

4.2.2 USB Facts

The Universal Serial Bus (USB) is the most commonly used connection interface. Almost every device (e.g., laptops, smart phones, tablets, desktop computers) uses USB in some capacity. USB:


- Uses serial communication (bits are sent sequentially)
- Supports plug-and-play and hot plugging (adding and removing devices without rebooting)
- Allows up to 127 devices to be connected to a single bus, directly to the host or via hubs (hubs are limited to five tiers)
- Shares the bandwidth among all devices connected to a single bus
- Provides 5 V of power through the cable

USB has several versions, all of which are backwards compatible. The following table describes the specifications of each version:

Version	Speed	Data Rate	Max Cable Length
1.1	Low Speed	1.5 Mbps	3 m
	Full Speed	12 Mbps	5 m
2.0	Hi-Speed	480 Mbps	5 m
3.0/3.1	SuperSpeed	Up to 5 Gbps	3 m
	SuperSpeed+	Up to 10 Gbps	5 m

Data transfer rates are limited by the slowest USB version being used. For example, a USB 2.0 device connected to a USB 3.0 port will run at USB 2.0 speeds.

USB uses several connector types for various peripheral devices. The following table describes the most common USB connector types:

Connector	Description
Type-A 	A rectangular connector that generally plugs directly into the computer or a hub. Almost all USB cables have one Type-A connector on one of the ends.
Type-B	A square connector with two beveled corners. Type-B connectors are mostly used with printers. Some networking devices, such as hubs and modems, also use this connector.

	Most USB cables that use this connector have a Type-A connector on one end that plugs into the computer.
Type-C 	A long, thin oval connector designed to be a universal USB port that works with many devices and connectors.
miniUSB 	This connector is used by portable electronic devices, such as digital cameras and some portable storage devices.
microUSB 	microUSB connectors are designed for smart phones and tablet devices. microUSB connectors are approximately half the thickness of miniUSB connectors, making them more appropriate for smaller devices.

USB 3.0 introduced several new connector types. The following table describes the connectors used by USB 3.0:

Connector	Description
Type-A	The blue tab indicates that the connector is a USB 3.0 Type-A connector and capable of USB 3.0 speeds. USB 3.0 Type-A connectors are backwards compatible with all previous USB versions.

	
<p>Type-B</p> 	<p>The USB 3.0 Type-B connector is larger in size and designed to carry both data and power. Due to their increased size, USB 3.0 Type-B connectors cannot be plugged into older USB Type-B ports. However, USB 3.0 peripherals that use this port are able to accept older USB Type-B connectors.</p>
<p>Micro-B</p> 	<p>The USB 3.0 Micro-B connector is used by portable devices, such as compact external storage devices, digital cameras, or smart phones.</p>

USB devices are connected to computers in one of two ways:

- Directly to a USB port located on the motherboard or on the front panel of a case
- To an external USB hub that is connected to the computer

USB hubs can be chained together to provide even more USB ports.

USB devices can be classified according to how they receive power.

Type	Description
Self-Powered	<p>Devices that rely on their own power supply (i.e., they are plugged into an AC outlet) are <i>self-powered</i> devices (sometimes called <i>active</i> devices). USB 2.0 devices that draw more than 500 mA of power are required to be self-powered; USB 3.0 devices that draw more than 900 mA of power are required to be self-powered.</p>
Bus-Powered	<p>USB cables have wires to carry both power and data. Bus-powered (sometimes called passive) devices get their power via the USB cable. Bus-powered devices are classified as low-powered or high-powered devices, depending on the amount of power they draw from the USB bus.</p> <ul style="list-style-type: none">▪ Low powered devices use 100 mA or less▪ High-powered devices use between 100 and 500 mA (up to 900 mA for USB 3.0)

Like USB devices, USB hubs can be bus-powered or self-powered. You cannot connect high-powered devices to a bus-powered hub (you can connect only low-powered or self-powered devices to a bus-powered hub). Therefore, self-powered hubs that provide 500 mA per port are recommended to ensure an adequate power supply to all bus-powered devices that you may wish to connect to the hub.

To install a USB device, you typically install the software driver before attaching the device. When you plug in the device, it will be automatically detected and configured.

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