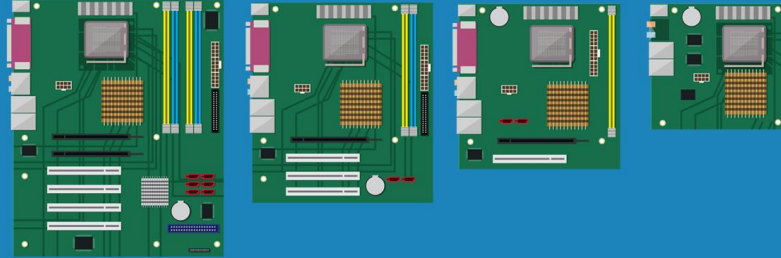


ITFreeTraining



Form Factors

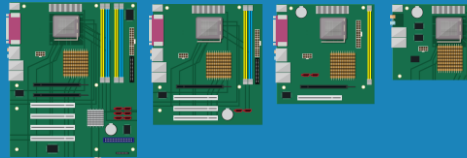
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In this video from ITFreeTraining, I will look at the different form factors that are available for computers. The form factors determine the design constraints for the motherboard, case and power supply. All three need to conform to the form factor design specification to ensure that they will work together.

Form Factors

- Defines dimensions and layouts

Motherboard sizes



PSU and connectors



IO/Panel



Computer cases



0:18 To start with, I will look at what a form factor is. A form factor defines the dimensions and layouts that can be used for the motherboard, power supply and the computer case. You will find that motherboards designed to meet a form factor specification will be the same size or very close. On closer inspection, you will find the drill holes are in the same place. This ensures that when you buy a motherboard of a particular form factor it will always fit inside a computer case that supports that form factor. The motherboard is attached to the computer case by standoffs. Standoffs are brass or plastic that attach to the computer case and provide somewhere for the screws to screw into.

The form factor also defines the power supply unit and the connectors that are used on the power supply. This is why you will find that different power supplies are the same shape and have the same connectors on them.

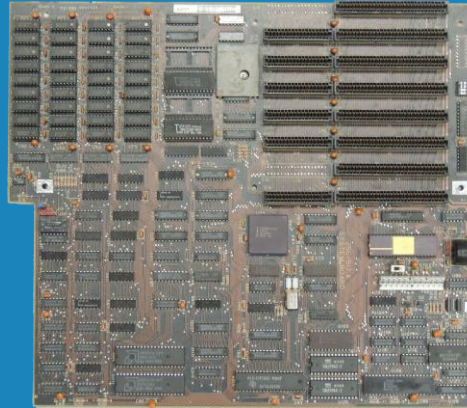
The form factor also defines the size of the area that will be used by the input and output connectors otherwise known as IO connectors. The IO area allows the motherboard to be connected to external devices like keyboards, USB devices and speakers. You will find that the area generally has a silver cover called the IO Shield. The area for the IO connectors will always be in the same place and also will always be the same size.

The form factor also defines the specifications for the computer case. The specifications gives the manufactures a lot of creative choices on how they design their case. A computer case may also support one or more form factors.

Having a form factor specification ensures that a motherboard and power supply designed for that form factor can be used in that computer case. As previously mentioned, the form factor will define where the screw holes in the motherboard will be. In order for the computer case to support a specific form factor, it will need to have screw holes in the correct locations.

AT Form Factor

- Developed in the 1980s
- Limited number of external ports
- PSU intake fan



2:22 The first form factor that I will look at is the AT form factor. This form factor was first invented in the 1980s. AT stands for Advanced Technology. At the time, AT was advanced technology. Now days this form factor is obsolete and has been for a long time. It is unlikely you will get asked any questions in the CompTIA exam about it, but it is good to have a basic understanding of how it works. Understanding how the AT form factor was designed helps to understand why modern computers are designed the way they are.

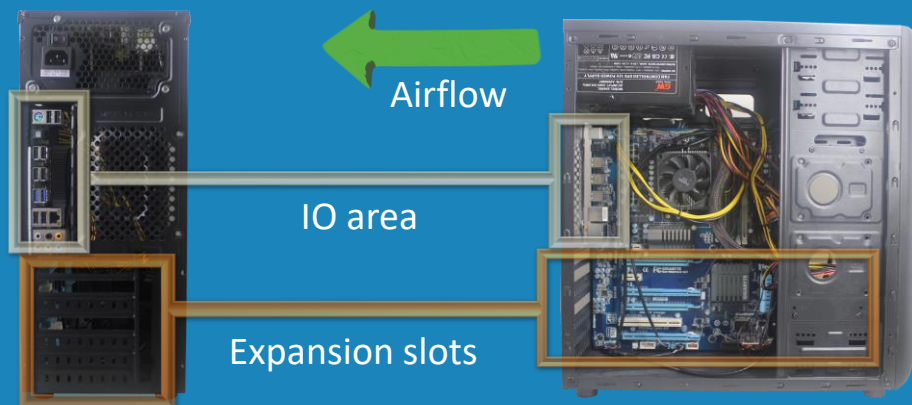
You can see the motherboard has a large number of chips on it. Back in those days, computers were new and it took a lot of chips to achieve what we can now achieve with a single chip. As a result, the AT motherboards were very large compared to motherboards you would find in computers today.

The main drawback of the AT form factor was the limited number of external ports. Generally, on the back of the computer you would have the keyboard port, two serial ports and a parallel port. If you had a mouse, one of the serial ports was used by the mouse. As computers improved, there became more need for additional ports. The original design of the AT form factor did not take into consideration how computers could change over time.

The next main difference is the power supply unit. On AT computers, the fan on the power supply is an intake fan. That is, air is drawn from outside into the computer case. In the old days of computers, the CPU and other components did not get that hot. Due to the low working temperatures, an intake fan was enough to keep the inside of the computer cool.

ATX Form Factor

- ATX (Advanced Technology eXtended)
- Developed in 1995. Took off in 1998



4:08 Although the AT Form factor provided a standard, it lacked the ability to support new features and new computer designs. This led to the development of the ATX form factor. This was developed in 1995 and then in 1998 became the most common form factor on the market. Everyone refers to it by initials but if you are interested it stands for Advanced Technology Extended.

If I have a look at an ATX computer, you will start to notice that all computers that use the ATX form factor will have similar characteristics. To start with, the power supply and case fan work as exhaust fans drawing air out of the case. You will notice that with different computer cases the power supply will be located in different places. The fan inside the power supply may be in different locations, however it will always be an exhaust fan.

You will find that on a lot of power supplies, one of the screw holes is offset so that the power supply can only be installed one way. However, if the computer case has the power supply at the bottom, you will find that the power supply can be mounted with the fan facing up or facing down. In later videos I will have a look at the advantages of both. The main point to remember is never to install a power supply fan in a direction in which the air flow is blocked.

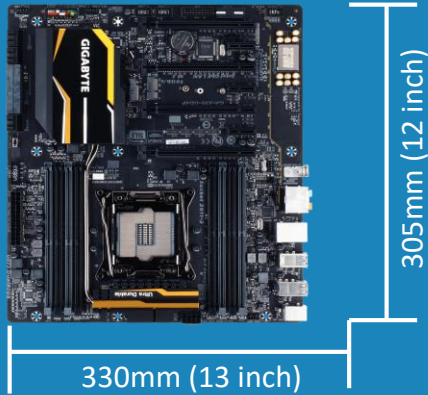
Next notice the IO area. This provides all the external connectors. This will always be in the same place. You will notice also that the CPU and memory modules are always next to this area. This makes the CPU and RAM easy to get to.

To assist keeping the CPU and RAM clear, the expansion slots will always be located at the bottom of the motherboard. If you have been working with computers for a long time, you may remember on certain motherboards that the memory modules and the CPU would get in the way of expansion cards. This was particularly true with the larger expansion cards. You will notice that with the ATX standard, it is designed so there should be nothing in the way of larger cards. Anything on the motherboard that is in the same space where an expansion card may go, is generally very low in height so that it does not get in the way. The ATX form factor supports up to seven expansion cards. It is up to the manufacturer of the motherboard to decide how many of these expansion slots they want to use.

The ATX form factor is still the most popular motherboard sold on the market, but there are some other versions of this form factor you can purchase.

Other ATX Form Factors

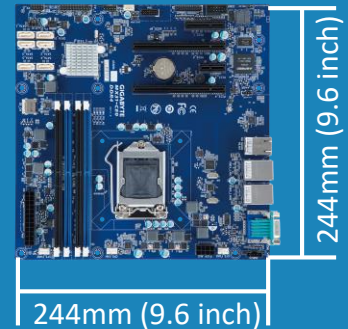
Extended ATX (EATX)



Standard ATX (ATX)



Micro ATX (μ ATX or mATX)



6:47 The ATX form factor also comes in the extended ATX form factor or EATX. You will notice that this motherboard is a few centimeters short of the total width the specification allows. This is not uncommon, generally you will find that EATX motherboards don't use all the width the specification allows. The motherboard will still meet the EATX specification if it is not larger than the specification allows and the screw holes are in the right places.

EATX is generally used in servers or on motherboards that have multiple CPUs. If you purchase an EATX motherboard, make sure that your computer case supports it. Due to EATX being larger than ATX, not all computer cases support it.

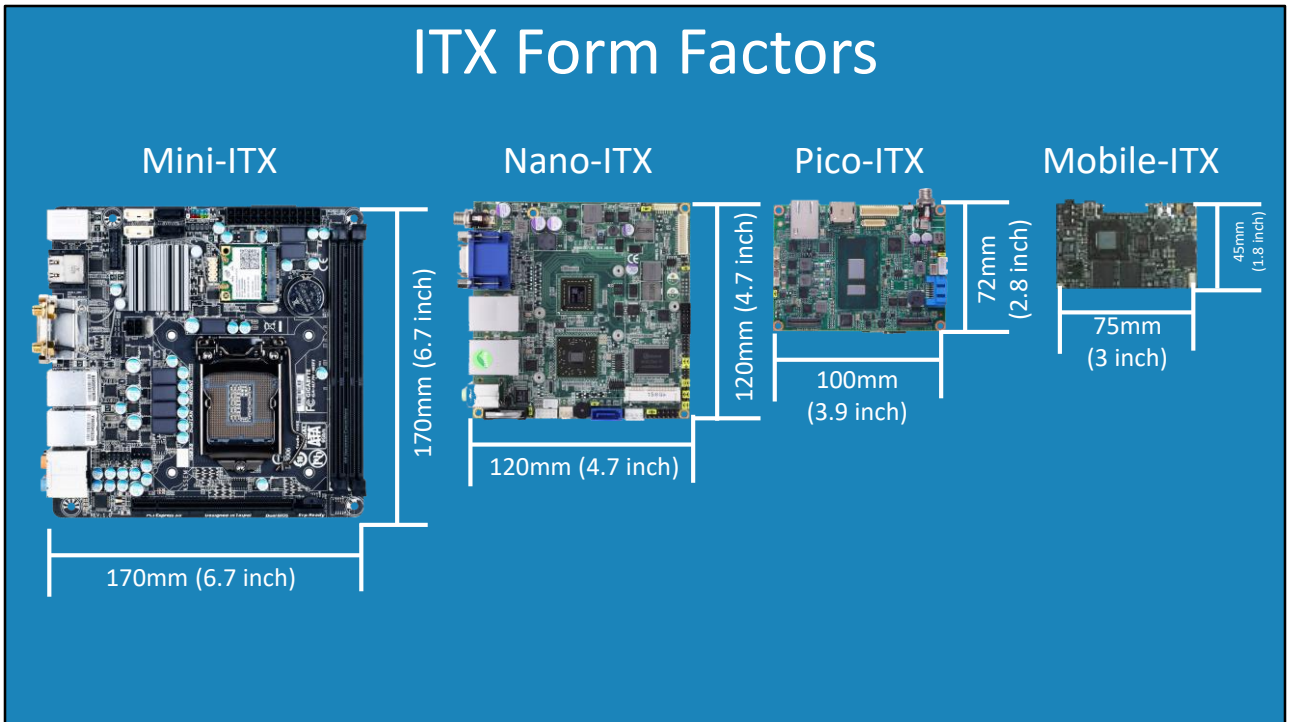
For the sake of comparison, I have included the ATX form factor and its measurements. This will give you the idea of the size difference. You will generally find that most ATX motherboards use the full size or will be very close.

The last ATX form factor that I will look at is the micro ATX form factor. This form factor may also be referred to as the Greek symbol μ followed by ATX as shown. CompTIA rather than using the Greek symbol use a little m.

This motherboard is smaller, but will still fit in any ATX case. There are also computer cases on the market that are specifically designed for the micro ATX form factor. If space is a factor, you would buy a micro ATX motherboard and a micro ATX case. The downside of this, is that due to having less room on the motherboard, these motherboards will have fewer expansion slots or memory slots compared with the larger motherboards. The most expansion slots that it supports is four.

There are also other variants of the ATX form factor like the FlexATX. The FlexATX standard is no longer used, however you may come across a computer that uses it. It is a slightly smaller form factor than the micro ATX.

ITX Form Factors



8:54 The next form factor that I will look at is the ITX form factor. This form factor was not developed until 2001. You can see there are a number of different variations of this form factor. The form factor is designed to be small and use less power. ITX stands for Information Technology Extended.

The most popular of these form factors is the mini-ITX which is also the largest. However, it is almost half the size of the ATX form factor. If you need a small computer, the ITX form factor may be worth looking into. When purchasing an ITX motherboard, keep in mind that, due to its size, a lot of features had to be removed. For example, the motherboard may only have one expansion slot or none at all.

These form factors generally use less power and produce less heat. For these reasons, generally they do not have a fan installed in them. This makes them good candidates for media centers.

You can buy a computer case that only supports the ITX form factor, but you will generally find that most ATX cases will also support ITX form factor motherboards.

BTX Form Factor

- Developed in 2004 to replace ATX
- Never widely adopted



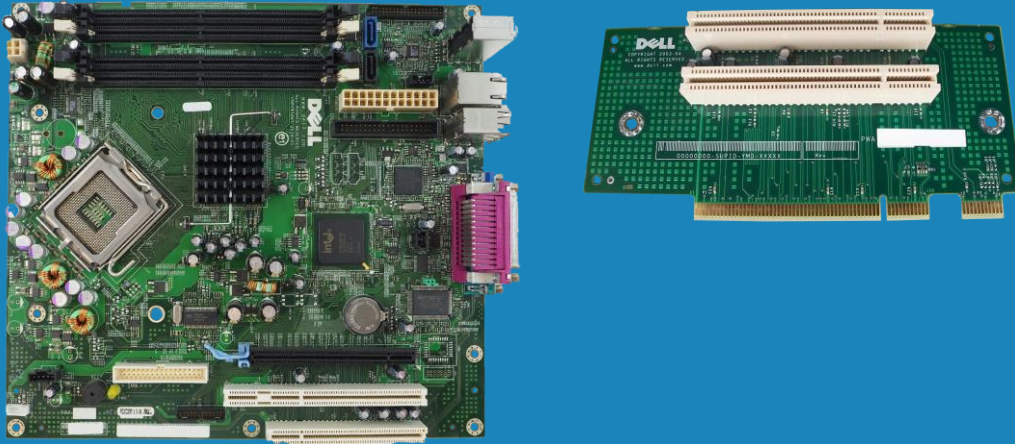
10:05 The next form factor that I will look at is the BTX form factor. You won't need to know this for the CompTIA exam, but it is useful to know about it in case you come across it. It was first developed in 2004 to replace the ATX form factor. The standard was never widely adopted and thus you cannot currently buy a new motherboard that uses the BTX form factor. If you are interested, BTX stands for Balanced Technology Extended.

The form factor was designed to improve air flow on the motherboard. The CPU was moved towards the front of the computer so it would receive air from the front intake fan. The expansion cards were moved to the top so their fans were not blowing air onto the CPU. As heatsinks became more efficient there was less need to have better air flow on the motherboard. However, the biggest reason the form factor was not adopted was that the form factor specifications were too rigid to allow larger CPUs. CPUs started becoming larger when memory controllers started being moved into the CPU. These CPUs had to use the ATX form factor and is thus the biggest reason the BTX form factor is no longer used.

You may come across an old BTX motherboard or purchase a computer case that supports the BTX form factor. Some computer cases will support both the ATX and BTX form factors. There are no products currently on the market that use the BTX form factor.

Proprietary Form Factors

- Only works with that manufacturer/model



11:33 Lastly, I will look at proprietary form factors. These are designed by the manufacturer and don't follow any industry standard. They generally can only be installed in that manufacturer's computer case. The form factor may also be model specific and thus cannot be installed in other computer cases from the same manufacturer.

In some cases, these motherboards will have a riser card like the one shown. These riser cards, also called a daughter card, plug into the motherboard and provide additional features. For example, they may provide additional expansion slots.

In many cases, the riser cards allow for better use of the space inside the computer case. If you are working with a proprietary form factor do not assume anything. Proprietary form factors can use different power supplies, custom parts and use non-standard cases. This causes problems for the technician, because you won't be able to use parts from other computers. You may also find that parts from one model from a given manufacturer cannot be used in different models from that same manufacturer. Proprietary form factors can cause a lot of headaches for the computer technician.

That concludes this video from ITFreeTraining on the different types of form factors. I hope you have found this video useful. Until the next video, I would like to thank you for watching.

References

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“ATX” <https://en.wikipedia.org/wiki/ATX>

“Mini-ITX” <https://en.wikipedia.org/wiki/Mini-ITX>

“BTX (form factor)” [https://en.wikipedia.org/wiki/BTX_\(form_factor\)](https://en.wikipedia.org/wiki/BTX_(form_factor))

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