USB4 is coming soon and will (mostly) unify USB and Thunderbolt



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This Tuesday, the USB Implementers Forum published the official USB4 protocol specification. If your initial reaction was “oh no, not again,” don’t worry—the new spec is backward-compatible with USB 2 and USB 3, and it uses the same USB Type-C connectors that modern USB 3 devices do.

Connectors and cables

Although you’ll still be able to connect old-school devices with USB Type-A or USB Type-B connectors to new USB4 laptops and hubs, you’ll need to do so with dongles. The older, non-

reversible connectors aren’t able to support USB Power Delivery, an intelligent charging protocol that allows negotiation of faster (or slower, but less battery-draining) charge rates.

This shift to USB Type-C is one we should all be embracing. Even if you don’t care about the power and data-delivery features, USB Type-C adapters are much easier to plug in. My family destroys so many USB Type-A charging cables I’ve seriously considered setting up a monthly recurring delivery on Amazon—but my eight-year-old son hasn’t damaged a single Type-C cable in the eight months that we’ve had them. The difference is enormous.

Although existing USB 3.x charging cables will continue to work fine, you will need to purchase new USB4 cables to take advantage of the full range of power and data delivery the protocol offers.

(And in case you were wondering, the document from the USB Implementers Forum puts spaces in “USD 2” and “USB 3,” but not “USB4.)

Thunderbolt compatibility

In 2017, Intel donated the specs for Thunderbolt 3 to the USB Implementers Forum for third-party use. Thunderbolt matters because its incredibly high 40Gbps signaling rate allows for peripheral, externally connected GPUs, as well as high-throughput, low-latency connections to more traditional peripherals such as storage and displays. USB4 offers Thunderbolt 3 compatibility—but only if individual manufacturers elect to build it in. The USB Promoter Group’s CEO, Brad Saunders, says he expects that most computers will offer Thunderbolt 3 compatibility, whereas phones and tablets will likely not.

Another problem is that, while use of the standard is royalty-

free, use of the trademark is not. If OEMs want to advertise their devices as Thunderbolt 3 compatible, they'll still need to be certified by Intel—which involves a decidedly non-free hardware validation process. If Intel continues requiring this direct validation in order to use the Thunderbolt brand, we may see new terms arise to inform consumers of the presence, or absence, of compatibility with Thunderbolt 3 devices.

USB4 low, medium, and high speeds

Not all USB4 devices support the full 40Gbps rate in the specification. USB4 devices may be designed for 10Gbps, 20Gbps, or 40Gbps signaling rates. There is unfortunately no proposed, clear branding indication, such as a change in the physical port color for higher-speed connections. So consumers will need to look closely at spec sheets if they want the highest rates available.

USB4's lowest transfer rate is equivalent to USB 3.1's SuperSpeedPlus, also at 10Gbps. Its higher 20Gbps and 40Gbps rates require dual-lane cables; the 20Gbps rate will work with any USB 3.2 Type-C dual-lane cable, but the 40 Gbps rate may need higher-cost, 40Gbps-certified cables.

The protocol also specifies rate control for multiple devices attached to the same port. This means that more devices can be connected to a single port before significant latency and throughput problems crop up. For example, a 1080p USB4 display might advertise a requirement for 3Gbps of data, which would then be prioritized over other peripherals connected to the same port. This can prevent frame drop or other latency issues from occurring with a storage device and display connected via the same port and cable.

Fast charging for all

Some, but not all, of the current crop of USB 3.2 Type-C

devices support the USB-PD power-delivery protocol. This changes with USB4, as USB-PD support becomes mandatory for all devices. Intelligent negotiation of charging rates brings both faster charging and better battery life to the devices which support it. Power-hungry devices like phones and laptops can charge up to 100W, while much lower-power devices such as headsets can opt for a much lower trickle charge rate, conserving battery on the laptops and phones powering them.

Conclusions and availability

USB4's faster signaling rate probably isn't going to lead to everything being suddenly faster—in particular, storage devices such as external disks and thumb drives will still be subject to the limits of their actual underlying media. It's not at all uncommon to see cheap USB 3.1 thumbdrives topping out at 30MB/sec or less—less than even USB 2.0's 480Mbps rate, let alone 3.1's 5Gbps.

The extension of Thunderbolt 3 from only select Intel devices to—hopefully—the majority of laptops and PCs is a welcome change, as is mandatory USB-PD support.

The USB4 specification itself is available today, but we don't expect to see the OEMs rolling out the first USB4 devices until sometime in 2020, with widespread availability more likely for early 2021.

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