Head to head: USB-C vs. HDMI vs. DisplayPort

DVI is pretty much dead. VGA ports are but a distant memory.

Welcome to 2018, and the age of the modern digital video connection, where HDMI and DisplayPort rule, the latter in the form of both dedicated DisplayPort sockets and courtesy of an alternate mode via the neat little USB-C connector. But how do these cutting-edge video interfaces compare? Does it matter whether you're gaming or hammering through spreadsheets? Let battle commence.

Round 1

BANDWIDTH

In this age of ever higher resolutions, color depths, dynamic ranges, and refresh rates, the most important metric for any digital display interface is bandwidth. Intriguingly, it's a moving target. Today, 2K displays with 144Hz refresh are becoming more popular. Tomorrow, it will be 4K, then in a few years, 8K and plenty of Hz. This also applies to the interfaces. HDMI first appeared in 2002, and supported up to 3.96Gb/s of raw data, and a maximum resolution of 1920x1200 at 60Hz. Today, the HDMI standard in available devices is at 2.0b spec, delivers 18Gb/s, and maxes out at 3840x2160 at 60Hz. HDMI 2.1 increases that hugely to 48Gb/s, but has yet to appear in shipping devices. The situation with DisplayPort is more complicated. Version 1.4 is the latest spec you'll find, and enables a maximum total bandwidth of 32.4Gb/s. However, by way of example, while Nvidia's GeForce 10 graphics chipsets support DP1.4, it's not implemented in all boards. For some, it can be enabled in a firmware update. Similar uncertainty applies to USB-C, which varies according to the underlying DisplayPort implementation.

WINNER:
DisplayPort and USB-C, but check your version.

Round 2

FEATURES AND EASE OF USE

We'll drop the suspense on this one, and declare the unambiguous winner: USB-C, of course. It takes everything DisplayPort can do up to version 1.4, and adds a whole slew of funky additional functionality. Firstly, it adds plain old USB data transmission, so you can use a single cable for video signals, and to drive a USB hub on your monitor. It also adds power, and critically in the downstream direction. That means you can use a single cable from a laptop to a monitor to have the former drive the video signal to the latter, and have the latter charge the former. Clever! It's also worth noting that USB-C is entirely reversible. You don't have to fumble around the back of a PC or display trying to orient the end of the cable correctly. It works both ways. As for the contest between DisplayPort and HDMI, it's probably a dead heat. Both support audio and video simultaneously. HDMI has the edge in terms of commonality—it's the interface of choice for consumer video products—while DisplayPort takes the prize for flexibility, thanks to its support for daisychaining multiple displays from a single output source socket (something USB-C also offers).

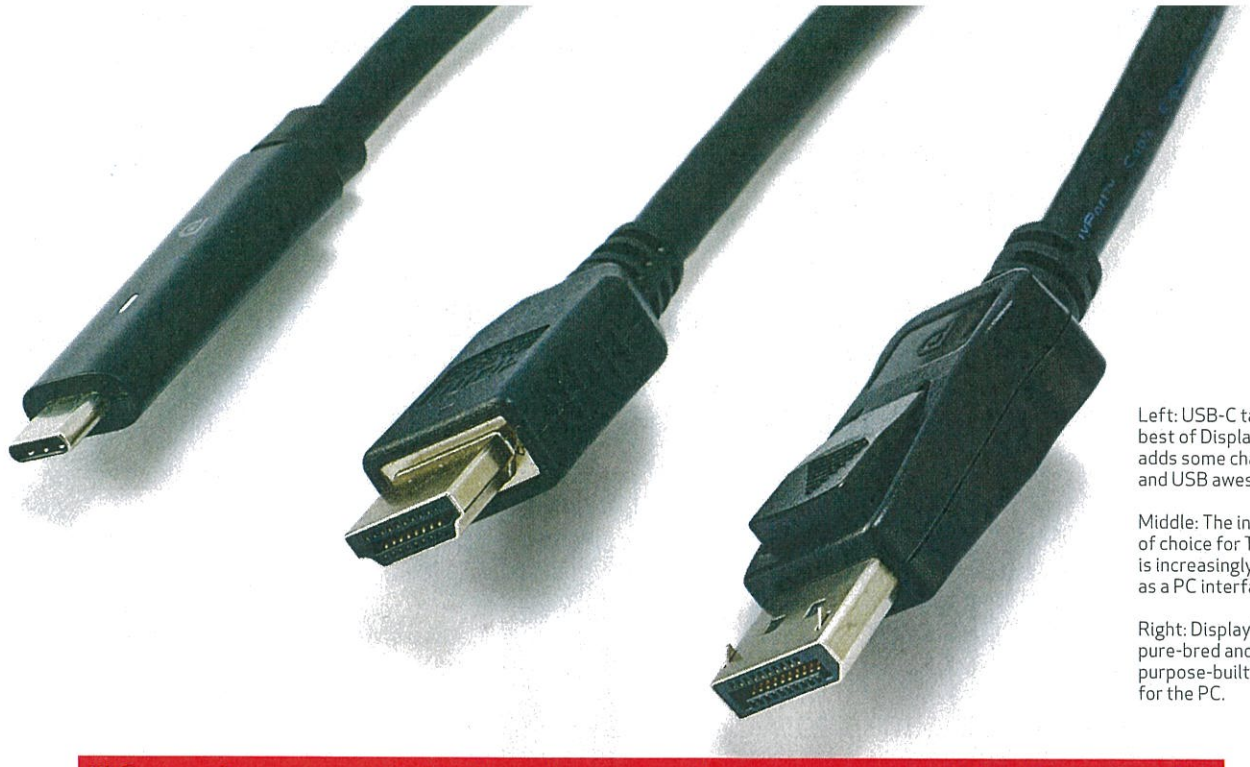
WINNER:
USB-C, easily.

Round 3

GAMING

So, you game a lot. But does it matter what video connection interface you use? That depends, mostly, on your display. If you have a pretty basic monitor with 60Hz refresh, modest native resolution, and nothing by way of features such as adaptive sync, it makes little difference. If you want to drive a VR headset with a single cable for power, video, audio, and control input, there's only one option: USB-C. In the middle, DisplayPort tends to be the best option for gamers, because of the greater bandwidth from DisplayPort 1.4. If you have, for instance, a 1440p monitor at 144Hz, both HDMI 2.0 and DisplayPort 1.4 have you covered. Up to 4K and 144Hz, however, only DisplayPort 1.4 will get the job done. Then there's adaptive sync and variable refresh rates. That includes Nvidia's G-Sync tech and AMD's simpler FreeSync. For now, DisplayPort is required to access these features, and thus improve the smoothness of your gaming, even at lower frame rates, while eliminating screen tearing. However, the upcoming HDMI 2.1 includes support for the VESA variable refresh rate standard.

WINNER:
USB-C for VR, DisplayPort is OK for everything else.



Left: USB-C takes the best of DisplayPort and adds some charging and USB awesomeness.

Middle: The interface of choice for TVs, HDMI is increasingly capable as a PC interface.

Right: DisplayPort is a pure-bred and purpose-built interface for the PC.

"If you're on a tight budget and you want a big, beautiful 4K screen, for instance, an HDTV is not only a great solution, it may be your only option."

Round 4

PRODUCTIVITY

Getting things done makes different demands on your PC from gaming. So, what's best for content creation, work, and generally making things happen? In part, that depends on your budget. Larger screens with higher resolutions and greater dynamic range require more bandwidth, for instance. Right now, anything beyond 4K remains pretty niche. On the other hand, future-proofing is worthwhile, even if you can't afford the latest $3,000 8K display. If you're buying a new PC, something with a graphics subsystem that supports 5K-plus is worthwhile. After all, 4K monitors went from exotic to fairly affordable in just a few years. The same will probably happen with 8K within five years. Today, that means DisplayPort or USB-C, but with the caveat that you need to check what version of DisplayPort is supported in each case. DP1.4 is what you want to ensure support for future high-res displays. Of the two, USB-C has the edge. It gives the full DisplayPort experience, and adds USB functionality, plus the ability to charge and drive a display, all with a single cable.

WINNER:
USB-C.

Round 5

HDR

High dynamic range, or HDR, is the latest and hottest display tech. It also makes very particular demands of your display subsystem. The HDR10 standard includes 10-bit per channel color, so requires 25 percent more bandwidth than conventional 8-bit color. HDMI 2.0b does support HDR, but only up to 4K and 50Hz. For 4K at 60Hz over HDMI 2.0b, the chroma subsampling must be reduced slightly to reduce the bandwidth, which means you're not getting the full range of colors. HDMI 2.1 will deliver the full HDR10 experience at 4K and 144Hz, or higher resolutions with lower refresh rates, but HDMI 2.1 devices aren't quite here yet. As for DisplayPort (and USB-C), HDR support was added with version 1.4. That supports HDR at 8K and 60Hz using "visually lossless" Display Stream Compression, or HDR at 4K and 60Hz without any compression. So, as it stands, the current best DisplayPort implementation is superior to HDMI for HDR. The catch is that no new DisplayPort standard has been announced, while HDMI 2.1 will outstrip DisplayPort 1.4.

WINNER:
DisplayPort and USB-C now, HDMI later this year.

And the winner is...

The overall winner among today's display standards for the PC is clear. It's USB-C. It's the most flexible, feature-rich, and capable of the three main options. The ability to plug a laptop into a monitor with a single cable, and drive it at very high resolutions and refresh rates, at the same time as charging the laptop and enabling the connection of USB devices is very, very cool. USB-C is also perfect for next-gen VR gaming with a single cable. Even on the desktop, the simplicity implied by USB-C is a significant boon. Of course, remember that USB-C as a display connector is only as good as the DisplayPort interface underneath. Also bear in mind that this subject is something of a moving target. HDMI 2.1 has been announced, and should soon begin to appear in devices. It has the edge on DisplayPort 1.4, and thus USB-C, for outright bandwidth, if not overall features, so may be the better option for some edge cases with really high spec displays. Meanwhile, the upgrade path for DisplayPort, and its support for future cutting-edge PC monitors, is a little uncertain. ■