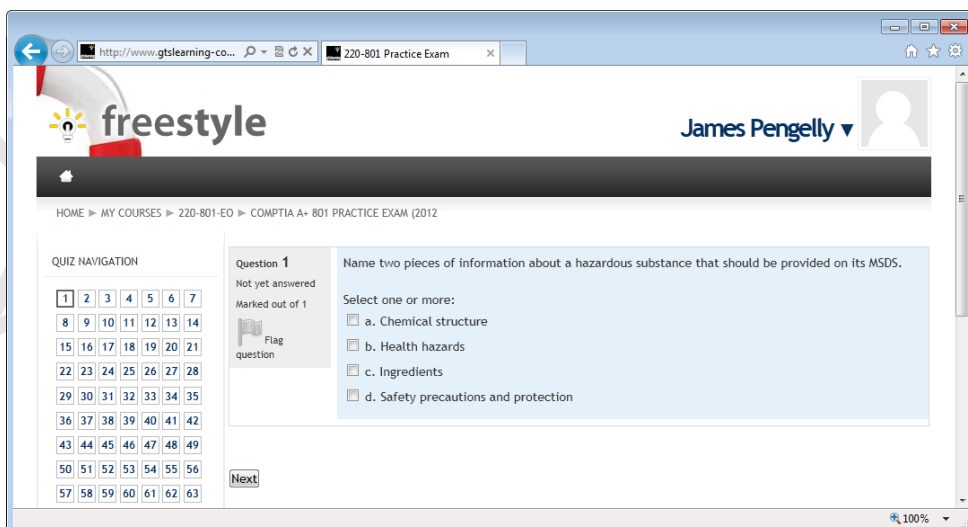
Your instructor edition is identical to the student edition, except that there are notes to help you deliver the course in the margins and the answers to the review questions are always shown.



This icon denotes a slide to accompany the text.

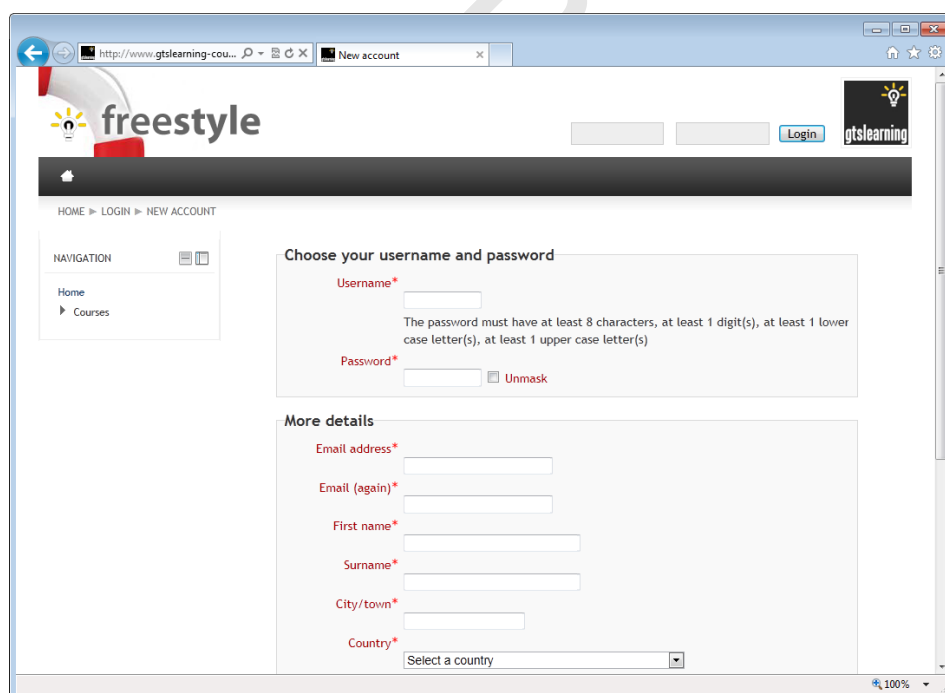
## Freestyle Support Site

gtslearning's **Freestyle** support site hosts study resources such as a prerequisites test and practice exam.



*Get tests and practice exams to accompany the course at gtslearning's Freestyle site*

- 1) Ask your training provider for the course enrollment key:  
\_\_\_\_\_
- 2) Visit the Freestyle site ([gtsgo.to/oup4x](http://gtsgo.to/oup4x)) and click the **Create new account** button.



*Creating an account*

- 3) Complete the sign-up process. You will need to validate the account using your email address.
- 4) When you have validated your account, open [gtsgo.to/9nz8x](http://gtsgo.to/9nz8x) and log in if necessary.
- 5) Enter your enrollment key to get access to the course resources.

## Content Seal of Quality

This courseware bears the seal of **CompTIA Official Approved Quality Content**. This seal signifies this content covers 100% of the exam objectives and implements important instructional design principles. CompTIA recommends multiple learning tools to help increase coverage of the learning objectives. The contents of this training material were created for the CompTIA **A+ Certification 220-801** exam covering the **2012 Edition** exam objectives and content examples.



*It is CompTIA's policy to update the exam regularly with new test items to deter fraud and for compliance with ISO standards. The exam objectives may therefore describe the current "Edition" of the exam with a date different to that above. Please note that this training material remains valid for the stated exam code, regardless of the exam edition. For more information, please check the FAQs on CompTIA's website ([support.comptia.org](http://support.comptia.org)).*

## Four Steps to Getting Certified

This training material can help you prepare for and pass a related CompTIA certification exam or exams. In order to achieve CompTIA certification, you must register for and pass a CompTIA certification exam or exams. In order to become CompTIA certified, you must:

- 1) Review the certification objectives at [www.comptia.org/certifications/testprep/examobjectives.aspx](http://www.comptia.org/certifications/testprep/examobjectives.aspx) to make sure you know what is covered in the exam.
- 2) After you have studied for the certification, take a free assessment and sample test from CompTIA at [www.comptia.org/certifications/testprep/practicetests.aspx](http://www.comptia.org/certifications/testprep/practicetests.aspx) to get an idea what type of questions might be on the exam. You can also use gtslearning's free practice tests on Freestyle ([gtsgo.to/9nz8x](http://gtsgo.to/9nz8x)).
- 3) Purchase an exam voucher on the CompTIA Marketplace, which is located at [www.comptiastore.com](http://www.comptiastore.com).
- 4) Select a certification exam provider and schedule a time to take your exam. You can find exam providers at [www.comptia.org/certifications/testprep/testingcenters.aspx](http://www.comptia.org/certifications/testprep/testingcenters.aspx)

Visit CompTIA online - [www.comptia.org](http://www.comptia.org) to learn more about getting CompTIA certified. Contact CompTIA - call 866-835-8020 ext. 5 or email [questions@comptia.org](mailto:questions@comptia.org).



# Module 1 / Peripherals and Adapters

## Delivery Tips

The exams no longer have official names but 801 collects most of the hardware topics together while 802 is more focused on the OS.

Each module in the course is designed to correlate to one training day, though you may wish to adjust timings depending on the students' level of existing knowledge and experience.

PC Hardware accounts for 40% of the exam. This content is covered in the first two modules (excepting a few network and wireless content examples, which are dealt with in the Networking module). This module starts with safety procedures then looks at the PC case and motherboard before reviewing the various peripheral and expansion bus technologies.

Make sure students know the functions of the main components of the PC and about the main technologies and standards. When preparing for the exam they should make sure to learn facts such as data transfer rates, cable lengths, pin numbers, and so on.

If you have any queries or suggestions to make about the course, please email them to [trainer@gtslearning.com](mailto:trainer@gtslearning.com)

A+ Certification 220-801 Domain Areas	% of Exam
1.0 PC Hardware	40%
2.0 Networking	27%
3.0 Laptops	11%
4.0 Printers	11%
5.0 Operational Procedures	11%

Unit	Domain Objectives / Examples
1.1 Safety Procedures	<b>5.1 Given a scenario, use appropriate safety procedures.</b> <i>ESD straps • ESD mats • Self-grounding • Equipment grounding • Personal safety (Disconnect power before repairing PC, Remove jewelry, Lifting techniques, Weight limitations, Electrical fire safety, Cable management) • Compliance with local government regulations</i>
1.2 Motherboard Components	<b>1.2 Differentiate between motherboard components, their purposes, and properties.</b> <i>Sizes (ATX, Micro-ATX, ITX) • RAM slots • CPU sockets • Chipsets (Northbridge, Southbridge, CMOS battery) • Jumpers • Power connections and types • Fan connectors • Front panel connectors (USB, Audio, Power button, Power light, Drive activity lights, Reset button)</i>
1.3 Power Supplies	<b>1.8 Install an appropriate power supply based on a given scenario.</b> <i>Connector types and their voltages (SATA, Molex, 4/8-pin 12v, PCIe 6/8-pin, 20-pin, 24-pin, Floppy) • Specifications, Wattage, Size, Number of connectors, ATX, Micro-ATX • Dual voltage options</i>
1.4 Connection Interfaces	<b>1.7 Compare and contrast various connection interfaces and explain their purpose.</b> <i>USB connections (1.1 vs. 2.0 vs. 3.0, Speed and distance characteristics, Connector types: A, B, mini, micro) • Firewire connections (400 vs. Firewire 800 speed and distance characteristics) • Other connector types (Serial, Parallel, VGA, HDMI, DVI, Audio) • Analog vs. digital transmission (VGA vs. HDMI)</i>  <b>1.11 Identify connector types and associated cables.</b> <i>Display connector types (DVI-D, DVI-I, DVI-A, DisplayPort, RCA, HD-15 (DE-15, DB-15), BNC, Mini HDMI, RJ-45, Mini-Din-6) • Display cable types (HDMI, DVI, VGA, Component, Composite, S-video, RGB, Coaxial, Ethernet) • Device connectors and various connector pin-outs (USB, IEEE1394, SCSI, PS/2, Parallel, Serial, Audio) • Device cable types (USB, IEEE1394, SCSI [68pin vs. 50pin vs. 25pin], Parallel, Serial)</i>

Unit	Domain Objectives / Examples
1.5 Peripherals and Expansion Slots	<b>1.2 Differentiate between motherboard components, their purposes, and properties.</b> <i>Expansion slots (PCI, PCI-X, PCIe, Mini PCI, CNR, AGP2x, AGP4x, AGP8x) • Bus speeds</i>
	<b>1.4 Install and configure expansion cards.</b> <i>Serial and parallel cards • USB cards • Firewire cards • Storage cards • Riser cards</i>
	<b>1.12 Install and configure various peripheral devices.</b> <i>Input devices (Mouse, Keyboard, Touch screen, KVM, Biometric devices, Game pads, Joysticks, Digitizer)</i>
1.6 Output and Multimedia Devices	<b>1.4 Install and configure expansion cards.</b> <i>Sound cards • Video cards • TV tuner cards • Video capture cards</i>
	<b>1.10 Given a scenario, evaluate types and features of display devices.</b> <i>Types (CRT, LCD, LED, Plasma, Projector, OLED) • Refresh rates • Resolution • Native resolution • Brightness/lumens • Analog vs. digital • Privacy/antiglare filters • Multiple displays</i>
	<b>1.12 Install and configure various peripheral devices.</b> <i>Input devices (Microphone) • Multimedia devices (Digital cameras, Microphone, Webcam, Camcorder, MIDI enabled devices) • Output devices (Speakers, Display devices)</i>



# Module 1 / Unit 1

## Safety Procedures

### Objectives

On completion of this unit, you will be able to:

- Understand safety procedures for dealing with hazards associated with PC support.
- Use procedures and tools to reduce the risk of ESD damage when handling computer components.
- Identify appropriate disposal methods for waste equipment.

### Health and Safety Laws



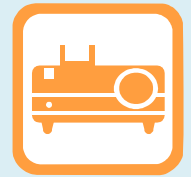
When performing PC maintenance work, you may need to take account of **compliance with local government regulations**. Regulations that typically affect PC maintenance or the installation of new equipment are:

- Health and safety laws - keeping the workplace free from hazards.
- Building codes - ensuring that fire prevention and electrical systems are intact and safe.
- Environmental regulations - disposing of waste correctly.

While specific regulations may vary from country to country and state to state, in general *employers* are responsible for providing a safe and healthy working environment for their employees. *Employees* have a responsibility to use equipment in the workplace in accordance with the guidelines given to them and to report any hazards. Employees should also not interfere with any safety systems, including signs or warnings or devices such as firefighting equipment. Employees should not introduce or install devices, equipment, or materials to the workplace without authorization or without making a health and safety assessment of the installation.

A company's health and safety procedures should be set out in a handbook, possibly as part of an employee's induction handbook. Health and safety procedures should:

- Identify what to do in the event of a fire or other emergency.
- Identify responsible persons (for example, for overall health and safety, nominated first aiders, fire marshals, and so on).
- Identify hazardous areas in the workspace and precautions to take when entering them.



#### Delivery Tips

*Focus on electrical safety and ESD and appropriate countermeasures.*

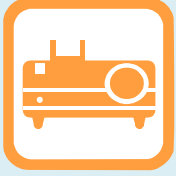
#### Timings

*Theory & Review Questions - 30 minutes*

*Labs - 15 minutes*



*As an example, discuss what Health and Safety procedures are in place in the training center.*



*You need to stress that this is a general procedure - there is no list of responses that are appropriate for different situations. A degree of common sense is required.*

*The most important thing is to keep calm.*



*Remember that you should not touch someone if they are connected to a live circuit. Also, if someone has been shocked, their muscles may go into spasm.*

- Describe best practice for use and care of the workspace and equipment within it.
- Establish an incident reporting procedure for detecting and eliminating workplace hazards and accidents.

The general procedure for an emergency situation is as follows:

- 1) Raise the **alarm** and contact the **emergency services**, giving them a description of the emergency and your location.
- 2) If possible, make the scene **safe**. For example, if faced with a fire, establish that you have an escape route or if faced with electrical shock, disconnect the power (if it is safe for you to do so).
- 3) If you have **training** and it is **safe** to do so, do what you can to **tackle** the emergency (for example, give first aid or use firefighting equipment).

Of course, circumstances could dictate that you do something differently. It is vital that you keep calm and do not act rashly.

## Electrical Safety

Electrical equipment can give an **electric shock** if it is broken, faulty, or installed incorrectly. An electric shock can cause severe burns or even kill. Electrical currents can pass through metal and most liquids, so neither should be allowed to come into contact with any electrical device installations.



*Always disconnect electrical equipment such as PCs and printers from any power sources (including removing laptop batteries) before cleaning or servicing.*

Damaged components or cables are also a risk and should be replaced or isolated immediately. It is important to test electrical devices regularly (the frequency will depend on the environment in which the device is used).

**Portable Appliance Testing (PAT)** carried out by a qualified electrician or technician ensures that a device is safe to use.

An electrical device must be fitted with a **fuse** appropriate to its power output. A fuse blows if there is a problem with the electrical supply, breaking the circuit to the power source. Fuses come in different ratings, such as 3A, 5A, and 13A. A device's instructions will indicate what rating of fuse to use, but most computer equipment is rated at 3A or 5A. If the fuse fitted is rated too low, it will blow too easily; if the rating is too high, it may not blow when it should (it will allow too much current to pass through the device).

If multiple devices need to be attached to a single power point, an appropriate **strip** of sockets should be used. If too many devices are attached to a single point, there is a risk that they will overheat and cause a fire.

"Daisy-chaining" one strip to another is not recommended. Strips may be fitted with a **surge suppressor**, which provides some protection for equipment against surges in the supply.



Overloaded (left) and properly used power strips

## Equipment Grounding

Electrical equipment must also be grounded (or earthed). If there is a fault that causes metal parts in the equipment to become live, a ground provides a "path of least resistance" for the electrical current to flow away harmlessly. Most computer products (PCs, printers, and so on) are connected to the building ground via the power plug. However, the large metal equipment racks often used to house servers and network equipment must also be grounded. Do not disconnect the ground wire. If it has to be removed, make sure it is replaced by a competent electrician.

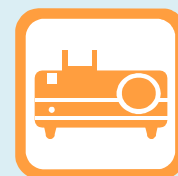
## Personal Safety

The human body is an electrical conductor and a resistor, so a current will pass through it and make it heat up, manifesting as a burn if the current is strong enough. A current can interfere with the body's nervous system, which also uses electrical signals. This might manifest as spasm or paralysis (an electric shock) or in a severe case cause a heart attack.



*High voltages (over about 30V) are more dangerous because they have the power to push more current through you (skin's resistance drops dramatically at higher voltages), but it is the current that causes the actual damage (this is why static electricity is not dangerous to you, despite the high voltages). More current will flow if a larger area of your body is exposed.*

- Do not work on electrical systems (especially an energized circuit) unless you have a good understanding of the risks and appropriate safety procedures.
- Disconnect the power to a circuit if you must handle it and always test live parts with a multimeter to ensure that no voltage is present.





*Before performing work within a PC, always remove the power cord. After removing the cord, hold down the power button for a few seconds to ensure that the circuits are de-energized. Similarly, before opening the chassis of a laptop, remove the AC adapter and the battery.*

- Always use properly insulated tools and never grip a tool by its metal parts.



*It is especially important not to touch the live parts of multimeter probes, as these may be connected to an energized circuit. Handle the probes by the insulated sheaths only.*

- Take care not to touch any part of a circuit with both hands to reduce the risk of a serious shock (the "hand in pocket" rule - this reduces the chance that the current will pass through your chest).
- Make sure your hands and the surrounding area are dry (sweat can make your hands more conductive). Do not leave any spill hazards in the vicinity.
- Do not wear jewelry or a wrist watch or other items such as name badges that may dangle from your neck or wrist and cause a short circuit or become trapped by moving parts.

## CRT Safety

Power supplies such as those inside the system unit, CRT monitors, LCD displays (inverter), and laser printers can carry extremely high levels of voltage. Charges held in capacitors can persist for hours after the power supply is turned off. You should not open up these units unless you have been specifically trained to do so. Adhere to all printed warnings, and never remove or break open any safety devices that carry such a warning.

## Electrical Fire Safety

Faulty electrical equipment can pose a **fire risk**. If the equipment allows more current to flow through a cable than the cable is rated for, the cable will heat up. This could ignite flammable material close to the cable. If an electrical wire does start a fire, it is important to use the correct type of extinguisher to put it out. Many extinguishers use water or foam, which can be dangerous if used near live electrical equipment. The best type to use is a **Carbon Dioxide (CO<sub>2</sub>)** gas extinguisher<sup>1</sup>. CO<sub>2</sub> extinguishers have a black label. Dry powder extinguishers can also be used, though these can damage electronic equipment.

You should also ensure that the electricity supply is turned off. This should happen automatically (the fuses for the circuit should trip) but make sure you know the location of the power master switches for a building.

<sup>1</sup> Care must be taken in confined spaces as the CO<sub>2</sub> plus smoke from the fire will quickly replace the available oxygen making it hard to breathe.

# Cable Management and Lifting Techniques

A **trip hazard** is caused by putting any object in people's path. When installing equipment, ensure that cabling is secured, using cable ties or **cable management** products if necessary. Check that cables running under a desk cannot be kicked out by a user's feet. Do not run cabling across walkways.

When servicing equipment, do not leave devices (PC cases for instance) in walkways or near the edge of a desk (where it could be knocked off). Be careful about putting heavy or bulky equipment down (ensure that it cannot topple).



*Built-in cable management such as on this HP LCD display make it less likely trailing wires will cause an accident*

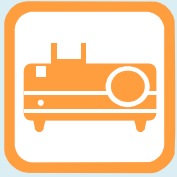
Lifting a heavy object in the wrong way can damage your back, but lifting and manual handling risks are not limited to particularly heavy objects. An object that is large or awkward to carry could cause you to trip over or walk into something else. An object that has sharp or rough edges or contains a hot or corrosive liquid could cause you to cut or hurt yourself. If necessary, you should obtain protective clothing (gloves and possibly goggles).

To lift a heavy object safely, plant your feet around the object with one foot slightly toward the direction in which you are going to move. Bend your knees to reach the object while keeping your back as straight as is possible and comfortable and your chin up. Find a firm grip on the object then lift smoothly by straightening your legs - do not jerk the object up. Carry the object while keeping your back straight. To lower an object, reverse the lifting process; keep your chin up and bend at the knees. Take care not to trap your fingers or to lower the object onto your feet.

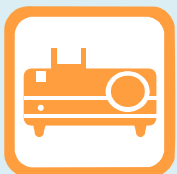
If you cannot lift an object because it is too awkward or heavy, get help. If you need to carry an object for some distance, make sure that the route is unobstructed and that the pathway (including stairs or doorways) is wide and tall enough.







Students taking the exam may need to know what effect the climate has on ESD.



# Static Electricity and ESD



Static electricity is a very high-voltage (potential difference) stored in an insulated body. Although the voltage is high, the amount of **ElectroStatic Discharge (ESD)** current that it can sustain is very low so static electricity is not that harmful. It can, however, be slightly painful; you may have felt a small shock when reaching for a metal door handle<sup>2</sup>.

The human body is mostly water and so does not generate or store static electricity very well. Unfortunately, our clothes are often made of synthetic materials, such as nylon and polyester, which act as good generators of static electricity and provide insulating layers that allow charges to accumulate. Humidity and climate also affect the likelihood of ESD. The risk increases significantly during dry, cool conditions when humidity is low. In humid conditions, such as before or during a storm, the residual charge will bleed into the environment before it can increase sufficiently to be harmful to electrical components.

An electronic component, such as a memory or logic chip, is composed of fine, conductive metal oxides deposited on a small piece of silicon. Its dimensions are measured in fractions of a micron (one millionth of a millimeter). Any static electricity discharged into this structure will flash-over (spark) between the conductive tracks, damaging or even vaporizing them<sup>3</sup>. This may make the chip completely unusable. If not, it is likely to fail at some later time. Damage occurring in this way can be hidden for many months and may only manifest itself in occasional failures.

To protect components and equipment from ESD damage, make sure that your body and clothing are drained of static electricity before starting work. If possible, work in an uncarpeted area. The simplest (but least effective) means of **self-grounding** is to touch an unpainted metal part of the PC (such as the power supply unit) before you handle a sensitive component. This is only a temporary solution and a static charge could build up again.



**Do not leave the PC plugged in if you open the case for servicing. Your safety is more important than the risk of damaging some PC components.**

Where possible, handle vulnerable components by holding the edges of the plastic mounting card and avoid touching the surfaces of the chips themselves.

Using an **anti-ESD wrist strap** can dissipate static charges more effectively. The wrist band should fit snugly around your wrist to maximize contact with the skin. Do not wear it over clothing. The wrist strap ground is made either using a grounding plug that plugs into a wall socket or a crocodile clip that attaches to a grounded point or an unpainted part of the computer's metal chassis.

<sup>2</sup> You can feel a discharge of over about 2500V. A discharge of 20,000V or more could produce a visible spark. Walking over an untreated carpet in dry conditions could create a charge of around 35,000V.

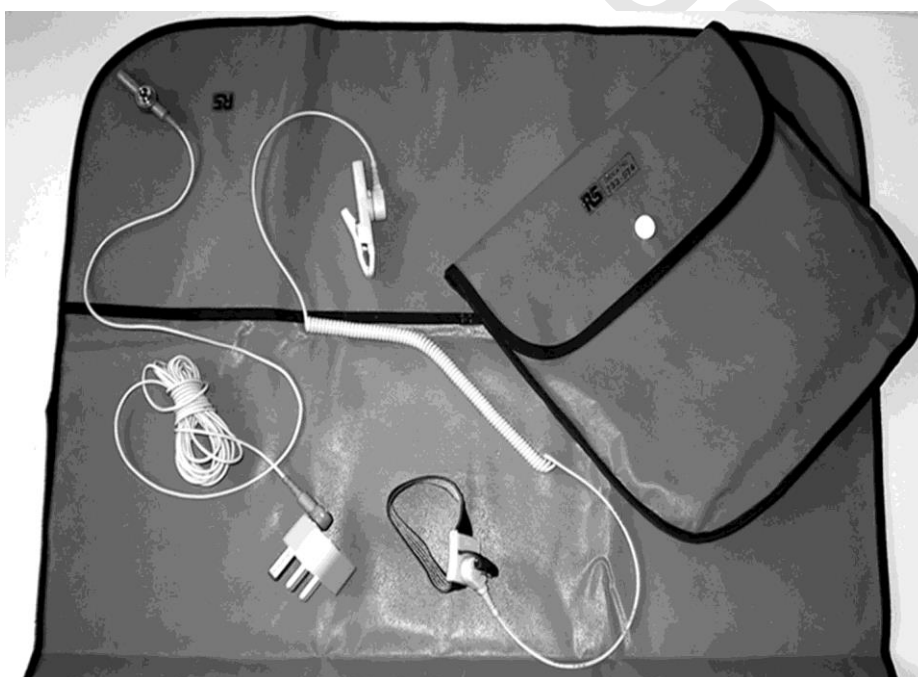
<sup>3</sup> A transistor designed to work with 1-3V can be damaged by a charge of under 100V (though most have ESD protection circuits that improves this tolerance). CMOS can typically withstand a charge of 2000-5000V.



Anti-ESD wrist strap and grounding cord

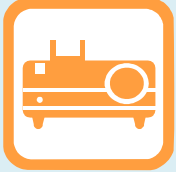


*Ensure that the strap has a working current-limiting resistor for safety (straps should be tested daily). Do not use a grounding plug if there is any suspicion of a fault in the socket or in the building's electrical wiring or if the wiring is not regularly inspected and tested.*



Anti-ESD service kit with mat

An anti-ESD service mat is also useful. Sensitive components can be placed on the mat safely.



Run lab 1 after completing the review questions with the students.



### **Review Questions / Module 1 / Unit 1 / Safety Procedures**

Answer the following questions. The correct answers are in the accompanying "Labs and References" manual.

- 1) What component helps to protect users of electrical equipment against a short circuit?  
**A fuse.**
- 2) What care should you take when lifting a heavy object?  
**The main concern is damaging your back. Lift slowly using your legs for power not your back muscles.**
- 3) What should you do before transporting a bulky object?  
**Check that there is a clear path to the destination point. If you cannot carry the object safely, get help.**
- 4) In which atmospheric conditions is the risk of ESD highest?  
**During cool, dry conditions when humidity is low. When humidity is high, the static electricity can dissipate through the moisture present in the air.**
- 5) Will damage caused to a chip by ESD be immediately apparent?  
**Not necessarily. It is sometimes not apparent until some time later, when the chip becomes unstable.**
- 6) Describe the equipment you should use to prevent static electricity on your body from damaging the equipment on which you are working:  
**An anti-ESD service kit comprised of an anti-ESD wrist strap, grounding cord and plug, and a conductive mat. The grounding plug should be connected to an earthed point.**
- 7) If static electricity is not harmful to humans, why is it damaging to electronic components?  
**These components are designed to work at very low voltages; a static discharge is very high voltage. No damage occurs to humans because the current is very small but electronic circuits are more fragile.**
- 8) You have to service a PC but anti-static protection is not available. You know that you can ground yourself by touching the metal chassis of the PC, but should you do this before or after unplugging the PC from mains power?  
**For safety reasons, always unplug the PC from mains power before opening the case.**



# Module 1 / Unit 2

## Motherboard Components

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### Objectives

On completion of this unit, you will be able to:

- Identify different case types and how to access system components.
- Distinguish ATX, ITX, and proprietary motherboard form factors.
- Identify components of the motherboard and describe the functions of the chipset.

### System Case Types

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"Desktop computer" refers to a PC that is not designed to be used on the move. The components of a desktop computer system are divided between those that are designed to be handled by the user (**peripheral devices**) and those that would be damaged or dangerous if exposed.

The **system case** is a plastic and metal box that houses this second class of components, such as the motherboard, Central Processing Unit (CPU), memory, adapter cards, disk drives, and power supply unit. There are three basic types of system case (or **chassis**): **Desktop**, **Tower**, and **Small Form Factor (SFF)**. All these types are available in different **sizes**. Be aware that while a small case may be desirable because it takes up less space, it has less room inside for installing extra devices and is less effective at cooling.

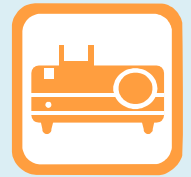
Up until a few years ago, PC cases were uniformly **beige**. As PCs are becoming integrated in home entertainment and companies become more image conscious about their office space, sleek black or chrome has become the preferred look.

### Desktop Case

A **desktop** case is designed to sit horizontally on a surface, so that it is wider than it is tall. If turned on its side, a CD-ROM or DVD tray would be oriented incorrectly. These are usually used for office or home PCs. Desktop cases come in two basic sizes: **standard** and **slimline**.

### Tower Case

A **tower** case is designed to sit vertically on a surface, so that it is taller than it is wide. Tower cases come in three basic sizes: full, midi, and mini.



#### Delivery Tips

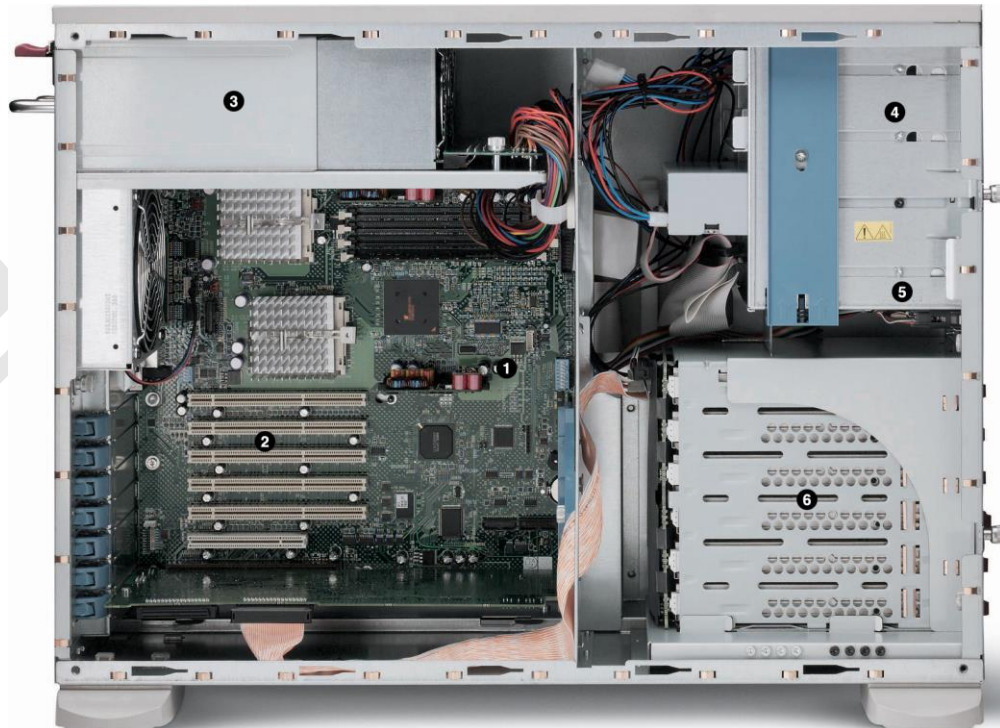
*Make sure students can distinguish between the latest technologies and those that they may only encounter on older PCs.*

#### Timings

*Theory & Review Questions - 45 minutes*



- **Full-tower** cases are usually used for PC servers - these require the extra internal space for additional hard disks, adapter cards, and redundant power supply units.
- **Midi-tower** cases are used for high-end user PCs. These PCs do require extra devices and adapter cards, but not as many as a server.



HP Compaq Proliant tower case (cover removed) showing 1) Motherboard; 2) Expansion slots; 3) Power supply; 4) 5.25" Drive bays; 5) Floppy disk drive bay; 6) 3.5" Drive bays (for hard drives)

- **Mini-tower** cases are usually used for office or home PCs where the requirement for additional internal devices and adapter cards is limited.

## Small Form Factor Cases

**Small Form Factor (SFF)** case designs are semi-portable, space-saving designs typically used for domestic entertainment "Media Center" systems that will not look out of place in a living room. They are usually cube-like or super slimline. SFF cases can only fit a limited number of components.



Shuttle XPC

## Matching Components to the Case

It is important to note that there are different system case design specifications to accommodate different motherboards and power supplies. **If you are building a PC, you must make sure that you buy a compatible case, motherboard, and power supply.**

Most PCs are based on the ATX case and power supply standard, but there are proprietary designs too, especially where SFF PCs are concerned.

## Disassembling a PC

PC components that are easily user-replaceable (or upgradeable) are referred to as **Field Replaceable Units (FRU)**. Due to economic factors, most units of a PC are not worth *repairing*; instead they are simply replaced with a new unit ("swapped out").

Before you start to disassemble a PC you should consider doing the following:

- Take a backup of the hard drive(s) to protect important data.
- Create a clean work environment with plenty of working space where you can set the PC at a comfortable height.
- Gather all necessary tools and equipment. A notepad and pen may be useful for making diagrams and notes. A digital camera is also useful for recording the layout of components.
- Make sure that all devices are powered off and disconnected from the mains before removing them.
- Take ESD precautions to minimize the chance of damaging static sensitive components. Always place static-sensitive equipment such as processors and memory in anti-static bags.

## Parts of the Case

The case has a **cover**, which is removed by either undoing the screws at the back or pressing together clips that release it. Cases based on the slimline design have a hinged cover that releases to allow access to the motherboard.

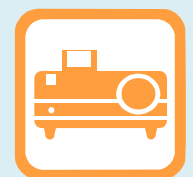


*Some cases feature tool-free access (that is, they are secured by clips). Some cases use proprietary screw fittings (to prevent unauthorized access to the internal components).*

The **front panel** provides access to the removable media drives, a power on/off switch, a reset switch, and LEDs (Light Emitting Diodes) to indicate drive operation. The front cover can be removed but may require the side panel to be removed first in order to access the screws or clips that secure it.



*Disassembling a PC to upgrade components such as RAM and CPU isn't actually a domain objective (though disassembling a laptop is). Nevertheless students must know how to do it.*

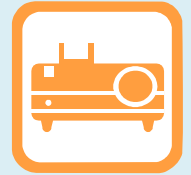




Front panel of an HP Pavilion PC: 1) CD-RW and CD-ROM drives (in 5" bays); 2) Spare 5" bays; 3) 3.5" floppy disk drive; 4) Flash memory card reader; 5) USB ports; 6) Video and audio input and output jacks; 7) Firewire port; 8) Power on/off switch

The **rear panel** has slots through which adapter card ports appear. These slots should either be covered by an **adapter card** or a metal strip known as a **blanking plate**. Uncovered slots can disrupt the proper flow of air around components in the PC and cause overheating and also increase the amount of dust in the system.





Rear Panel of HP Compaq PC: 1) Power Supply Unit with fan; 2) Chassis fan; 3) Motherboard I/O ports; 4) Expansion card slots (covered by blanking plates)

There are also slots through which the motherboard ports appear - such as parallel and serial ports. The rear panel provides access to the **Power Supply Unit (PSU)** sockets. The PSU has an integral fan exhaust - care should be taken that it is not obstructed, as this will adversely affect cooling.

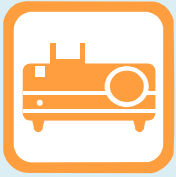
## Removing the System Case Lid

With the power cable removed, press and hold the power button for a few seconds. This should ensure that the circuits within the computer are completely de-energized. Find the screws that secure the lid to the system case and unscrew them. Some system case lids have clips instead of or as well as these screws. Remember to keep the screws in a secure place.



*The main panel is the one opposite the I/O ports. For example, in the system shown above, the main panel is on the right.*

Once the system case lid is removed, you can access the internal devices and begin to remove them. Other parts of the case (such as the front panel or second side panel) are usually removed using clips (accessible once the main side panel has been removed).



Students taking the exam may need to be able to identify all of the parts of the motherboard from a diagram.

If you have any exhibits of different motherboards you could pass them around at this point.

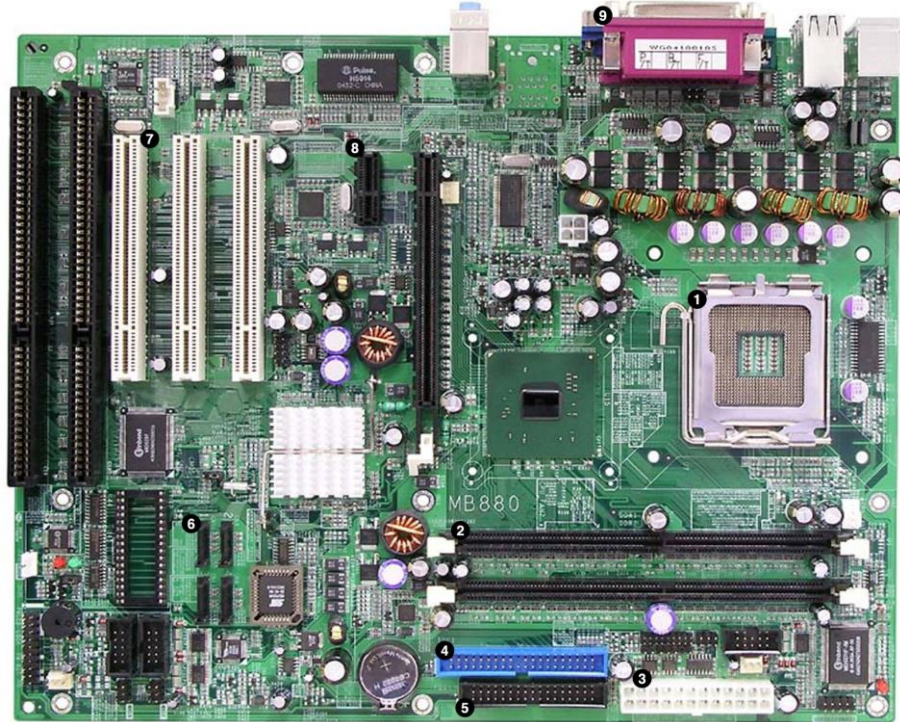


# Motherboard Layout



jk8h5

A printed circuit board (variously called the **motherboard**, "**mobo**", **system board**, or **main board**) houses the processor, chipset, memory, and expansion slots. The type of motherboard influences system speed and upgrade capabilities. There are a great many motherboard manufacturers, including Abit, AOpen (Acer), ASUSTek, Chaintech, Gigabyte, Intel, MSI, Shuttle, Tyan, and Via.



Intel ATX motherboard showing 1) CPU socket; 2) Memory slots; 3) Power connector; 4) PATA port; 5) Floppy drive port; 6) SATA ports; 7) PCI ports; 8) PCI Express ports; 9) I/O ports

## Motherboard Form Factor

The **form factor** of the motherboard describes its shape, physical layout, and the type of case and power supply that can be used. Two motherboards may have exactly the same functionality but different form factors; the difference is the layout of the components on the motherboard. Most motherboards are based on the ATX or Micro-ATX design.

You can obtain more information about motherboard form factors at [www.formfactors.org](http://www.formfactors.org).

The motherboard is attached to the case using **standoffs**. These hold the motherboard firmly and ensure it is electrically grounded. The standoffs are positioned in holes that line up in the same position in the case and the motherboard (so long as they use compatible form factors). Standoffs are either brass ones secured by screws or plastic ones that snap into place.

## ATX and Micro-ATX

The **ATX (Advanced Technology Extended)** specification was developed by Intel in 1995 to provide a new design for PC motherboards, updating the previous AT form factor. Full size ATX boards are 12" wide by 9.6" deep (or 305x244mm). The Micro-ATX standard specifies a 9.6" (244x244mm) square board, with fewer expansion slots (four compared to seven).

## Other Form Factors

**Small Form Factor (SFF)** PCs are becoming popular as home machines (and in image-conscious offices). Leading products include Shuttle's range of XPCs and Via's Mini-ITX form factor. Mini-ITX is 6.7x6.7" (170x170mm) with one expansion slot<sup>4</sup>.



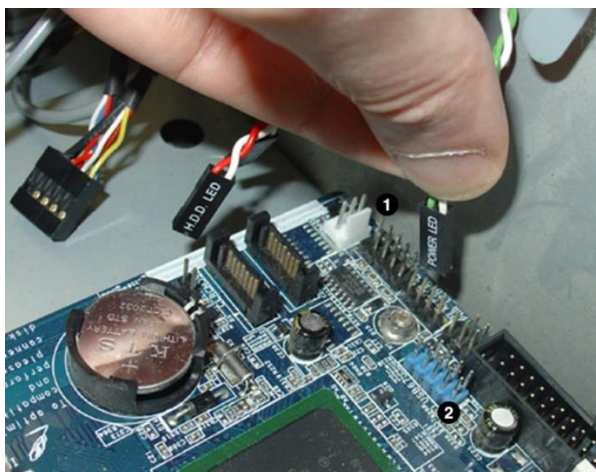
*Most Micro-ATX boards and Mini-ITX boards can be mounted in ATX cases.*



## Front Panel Connectors

Components on the front panel of the chassis connect to headers on the motherboard. Typically, front panel connectors can include:

- Power button / reset button (soft power) - on modern computers, the power button sends a signal to the PC that can be interpreted by the OS rather than actually switching the PC off. Holding down the power button for a few seconds will cut the power however. Some older computers might also feature a physical reset button in addition to a power button.
- Power light - there may be a separate power light (LED), though this is usually part of the button.



1) Front panel headers and 2) 9-pin internal USB header

- Drive (HDD) activity lights - these show when an internal hard disk is being accessed.
- USB ports - a computer will normally feature one or two front USB ports to connect peripherals, as well as more on the back. Internal USB connections are made via 9-pin headers, which accept up to two 4-pin port connections (the 9th pin is to orient the cable correctly).
- Audio ports - these allow headphones and a microphone to be connected to the computer.



<sup>4</sup> There are smaller nano and pico ITX form factors but these are used for embedded systems and portables rather than PCs and laptops.



When disassembling the system, you should have made a diagram of how these connectors are plugged in (position and orientation). If you do not have a diagram, you will have to refer to the motherboard documentation or go by any labels printed on the wires and headers. These are not always very easy to follow however, which is why you should always make a diagram (or take a digital photo) to refer to.

## Jumper Settings

When upgrading components such as the CPU, you may also have to change the position of **jumpers** on the motherboard. A jumper is a small plastic clip that fits over two contacts on the motherboard. The position of the clip completes a circuit that configures the motherboard in one way or another.



*There may also be a motherboard reset jumper. Setting this may allow you to restore the system from a failed BIOS update, forgotten BIOS supervisor password, and so on.*

## Power and Fan Connectors

The motherboard contains various connection points for the power supply and fans. The power connector is usually a 24-pin white block. Fan connectors are smaller. There will be one for the CPU and one or more for the case fans.



Typical power connectors on a Foxconn motherboard: 1) Main connector for the PSU (P1); 2) Fan connectors; 3) Dedicated CPU power (EPS12V); 4) AUX connector (for graphics card)



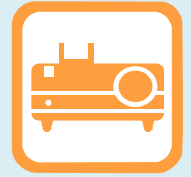
*Power supplies are covered in detail in Unit 1.3. Fan connector formats are discussed in Unit 2.4.*



# Bus Architecture

PCs are composed of many internal components, which communicate with each other using a **bus**. Physically, a bus is implemented on the motherboard as tiny wires (called **traces**) running between components. The bus carries information being processed by the computer (**data**) and information about where the data are located in memory (**address**). The bus also carries **power** to a component and the **timing signals** that synchronize components.

"Bus architecture" usually means an **expansion** bus, used to connect peripheral devices. However, a variety of buses exist within a PC. Also, the way that bus designs are implemented has changed considerably as PC technology has developed and improved.



*Note the key functions of the bus: addressing and data transfer plus timing signals and power.*

## Internal and External Buses

One way of categorizing types of bus is to divide them into *internal* and *external*. An internal (or local) bus connects core components, such as the CPU, memory, and the system controllers.

An external bus, or expansion bus, allows additional components to be connected to the computer. These components could be peripheral devices (located outside the case) or adapter cards (located inside the case).

"External" bus technologies do not necessarily extend outside the computer case. For example, PCI, the most popular expansion bus standard, provides connections to internal adapter cards only. A genuinely external bus (like SCSI, USB, or Firewire) extends the bus wires outside the computer case using cabling.

The distinction between internal and external bus types has also become a lot less clear as one bus *technology* will be used to perform both types of role (for example, PCI Express).

## System Clock and Bus Speed

The **system clock** synchronizes the operation of all parts of the PC and provides the basic timing signal for the CPU. Clock speeds are measured in Megahertz (MHz) or Gigahertz (GHz).

The clock consists of a **clock generator** that sets up a timing signal and **clock multipliers** that take the timing signal produced by the generator and apply a multiplication factor to produce different timing signals for different types of bus.

## Parallel and Serial Bus Types

Historically, most bus designs have used parallel technology. The width of a parallel bus (32-bit or 64-bit for instance) and the clock speed determine bandwidth (or transfer rates).



Note that this is all an overview - later units fill in the detail on CPUs, memory, I/O, peripherals etc

Recent bus designs, notably USB, Firewire, and PCI Express, use serial communications. The data rate for serial communications is based on the clock speed and encoding mechanism.

## Motherboard Components

All motherboards have connectors for the same sort of components: CPU, memory, disk drives, peripherals, and so on. However, the type and number of these connectors depends upon the models supported.



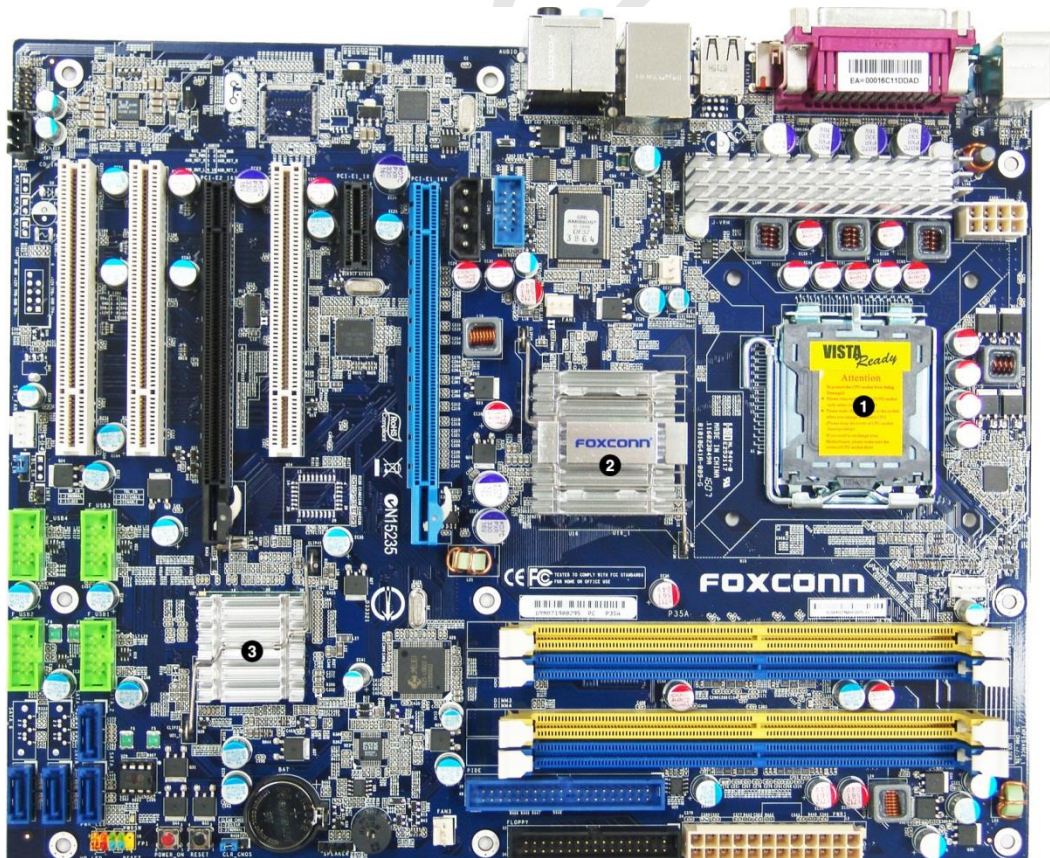
### CPU Socket and Chipset

New motherboards are generally released to support new CPU designs. Because technology changes rapidly, a given motherboard will only support a limited number of CPU models. The CPU is typically inserted into a squarish socket, located close to the memory sockets, and then covered by a heatsink and fan.



See Unit 2.4 for more information about CPUs and sockets.

The system **chipset** is soldered onto the motherboard and cannot be upgraded. The type of chipset on the motherboard can affect the type of processor, processor speed, and multiprocessing support, type and amount of system memory supported, and type(s) of system bus supported.



Foxconn motherboard with 1) CPU socket; 2) Northbridge chipset; 3) Southbridge chipset

The chipset consists of a number of controllers that handle the transfer of data between the CPU and various devices:

- System memory controller.
- PS/2 keyboard and mouse controller.
- An Input / Output (I/O) controller that handles serial ports, parallel ports, floppy disks, disk drives, and expansion buses.
- Controllers for any integrated video, sound, network (cabled and wireless), and SCSI interfaces.



*Intel and AMD manufacture all the CPUs used in PCs, but there are various chipset vendors. Some of the major names include ATI (now owned by AMD), nVIDIA, SiS, ULI, and VIA.*



g6zqa

## Chipset and Memory Architecture

CPU models are now closely tied to the chipset and memory subsystem. This means that there is far less scope for upgrading the CPU than used to be the case. You could not, for instance, take a motherboard designed for the Core 2 CPU and plug an AMD Phenom into it. Both the physical interface (socket) and system architecture have diverged along proprietary lines since the old socket 7 interface used by the original Pentiums.

The link between the CPU and system memory is a key factor in determining system performance. This link has been implemented using several different architectures over the years.

### Northbridge/Southbridge

In legacy PC motherboards, the chipset is split into two sections; the Northbridge and the Southbridge. The Northbridge can be one or more chips on the motherboard. Its main function is as the system memory controller, connecting the processor to RAM. The northbridge also supports other fast components, such as the AGP bus. The northbridge is connected to the processor through the Front Side Bus.

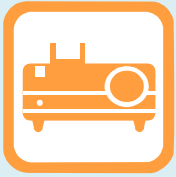
The Southbridge is usually one chip and is designed to control all of the I/O functions not handled by the northbridge (often older, slower technologies), such as USB, serial, parallel, ISA bus, PCI bus, system BIOS, disk controllers, and onboard audio or network adapters. The southbridge is connected to the CPU via the northbridge (usually via the PCI bus).

### Developments from Northbridge/Southbridge

As video and hard disk technologies improved, the shared PCI bus linking northbridge and southbridge became a bottleneck to performance. Newer CPUs and chipsets use different designs, with Intel and AMD both introducing different architectures.







Memory slots and technologies will be covered in more detail later in the course.

The general trend is for subsystems that require a lot of bandwidth - notably the system memory controller and graphics controller - to be incorporated on the same chip as the CPU itself (referred to as "on die").



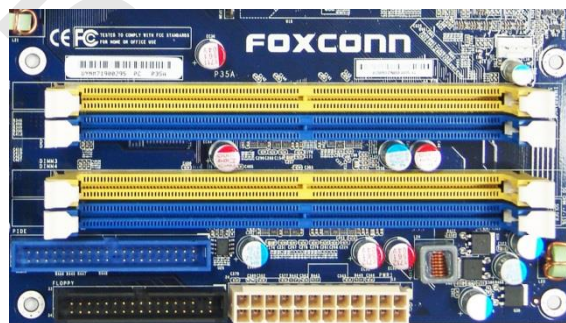
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## Memory

PC memory can be categorized as **RAM** or **ROM**, each of which perform different functions within the PC. A motherboard will generally have between 2 and 4 slots for installation of system RAM. It also houses a ROM BIOS chip.

## System RAM Slots

**Random Access Memory (RAM)** is the working memory of the PC. Program code is loaded into RAM so that it can be accessed and executed by the processor. RAM also holds data (for example, the contents of a spreadsheet or document), while it is being modified. System RAM is **volatile**; it loses its contents when power is removed. System RAM is normally packaged as **Dual Inline Memory Modules (DIMM)** fitted to motherboard sockets<sup>5</sup>. The type of sockets and chipset determine what types of system memory can be installed. The capabilities of the memory controller and number of physical sockets determine how much memory can be fitted.



DIMM system memory slots on a Foxconn motherboard

**Flash memory** is a *non-volatile* type of RAM increasingly used in place of or alongside hard disks for persistent storage of data.



System memory is covered in detail in Unit 2.3 while solid state flash memory drives are covered in Units 2.1 and 2.2.



qrku5

## ROM BIOS

The **BIOS (Basic Input / Output System)** provides the industry standard program code that operates the fundamental components of the PC and ensures that the design of each manufacturer's motherboard is PC-compatible.

BIOS code is manufacturer-specific; therefore BIOS chips cannot be swapped between different motherboards. However, most use **Flash ROM**, which can be upgraded. The BIOS is often known as **firmware** as it consists of both the physical chip (hardware) and the programs coded into it (software).

<sup>5</sup> You may see references to Single Inline Memory Module (SIMM). This format was the precursor of DIMMs but has been obsolete since the mid-1990s.



The ROM BIOS can be identified by a label on the chip showing the name of the manufacturer and a version number or (in Windows) via the System Information (**msinfo32**) utility.



ROM BIOS chip

The BIOS also provides the following features:

- The **Power-on Self-Test (POST)** diagnostic tests for the PC.
- A **Real Time Clock (RTC)** that keeps track of the current date and time.
- Setup menus that allow the low-level hardware configuration settings of a PC (stored in **CMOS RAM**) to be viewed and edited.

## CMOS RAM

CMOS RAM stores the PC's basic configuration (for example, disk types, amount of memory installed, current time and date). This prevents the need for reconfiguration when powering on a PC.

CMOS stands for **Complementary Metal-Oxide Semiconductor**, which describes the manufacturing process used to make the RAM chip. CMOS devices require very little power to operate and use a small battery to maintain their settings. The CMOS battery is a coin cell lithium battery.



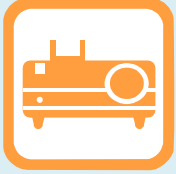
CMOS coin cell battery (non-rechargeable CR2032 lithium battery)

## Expansion Slots

Expansion slots allow plug-in adapter cards to be installed in a computer to extend the range of functions it can perform. There are a number of different expansion bus types and many different types of adapter card.



*Expansion slots and adapter cards are covered in more detail in Unit 1.5.*



### ***Review Questions / Module 1 / Unit 2 / Motherboard Components***

---

Answer the following questions. The correct answers are in the accompanying "Labs and References" manual.

- 1) At the rear of a system case are slots for adapter card ports. Why should these be covered with blanking plates if not in use?  
**The fan system is designed to draw cool air across the motherboard and blow out warm air - large holes in the chassis disrupts this air flow. Also dust will be able to settle on the system components more easily.**
- 2) True or false? The Real Time Clock controls the timing of signals between the CPU and other components.  
**False - the system clock controls timing; the Real Time Clock keeps track of the calendar date and time.**
- 3) What is the main function of the chipset?  
**Provides controllers for the CPU to interface with other components (memory and expansion bus for instance) and adapters to provide functions such as video and audio, and Ethernet and wireless networking on the motherboard.**
- 4) What type of socket is used to install system memory?  
**DIMM.**
- 5) Apart from addressing and data transfer, what are the other functions of a bus?  
**Carry power and timing signals to a component.**
- 6) Describe how you would open a PC case to access the motherboard.  
**Remove the main panel - that is the one opposite the ports at the rear. Most cases support tool-free access. This should expose the motherboard. You would only usually need to remove other panels to access storage devices.**
- 7) If you want to build the smallest system you can, should you choose a Micro-ATX or Mini-ITX motherboard?  
**Mini-ITX is smaller (6.7" square compared to 9.6" square).**
- 8) How many expansion slots does a Micro-ATX board support?  
**Four.**
- 9) You have been servicing a computer but when you have finished you find that it will not turn on. There was no power problem before and you have verified that the computer is connected to a working mains socket. What is the most likely explanation?  
**The cable connecting the power button to the motherboard could have been disconnected and either not reconnected or not properly reconnected.**

# Index

Where a term or phrase is abbreviated, the abbreviation is the form listed in the index. Note that index references are made to the nearest main heading for the topic in which the term appears.

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801 Support Skills**

Instructor Edition  
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# CompTIA A+ 801 Exam Objectives

The material in this course will help you to learn and practice the CompTIA **A+ Certification 220-801** exam covering the **2012 Edition** exam objectives and content examples.



*It is CompTIA's policy to update the exam regularly with new test items to deter fraud. The exam objectives may therefore describe the current "Edition" of the exam with a date different to that of the objectives. Please note that this training material remains valid for the specified exam code, regardless of the exam edition.*

The following tables list where the domain objectives of the 801 exam are covered in this course.

A+ Certification 220-801 Domain Areas	% of Exam
<b>1.0 PC Hardware</b>	40%
<b>2.0 Networking</b>	27%
<b>3.0 Laptops</b>	11%
<b>4.0 Printers</b>	11%
<b>5.0 Operational Procedures</b>	11%

## Domain 1.0 PC Hardware

Domain Objectives / Examples	Unit
<b>1.1 Configure and apply BIOS settings.</b> <i>Install 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, LoJack) • Use built-in diagnostics • Monitoring (Temperature monitoring, Fan speeds, Intrusion detection/notification, Voltage, Clock, Bus speed)</i>	2.5 BIOS
<b>1.2 Differentiate between motherboard components, their purposes, and properties.</b> <i>Sizes (ATX, Micro-ATX, ITX) • RAM slots • CPU sockets • Chipsets (Northbridge, Southbridge, CMOS battery) • Jumpers • Power connections and types • Fan connectors • Front panel connectors (USB, Audio, Power button, Power light, Drive activity lights, Reset button)</i>	1.2 Motherboard Components
<i>Expansion slots (PCI, PCI-X, PCIe, Mini PCI, CNR, AGP2x, AGP4x, AGP8x) • Bus speeds</i>	1.5 Peripherals and Expansion Slots
<b>1.3 Compare and contrast RAM types and features.</b> <i>Types (DDR, DDR2, DDR3, SDRAM, SODIMM, RAMBUS, DIMM, Parity vs. non-parity, ECC vs. non-ECC, RAM configurations [Single channel vs. dual channel vs. triple channel], Single sided vs. double sided) • RAM compatibility and speed</i>	2.3 System Memory



Domain Objectives / Examples	Unit
<b>1.4 Install and configure expansion cards.</b> <i>Serial and parallel cards • USB cards • Firewire cards • Storage cards • Riser cards</i>	1.5 Peripherals and Expansion Slots
<i>Sound cards • Video cards • TV tuner cards • Video capture cards</i>	1.6 Output and Multimedia Devices
<i>Network cards • Wireless cards</i>	4.1 Network Hardware
<i>Modem cards • Cellular cards</i>	4.4 Internet Access
<b>1.5 Install and configure storage devices and use appropriate media.</b> <i>External connection types (USB, Firewire, eSATA, Ethernet) • Internal connection types: SATA, IDE (IDE configuration and setup [Master, Slave, Cable Select]) and SCSI (SCSI IDs [0 - 15]) • Hot swappable drives • Hard drives (Magnetic, 5400 rpm, 7200 rpm, 10,000 rpm, 15,000 rpm) • Solid state/flash drives (SSD) • RAID types (0, 1, 5, 10)</i>	2.1 Mass Storage Devices
<i>Optical drives (CD-ROM, DVD-ROM, Blu-Ray • Combo drives and burners (CD-RW, DVD-RW, Dual Layer DVD-RW, BD-R, BD-RE) • Solid state/flash drives (CompactFlash, SD, microSD, miniSD, xD) • Floppy drive • Tape drive • Media capacity (CD, CD-RW, DVD-RW, DVD, Blu-ray, Tape, Floppy, DL DVD)</i>	2.2 Removable Storage Devices
<b>1.6 Differentiate among various CPU types and features and select the appropriate cooling method.</b> <i>Socket types (Intel [LGA, 775, 1155, 1156, 1366], AMD [940, AM2, AM2+, AM3, AM3+, FM1, F]) • Characteristics (Speeds, Cores, Cache size/type, HyperThreading, Virtualization support, Architecture (32-bit vs. 64-bit), Integrated GPU) • Cooling (Heat sink, Fans, Thermal paste, Liquid-based)</i>	2.4 Processors
<b>1.7 Compare and contrast various connection interfaces and explain their purpose.</b> <i>USB connections (1.1 vs. 2.0 vs. 3.0, Speed and distance characteristics, Connector types: A, B, mini, micro) • Firewire connections (400 vs. Firewire 800 speed and distance characteristics) • Other connector types (Serial, Parallel, VGA, HDMI, DVI, Audio) • Analog vs. digital transmission (VGA vs. HDMI)</i>	1.4 Connection Interfaces
<i>SATA1 vs. SATA2 vs. SATA3, eSATA, IDE speeds</i>	2.1 Mass Storage Devices
<i>Other connector types (RJ-45, RJ-11)</i>	4.1 Network Hardware
<i>Speeds, distances and frequencies of wireless device connections (Bluetooth, IR, RF)</i>	4.3 Wireless Networking
<b>1.8 Install an appropriate power supply based on a given scenario.</b> <i>Connector types and their voltages (SATA, Molex, 4/8-pin 12v, PCIe 6/8-pin, 20-pin, 24-pin, Floppy) • Specifications, Wattage, Size, Number of connectors, ATX, Micro-ATX • Dual voltage options</i>	1.3 Power Supplies

Domain Objectives / Examples	Unit
<b>1.9 Evaluate and select appropriate components for a custom configuration, to meet customer specifications or needs.</b> <i>Graphic / CAD / CAM design workstation (Powerful processor, 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 (Powerful processor, High-end video/specialized GPU, Better sound card, High-end cooling) • Home Theatre PC (Surround sound audio, HDMI output, HTPC compact form factor, TV tuner) • Standard thick client (Desktop applications, Meets recommended requirements for running Windows) • Thin client (Basic applications, Meets minimum requirements for running Windows) • Home Server PC (Media streaming, File sharing, Print sharing, Gigabit NIC, RAID array)</i>	2.6 Custom Configuration
<b>1.10 Given a scenario, evaluate types and features of display devices.</b> <i>Types (CRT, LCD, LED, Plasma, Projector, OLED) • Refresh rates • Resolution • Native resolution • Brightness/lumens • Analog vs. digital • Privacy/antiglare filters • Multiple displays</i>	1.6 Output and Multimedia Devices
<b>1.11 Identify connector types and associated cables.</b> <i>Display connector types (DVI-D, DVI-I, DVI-A, DisplayPort, RCA, HD-15 (DE-15, DB-15), BNC, Mini HDMI, RJ-45, Mini-Din-6) • Display cable types (HDMI, DVI, VGA, Component, Composite, S-video, RGB, Coaxial, Ethernet) • Device connectors and various connector pin-outs (USB, IEEE1394, SCSI, PS/2, Parallel, Serial, Audio) • Device cable types (USB, IEEE1394, SCSI [68pin vs. 50pin vs. 25pin], Parallel, Serial)</i>	1.4 Connection Interfaces
<i>Device connectors and various connector pin-outs (SATA, eSATA, PATA [IDE, EIDE]) • Device cable types (SATA, eSATA, IDE, EIDE)</i>	2.1 Mass Storage Devices
<i>Device connectors and various connector pin-outs (Floppy) • Device cable types (Floppy)</i>	2.2 Removable Storage Devices
<i>Device connectors and various connector pin-outs (RJ-45) • Device cable types (Ethernet, Phone)</i>	4.1 Network Hardware
<b>1.12 Install and configure various peripheral devices.</b> <i>Input devices (Mouse, Keyboard, Touch screen, KVM, Biometric devices, Game pads, Joysticks, Digitizer)</i>	1.5 Peripherals and Expansion Slots
<i>Input devices (Microphone) • Multimedia devices (Digital cameras, Microphone, Webcam, Camcorder, MIDI enabled devices) • Output devices (Speakers, Display devices)</i>	1.6 Output and Multimedia Devices
<i>Input devices (Scanner, Barcode reader)</i>	3.2 Printer Types
<i>Output devices (Printers)</i>	3.3 Installing and Configuring Printers

## Domain 2.0 Networking

Domain Objectives / Examples	Unit
<b>2.1 Identify types of network cables and connectors.</b> <i>Fiber (Connectors [SC, ST and LC]) • Twisted Pair (Connectors [RJ-11, RJ-45], Wiring standards: T568A, T568B) • Coaxial (Connectors [BNC, F-connector])</i>	4.1 Network Hardware
<b>2.2 Categorize characteristics of connectors and cabling.</b> <i>Fiber (Types [single-mode vs. multi-mode], Speed and transmission limitations) • Twisted pair (Types [STP, UTP, CAT3, CAT5, CAT5e, CAT6, plenum, PVC], Speed and transmission limitations) • Coaxial (Types [RG-6, RG-59], Speed and transmission limitations)</i>	4.1 Network Hardware
<b>2.3 Explain properties and characteristics of TCP/IP.</b> <i>IP class (Class A, Class B, Class C) • IPv4 vs. IPv6 • Public vs. private vs. APIPA • Static vs. dynamic • Client-side DNS • DHCP • Subnet mask • Gateway</i>	4.2 TCP/IP Essentials
<b>2.4 Explain common TCP and UDP ports, protocols, and their purpose.</b> <i>Ports (21 - FTP, 23 - TELNET, 25 - SMTP, 53 - DNS, 80 - HTTP, 110 - POP3, 143 - IMAP, 443 - HTTPS, 3389 - RDP) • Protocols (DHCP, DNS, LDAP, SNMP, SMB, SSH, SFTP) • TCP vs. UDP</i>	4.2 TCP/IP Essentials
<b>2.5 Compare and contrast wireless networking standards and encryption types.</b> <i>Standards (802.11 a/b/g/n, Speeds, Distances and frequencies) • Encryption types (WEP, WPA, WPA2, TKIP, AES)</i>	4.3 Wireless Networking
<b>2.6 Install, configure, and deploy a SOHO wireless/wired router using appropriate settings.</b> <i>MAC filtering • Channels (1 - 11) • SSID broadcast (on/off) • Wireless encryption • DHCP (on/off) • WPS</i>	4.3 Wireless Networking
<i>Port forwarding, Port triggering • Firewall • DMZ • NAT • Basic QoS</i>	4.4 Internet Access
<b>2.7 Compare and contrast Internet connection types and features.</b> <i>Cable • DSL • Dial-up • Fiber • Satellite • ISDN • Cellular (mobile hotspot) • Line of sight wireless internet service • WiMAX</i>	4.4 Internet Access
<b>2.8 Identify various types of networks.</b> <i>LAN • WAN • PAN • MAN • Topologies (Mesh, Ring, Bus, Star, Hybrid)</i>	4.1 Network Hardware
<b>2.9 Compare and contrast network devices their functions and features.</b> <i>NAS</i>	2.6 Custom Configuration
<i>Router • Hub • Switch • PoE • Bridge</i>	4.1 Network Hardware
<i>Access point</i>	4.3 Wireless Networking
<i>Modem • Firewall • VoIP phones • Internet appliance</i>	4.4 Internet Access
<b>2.10 Given a scenario, use appropriate networking tools.</b> <i>Crimper • Multimeter • Toner probe • Cable tester • Loopback plug • Punchdown tool</i>	4.1 Network Hardware

## Domain 3.0 Laptops

Domain Objectives / Examples	Unit
<b>3.1 Install and configure laptop hardware and components.</b> <i>Expansion options (ExpressCard /34, ExpressCard /54, PCMCIA, SODIMM, Flash) • Hardware/device replacement (Keyboard, Hard Drive [2.5 vs. 3.5], Memory, Optical drive, Wireless card, Mini-PCIe, screen, DC jack, Battery, Touchpad, Plastics, Speaker, System board, CPU)</i>	3.1 Laptops
<b>3.2 Compare and contrast the components within the display of a laptop.</b> <i>Types (LCD, LED, OLED, Plasma) • Wi-Fi antenna connector/placement • Inverter and its function • Backlight</i>	3.1 Laptops
<b>3.3 Compare and contrast laptop features.</b> <i>Special function keys (Dual displays, Wireless [on/off], Volume settings, Screen brightness, Bluetooth [on/off], Keyboard backlight) • Docking station vs. port replicator • Physical laptop lock and cable lock</i>	3.1 Laptops

## Domain 4.0 Printers

Domain Objectives / Examples	Unit
<b>4.1 Explain the differences between the various printer types and summarize the associated imaging process.</b> <i>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)</i>	3.2 Printer Types
<b>4.2 Given a scenario, install, and configure printers.</b> <i>Use appropriate printer drivers for a given operating system • Wired print device connections (USB, Parallel, Serial, Ethernet) • Wireless print device connections (Bluetooth, 802.11x, Infrared [IR]) • Printer sharing (Sharing local/networked printer via Operating System settings, Printer hardware print server)</i>	3.3 Installing and Configuring Printers
<b>4.3 Given a scenario, perform printer maintenance.</b> <i>Laser (Replacing toner, Applying maintenance kit, Calibration, Cleaning) • Thermal (Replace paper, Clean heating element, Remove debris) • Impact (Replace ribbon, Replace print head, Replace paper)</i>	3.3 Installing and Configuring Printers

## Domain 5.0 Operational Procedures

Domain Objectives / Examples	Unit
<b>5.1 Given a scenario, use appropriate safety procedures.</b> <i>ESD straps • ESD mats • Self-grounding • Equipment grounding • Personal safety (Disconnect power before repairing PC, Remove jewelry, Lifting techniques, Weight limitations, Electrical fire safety, Cable management) • Compliance with local government regulations</i>	1.1 Safety Procedures
<i>CRT safety - proper disposal</i>	3.4 Preventive Maintenance
<b>5.2 Explain environmental impacts and the purpose of environmental controls.</b> <i>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) • Dust and debris (Compressed air, Vacuums) • Component handling and protection (Anti-static bags) • Compliance with local government regulations</i>	3.4 Preventive Maintenance
<b>5.3 Given a scenario, demonstrate proper communication and professionalism.</b> <i>Use proper language - avoid jargon, acronyms, slang when applicable • Maintain a positive attitude • Listen and do not interrupt the customer • Be culturally sensitive • Be on time (if late contact the customer) • Avoid distractions (Personal calls, Talking to co-workers while interacting with customers, Personal interruptions) • Dealing with difficult customer or situation (Avoid arguing with customers and/or being defensive, Do not minimize customer's 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]) • 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 materials (Located on a computer, desktop, printer, etc)</i>	3.5 Professionalism and Communication
<b>5.4 Explain the fundamentals of dealing with prohibited content/activity.</b> <i>First response (Identify, Report through proper channels, Data/device preservation) • Use of documentation/documentation changes • Chain of custody (Tracking of evidence/documenting process)</i>	3.5 Professionalism and Communication



# Exam Tips

Use the following notes to prepare for and book the CompTIA certification exam. Remember that you can use the practice exam available with this course at gtslearning's Freestyle site (you will also need an enrollment key from your training provider).

## Registering for the Test

CompTIA Certification exams are delivered exclusively by Pearson VUE. You can locate a test center using the link on CompTIA's website:

[certification.comptia.org/Training/testingcenters.aspx](http://certification.comptia.org/Training/testingcenters.aspx)

- Arrive at the test center at least 15-30 minutes before the test is scheduled.
- The test center administrator will demonstrate how to use the computer-based test system.
- You must have two forms of ID - one with picture, both with signature, preferably with your private address (driving license, passport, and so on).
- Books, calculators, laptops, smartphones, or other reference materials are not allowed.
- Pens, pencils, and paper are not required! You must not attempt to write down questions or remove anything from the exam room.
- It is CompTIA's policy to make reasonable accommodations for individuals with disabilities.

## Taking the Test

CompTIA have prepared a [Candidate Experience](#) video. Watch this to help to familiarize yourself with the exam format and types of questions.

- There are up to 90 multiple-choice questions and performance-based items, which must be answered in 90 minutes. The passing score is 675 on a scale of 100-900.
- Read each question and its option answers carefully. Don't rush through the exam as you'll probably have more time at the end than you expect.
- At the other end of the scale, don't get "stuck" on a question and start to panic. You can mark questions for review and come back to them.
- As the exam tests your ability to recall facts and to apply them sensibly in a troubleshooting scenario, there will be questions where you cannot recall the correct answer from memory. Adopt the following strategy for dealing with these questions:
  - Narrow your choices down by eliminating obviously wrong answers.

*Try to allocate some time to discuss the format of the exam.*

*Make sure students understand that "unscored" items will appear that may test things that are not part of the exam objectives.*

*For example, exam items that have been written for the next version of the exam objectives are often "seeded" into the current exams to gather psychometric data to check their validity.*

*Discuss the format of the performance-based items - students may be expected to label a diagram, configure some hardware, or complete some steps in Windows. You **MUST NOT** reveal the tasks or contents of specific items.*

*Remind students that free practice exams are available on the Freestyle site. The enrollment key to give to the students is published on [gtstrainer.com](http://gtstrainer.com).*



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- Don't guess too soon! You must select not only a *correct* answer, but the *best* answer. It is therefore important that you read all of the options and not stop when you find an option that is correct. It may be impractical compared to another answer.
- Utilize information and insights that you've acquired in working through the entire test to go back and answer earlier items that you weren't sure of.
- Think your answer is wrong - should change it? Studies indicate that when students change their answers they usually change them to the wrong answer. If you were fairly certain you were correct the first time, leave the answer as it is.
- As well as multiple-choice questions, there will be a number of performance-based items. Performance-based items require you to perform a task or solve a problem in simulated IT environments. Use your experience of completing the labs in this course to help you complete the performance-based items successfully. Make sure you read the item scenario carefully and check your submission.
- Don't leave any questions unanswered! If you really don't know the answer, just guess.
- The exam may contain "unscored" questions, which may even be outside the exam objectives. These questions do not count towards your score.

## After the Test

- A score report will be generated and a copy printed for you by the test administrator. The score report will show whether you have passed or failed and domain objectives where you did not answer questions correctly. Make sure you retain the report!
- 5 days after passing the exam, go to [www.comptia.org/careerid](http://www.comptia.org/careerid) and create an account (or log on to an existing account) using the information in your score report. When you have passed both A+ exams, you can use this site to order your certificate and ID card.
- If 6 weeks have passed after ordering your certificate and you haven't received it, contact [questions@comptia.org](mailto:questions@comptia.org)

## Retaking the Test

If you do fail the certification test at the first attempt, then you can retake it at your convenience. However, should you fail the test at the second, third, or subsequent try, you will not be able to resit the exam for at least 30 days after your last attempt. Study your score report to see which areas of the exam you were weak on.

*Note that A+ is one of the CompTIA certifications now valid for 3 years (rather than for life as previously).*

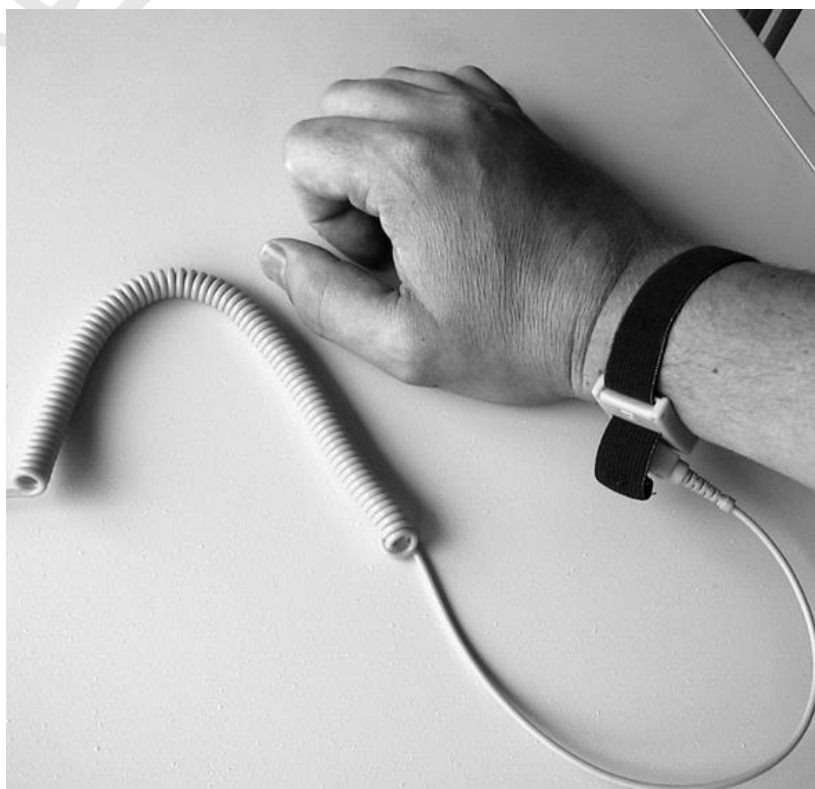
*The certifications can either be renewed by taking the next exam iteration or by joining the CompTIA Continuing Education Program and earning the relevant credits.*

*For more information, direct students to [gtsgo.to/5zmss](http://gtsgo.to/5zmss).*



## Lab 1 / Implementing an Anti-ESD Service Kit

- 1) Your instructor will provide you with an anti-ESD service kit. Prepare it for use and allow your instructor to check that you have connected everything correctly - the picture below will help remind you how to use the anti-ESD kit.



#### Delivery Tips

Check the instructor guide on [gtstrainer.com](http://gtstrainer.com) for the equipment list and build instructions.

The labs in the 801 Support Skills course involve hands-on with the PC hardware and so should be performed on less valuable equipment.

Before the course begins, ensure that you are familiar with all of the PCs that you have in the room – the students may ask for your assistance in identifying various components in the PC.

While the students are performing the exercise walk around the room offering assistance and advice.

#### Delivery Tips

Hand out one anti-ESD service kit per student (they will need these for the remainder of the labs, but remember to collect the kits again after class unless you are letting students take their toolkits away with them).

Make sure that you check each student's anti-ESD service kit setup to ensure that they have correctly connected their wrist-strap, grounding cord etc.

Also get students to check the installation of standard classroom PCs - note measures to prevent trip hazards etc.

#### Timings

15 minutes



## **Lab 2 / Identifying PC Components**

### **Delivery Tips**

*If you have a variety of PCs in the room, encourage the students to move to another desk and perform the same exercise on another PC.*

### **Timings**

**30 minutes**

In this lab, you will examine components within the PC case.

- 1) Cables to devices should all be disconnected. If they are not, remove all the cables, starting with the power connector.
- 2) Carefully lift the system unit onto your workbench so that you can get a good look at it.
- 3) Remove the system case lid. Without touching anything inside the system unit<sup>1</sup>, identify the following components, drawing a diagram to show their layout.
  - CPU
  - Memory slots
  - Expansion slots
  - Drive ports
  - Power connectors (P1 and fans)
  - CMOS battery
  - Front panel connectors



- 4) Write down any problems you might suspect with the way the system is built (for example, cables not connected to devices, scorch marks, excessive dust or dirt, and so on).
- 5) Replace the system case lid.

<sup>1</sup> You can move cables if they obstruct your view but be careful not to dislodge them from their connectors.

## Module 1 / Peripherals and Adapters

### Review Questions / Module 1 / Unit 1 / Safety Procedures

- 1) What component helps to protect users of electrical equipment against a short circuit?  
**A fuse.**
- 2) What care should you take when lifting a heavy object?  
**The main concern is damaging your back. Lift slowly using your legs for power not your back muscles.**
- 3) What should you do before transporting a bulky object?  
**Check that there is a clear path to the destination point. If you cannot carry the object safely, get help.**
- 4) In which atmospheric conditions is the risk of ESD highest?  
**During cool, dry conditions when humidity is low. When humidity is high, the static electricity can dissipate through the moisture present in the air.**
- 5) Will damage caused to a chip by ESD be immediately apparent?  
**Not necessarily. It is sometimes not apparent until some time later, when the chip becomes unstable.**
- 6) Describe the equipment you should use to prevent static electricity on your body from damaging the equipment on which you are working:  
**An anti-ESD service kit comprised of an anti-ESD wrist strap, grounding cord and plug, and a conductive mat. The grounding plug should be connected to an earthed point.**
- 7) If static electricity is not harmful to humans, why is it damaging to electronic components?  
**These components are designed to work at very low voltages; a static discharge is very high voltage. No damage occurs to humans because the current is very small but electronic circuits are more fragile.**
- 8) You have to service a PC but anti-static protection is not available. You know that you can ground yourself by touching the metal chassis of the PC, but should you do this before or after unplugging the PC from mains power?  
**For safety reasons, always unplug the PC from mains power before opening the case.**



## Review Questions / Module 1 / Unit 2 / Motherboard Components

- 1) At the rear of a system case are slots for adapter card ports. Why should these be covered with blanking plates if not in use?  
**The fan system is designed to draw cool air across the motherboard and blow out warm air - large holes in the chassis disrupts this air flow. Also dust will be able to settle on the system components more easily.**
- 2) True or false? The Real Time Clock controls the timing of signals between the CPU and other components.  
**False - the system clock controls timing; the Real Time Clock keeps track of the calendar date and time.**
- 3) What is the main function of the chipset?  
**Provides controllers for the CPU to interface with other components (memory and expansion bus for instance) and adapters to provide functions such as video and audio, and Ethernet and wireless networking on the motherboard.**
- 4) What type of socket is used to install system memory?  
**DIMM.**
- 5) Apart from addressing and data transfer, what are the other functions of a bus?  
**Carry power and timing signals to a component.**
- 6) Describe how you would open a PC case to access the motherboard.  
**Remove the main panel - that is the one opposite the ports at the rear. Most cases support tool-free access. This should expose the motherboard. You would only usually need to remove other panels to access storage devices.**
- 7) If you want to build the smallest system you can, should you choose a Micro-ATX or Mini-ITX motherboard?  
**Mini-ITX is smaller (6.7" square compared to 9.6" square).**
- 8) How many expansion slots does a Micro-ATX board support?  
**Four.**
- 9) You have been servicing a computer but when you have finished you find that it will not turn on. There was no power problem before and you have verified that the computer is connected to a working mains socket. What is the most likely explanation?  
**The cable connecting the power button to the motherboard could have been disconnected and either not reconnected or not properly reconnected.**

## Review Questions / Module 1 / Unit 3 / Power Supplies

- 1) How would you calculate the power used by a component?  
**Multiply its voltage by the current it draws ( $W=V \times I$ ).**

# Glossary

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**1/8 Connector**

Standard 3.5mm audio socket (the type of jack found on headphones and basic speakers).

**10/100/1000BASE-T**

Specifications for Ethernet running over twisted pair cable at 10/100/1000 Mbps.

**32-bit**

Most programs and operating systems run in 32-bit mode. Aside from allowing the computer to access more memory (4 GB), programs are protected from one another; each runs in its own address space.

**64-bit**

The PC is starting to move to a 64-bit platform. 64-bit offers some speed improvements, especially for tasks such as 3D processing, but its main advantage is the increase in address space and better support for virtualization (running multiple OS on the same hardware). The main 64-bit platform is called AMD64 or EM64T (by Intel). This platform is supported by 64-bit versions of Windows XP / Vista / 7 as well as various Linux distributions.

**8.3 Filenames**

The DOS file naming standard - an eight-character ASCII name followed by a three-character file extension (which identifies the file type). Windows supports long file names but can also generate a short file name, based on DOS 8.3 naming rules. This provides backwards compatibility for older applications.

**802.11**

See: *Wi-Fi*.

**802.1X**

802.1X (or EAP [Extensible Authentication Protocol]) is an authentication standard, developed to allow remote, wireless, and wired authentication to be centrally managed. A client device such as an access point passes authentication information to a RADIUS server on the wired network for validation. The authentication information could be a user name and password or could employ smart cards or tokens.

**802.2**

See: *Ethernet*.

**8mm Tape Backup**

8mm (1/4") data tape storage systems appear similar to the tape cartridges used by many video cameras, although the media is higher quality.

**A/V (Audio/Video)**

Any receiver that can process audio and video signals. A/V signals can be analog or digital and there are numerous cable, connector, and signaling formats.

**AAA**

Authentication, Authorization, and Accounting - the principal types of security control. A resource should be protected by all three types of control.

**AC (Alternating Current)**

When electricity is produced by a generator at the power station, the rotational movement of the magnetic coils causes the current produced to oscillate like a sine wave (it is said to alternate). Computers require direct current (at a constant voltage). A transformer is used to convert AC from the power outlet into the 3.3, 5, and 12V DC supply required by the computer.

**AC Adapter**

Portable power supply for portable computers. The AC adapter converts incoming AC mains power into the DC voltages required by the portable computer.

**Accelerometer / Gyroscope**

Devices used in mobile devices to detect motion (accelerometer) and rotation (gyroscope). As well as switching screen orientation, this can be used as a control mechanism (for example, a driving game could allow the tablet itself to function as a steering wheel).

**Access Control**

Creating one or more barriers around a resource such that only authenticated users can gain access. Each resource has an Access Control List (ACL) specifying what users can do. Resources often have different access levels (for example, being able to read a file or being able to read and edit it).

**Access Point (AP)**

Device that provides connectivity between wireless devices and a cabled network. APs with internet connectivity located in public buildings (cafes, libraries, airports for instance) are often referred to as hotspots.

**Access Time**

Access time is the speed at which memory or a disk drive can be addressed and utilized (opened, read from, or written to).

**Accessories / System Tools**

Folder in Start menu programs containing tools for configuring and optimizing the system.

**Accident**

Health and safety means that an organization should prepare employees to deal with accidents and emergencies. Obviously accidents vary widely in terms of type and seriousness, but the basic procedure should be to sound the alarm, alert emergency services, attend to the situation yourself (if it is safe for you to do so), and complete an incident report.

**Account Policies**

User security information - such as password expiration and uniqueness - can be configured globally as a set of rules (policy).

**ACPI (Advanced Configuration and Power Interface)**

*See: Power Management.*

**ACT**

The link / activity LED on a network adapter or switch port shows whether an Ethernet link has been established and flickers when there is network traffic.

**Active Directory**

The database that contains the users, groups, and computer accounts in a Windows Server domain.