**DISPLAYPORT FREQUENTLY ASKED QUESTIONS**

**DISPLAYPORT GENERAL FAQS**

Q: Who owns and develops DisplayPort Standards?

A: DisplayPort is a video interface standard administered by VESA, the Video Electronics Standards Association. DisplayPort is the new generation audio/video (A/V) interface developed by the GPU/display industry segment and it continues to gain market momentum. DisplayPort enables high display performance, robustness, and versatility, the highest degree of system integration, and greater interoperability among various device types.

Q. What is the current version of the DisplayPort Standard?

A. DisplayPort 1.4 was published in March 2016 and defines the new normative requirement and informative guideline for component and system design.  Most DisplayPort products currently available in the market today (as of May 2016) were built to the previous version, DisplayPort v1.2a. Testing that is performed for DisplayPort device certification is also still based on the DisplayPort v1.2a Standard (devices must be certified to use the DisplayPort logo). Products built to DisplayPort 1.4, as well as compliance testing based on DisplayPort 1.4, should become available in 2017.

For more information on DisplayPort 1.4, see [DisplayPort 1.4 Standard FAQs](https://www.displayport.org/faq/#DisplayPort 1.3 FAQs)

Q. Which types of products include DisplayPort?

A. DisplayPort was originally developed as the next generation personal computer display interface and is now available on a wide range of tablets, notebooks, and desktop computers as well as monitors. It is now also becoming available on digital televisions, including some 4K TVs, as a display input.

Q. What are the user benefits of DisplayPort?

A. DisplayPort provides several direct and indirect benefits to the user. Direct benefits include higher performance capability, the availability of display adapters for legacy display types, and the ability to connect multiple displays to a single video output. Indirect benefits include smaller system form factor and lower system cost, because DisplayPort enables higher system integration, requires less RF shielding, and is royalty free. DisplayPort also uses a small connector, or can be combined with other interfaces onto a single common connector. As the only AV interface with link training, a more robust and stable link is established.

Q. How is DisplayPort different from HDMI? Aren’t they very similar?

A. DisplayPort and HDMI are very different technically, and each began with a different product focus. For over ten years, HDMI has been the de-facto connection for home entertainment systems and is used widely on HDTVs as an AV interface. Some PCs and monitors include HDMI to enable connectivity with HDTVs and other consumer electronics gear. DisplayPort, a newer standard originally developed to support the higher performance requirements of personal computers, is based on updated signal and protocol technology similar to that already used in today’s computer systems, enabling an increase in performance and integration. Because DisplayPort uses common signaling technology in use for data communications and a packetized data structure, through a common connector, it can be combined with standards such as USB and Thunderbolt. With link training/link quality monitoring as in data communications, DisplayPort provides a more robust and stable AV link.

Q. How can I use my existing display or digital TV set with a new computer that has a DisplayPort output?

A. DisplayPort has the unique ability to support external display adapters. The DisplayPort Source device (such as a notebook computer) provides power at the DisplayPort plug to power such an adapter, and it detects the type of adapter connected, as well as the type of monitor. Inexpensive DisplayPort adapters are readily available for VGA, DVI, and HDMI displays. Adapters for HDMI 2.0 will become available in the near future.

Q. Does DisplayPort also support audio?

A. Yes, DisplayPort supports multi-channel audio and many advanced audio features. DisplayPort to HDMI adapters also include the ability to support HDMI audio.

Q. Can DisplayPort support 3D Stereo?

A. Yes, DisplayPort includes protocol support for transmitting left and right eye display data. DisplayPort 1.4 supports 4K Stereo at 120Hz frame rate with full 24 bit 4:4:4 color.

Q. Does DisplayPort include content protection capability?

A. Just like DVI and HDMI, DisplayPort supports HDCP content protection. DisplayPort 1.4 supports the latest HDCP 2.2 content protection that is required for the latest premium AV contents.

Q. What are some of the unique capabilities in DisplayPort?

A. Because of its high data rate, DisplayPort 1.2a systems today can support 4K displays at 60Hz refresh and full 30-bit 4:4:4 color (non-chroma subsampled).  DisplayPort 1.4 systems will support 5K displays (5120 x 2880) at 60Hz refresh, and for 4K displays will enable deeper color and higher refresh rates. When enabled with DisplayPort’s Multi-Stream feature, several monitors can be connected to a single output on a video source device (such as a laptop or computer), using a daisy-chain or hub configuration.

Q. How does VESA assure interoperability among DisplayPort enabled systems?

A. VESA manages the DisplayPort Compliance program, which is designed to assure interoperability between various systems. To bear the DisplayPort Logo, a system must pass compliance testing and the system OEM needs to be a VESA member, which assures they are aware of the latest DisplayPort related specifications and updates.

Q. How has the adoption of Thunderbolt affected DisplayPort?

A. Thunderbolt takes advantage of DisplayPort technology, and Thunderbolt Hosts (such as notebooks and personal computers) are backward-compatible with DisplayPort cables and DisplayPort monitors. This means you can plug a DisplayPort monitor into a Thunderbolt computer output, using a standard DisplayPort cable. The adoption of DisplayPort technology by Thunderbolt has helped to accelerate the adoption of DisplayPort in high-end computing and video post-production.

 **DISPLAYPORT 1.4 STANDARD FAQS**

Q: Does the release of DisplayPort 1.4 mean that DisplayPort 1.2 products are obsolete?

A: Not at all. VESA develops and publishes standards like DisplayPort prior to their actual deployment in the field. DisplayPort 1.2a represents the latest interconnect technology now available to consumers from manufacturers. The new DisplayPort capabilities included in DisplayPort 1.4 have begun the cycle of hardware development that will result in such technology becoming available to consumers in a range of products over the next few years. And like other new versions of DisplayPort, DisplayPort 1.4 is backward compatible with earlier DisplayPort standards.

Q: When will I be able to buy products that use DisplayPort 1.4?

A: Products that support new DisplayPort features defined in DisplayPort 1.4 should become available in 2017. Early implementations could very likely use DisplayPort Alt Mode over USB Type-C – See [DisplayPort Alt Mode for USB Type-C FAQs](https://www.displayport.org/faq/#DisplayPort Alt Mode for USB Type-C FAQs) for more information.

Q: How will I know if my device supports new DisplayPort 1.4 features?

A: Vendor packaging and on-line information should indicate the DisplayPort features supported for each product.

Q: Will DisplayPort Alt Mode on the Type-C connector support DisplayPort 1.4?

A: Yes. All of the features associated with DisplayPort 1.4 will be available for the DisplayPort Alt Mode.

Q: Will Thunderbolt, which uses DisplayPort for video, support DisplayPort 1.4?

A: We expect that other interconnect technologies that use DisplayPort as a video transport will adopt the DisplayPort 1.4 features.

Q: Does DisplayPort 1.4 enable support for the latest content protection?

A: Yes, DisplayPort 1.4 enables support for HDCP version 2.2. This requirement will apply to DisplayPort-to-HDMI 2.0 converters as well (including USB Type-C to HDMI 2.0 converters that utilize DisplayPort Alt Mode).

Q: Can I connect a DisplayPort 1.4 device to a new television that supports HDMI 2.0?

A: Existing DisplayPort source devices, such as PCs, already support HDMI televisions up to 1080p through the use of a DisplayPort to HDMI adapter. DisplayPort 1.4 adapters will enable DisplayPort source devices to support HDMI 2.0, enabling the support for 4K UHD with up to 60Hz refresh and up to full 24 bit color with the 4:4:4 pixel format. These adapters do not require the HBR3 link rate, requiring only HBR2, but will depend on some of the protocols within the DisplayPort 1.4 Standard. Some DisplayPort 1.2a systems will most likely be upgradable through firmware to support this new feature. These new adapters will also be available in DisplayPort Alt Mode over the USB Type-C connector.

Q: Does DisplayPort 1.4 still support adapters to VGA, DVI and HDMI?

A: Yes.

Q: Does DisplayPort 1.4 enable support for camera RAW format data?

A: Yes.

Q: Is VESA’s new AdaptiveSync supported?

A: Yes. AdaptiveSync was first supported by DisplayPort 1.2a, and it is already supported in some available products. This is also branded as “Free-Sync” from AMD, which is based on VESA’s AdaptiveSync Standard.

 **DISPLAYPORT OVER USB-C (DISPLAYPORT ALT MODE) FAQS**

Q: What is the DisplayPort™ over USB-C™?

A: DisplayPort™ over USB-C™ enables the USB Type-C connector and cable to support the DisplayPort interface for A/V transport capability.

Q: Is DisplayPort over USB-C a VESA Standard?

A: Yes, it is published by VESA and called the DisplayPort Alt Mode for USB Type-C Standard. The development of this Standard was done in collaboration with the USB 3.0 Promoters group, and VESA continues to collaborate with USB for the refinement of the specification and for compliance test development.

Q: What type of products will use this standard?

A: The USB Type-C connector is the next generation USB interface and it will appear on devices such as Smart Phones, Tablets, PCs, Notebooks, Docking Stations, Displays, and Peripherals. Many of these systems are expected to support DisplayPort over USB-C for video output support, just as the Apple MacBook and Google Chromebook Pixel do now.

Q: When will I be able to buy these products?

A: Products from Google and Apple are shipping now, and more products with DisplayPort over USB-C are expected in 2015.

Q: What user benefits are derived from DisplayPort over USB-C?

A: When using DisplayPort over USB-C, the USB Type-C connector becomes the single system connection point for data, full performance AV interface, and power, with such features combined or supported individually. DisplayPort over USB-C enables the USB Type-C connector to support full DisplayPort capability including video resolutions of 5K and beyond. The USB Type-C connector is also reversible, which further simplifies the consumer experience.

Q: Does this mean that with the addition of DisplayPort over USB-C, I can still expect the same USB data and USB Power Delivery capabilities across USB Type-C connector?

A: Yes. DisplayPort, USB data, and USB Power Delivery can all be carried simultaneously through the same USB Type-C connector and cable. This is supported by a standard full-featured USB Type-C cable.

Q: Can DisplayPort over USB-C provide the same level of performance and features as the standard DisplayPort connection?

A: Yes. Just like in standard DisplayPort connectors and cables, DisplayPort over USB-C can take advantage of the four high-speed data lanes in the USB Type-C connector and cable to provide 4K display resolutions and beyond.

Q: How will I know if the Type-C connector on my device supports DisplayPort over USB-C?

A: USB Type-C connectors that support the DisplayPort over USB-C will normally include the DisplayPort (DP) logo near the connector. This is described in the USB-IF Trademark License Agreement and Usage Guidelines document published by the USB IF and available here:  <http://www.usb.org/developers>

Q: Can I connect an existing monitor to a new computer, tablet or phone that uses the USB Type-C connector with DisplayPort over USB-C?

A: Yes. Adapters and Adapter cables, as defined in the DisplayPort Alt Mode for USB Type-C Standard, are available to connect DisplayPort over USB-C to DisplayPort, HDMI, DVI, and VGA monitor inputs.

Q: What is the best way to connect a DisplayPort over USB-C video source device to a display that uses a standard DisplayPort receptacle?

A: It is preferable to use a USB-C to DisplayPort adapter cable, and it is best to use a DP certified adapter cable.  This cable has a USB-C plug on one end, and a DisplayPort plug on the other end (either a mini-DP or standard DP plug). The DisplayPort over USB-C Standard was designed to accommodate such adapter cable.  While there are USB-C to DisplayPort receptacle adapters on the market that enable the use of a standard DisplayPort cable (one with a DisplayPort plug on both ends), use of such adapter is not recommended because it may result in poor picture quality, intermittent operation, or no video display.

Q: Can I connect my HDTV to a device that uses DisplayPort over USB-C for video output?

A:  Yes. Adapters and Adapter cables are used to connect DisplayPort over USB-C to an HDMI input on the HDTV.  HDMI 2.0 is supported to enable 4K resolution. If the HDTV has a DisplayPort input, then a USB-C to DisplayPort adapter cable can be used to provide DisplayPort display capability.

Q: Can we expect to see displays using DisplayPort over USB-C for video input?

A:  Yes. Displays will also take advantage of the USB Type-C connector to enable the use of the reversible connector as well as carry USB data and power over the same cable. This can allow the inclusion of a USB hub in the monitor, for example, and allow the monitor to provide power to the computer – thereby enabling a single cable for desktop use of a portable system. A standard, full-featured USB Type-C cable would be used in such configuration.

Q: Will dock products that use the USB Type-C connector support DisplayPort over USB-C?

A: Yes. A dock can provide a single connection to a PC or other device using a USB-C cable that can provide charging power, transport USB data, and transport A/V data for one or more displays using the DisplayPort Alt Mode. The dock can be implemented in a variety of form factors, including as a PC monitor. The dock can include a USB 2.0 or USB 3.1 hub function to support one or more downstream USB devices, and in the case where the dock is also a PC monitor, can include a display and speaker that would utilize the transported DisplayPort data. The dock can also include a DisplayPort branch device to support one or more downstream display devices, including DisplayPort displays, or VGA, DVI, and HDMI displays by using a DisplayPort protocol converter. Downstream DisplayPort displays can be supported using either native DisplayPort receptacles, or by using a USB-C connector supporting the DisplayPort Alt mode was well as power and USB data.

Q: Will USB hubs that use the USB Type-C connector support DisplayPort over USB-C?

A: No, the USB IF (Implementers Forum) defines a “hub” as a product that only supports USB, and in particular does NOT support Alt Modes, including the DisplayPort Alt Mode. The sort of “hub” product that also supports DisplayPort Alt Mode is not identified as a “hub”, but is instead identified as a “dock”, as explained in the above FAQ. This avoids consumer confusion and terminology conflict with USB specifications. The dock can include USB hub functionality.

Q: Can a user connect a DockPort™ hub to a video source device that uses the new Type-C connector?

A: Yes. An adapter should be available to connect a DockPort capable source device that uses a USB Type-C connector to a DockPort Hub, which uses a tethered cable with a mini DisplayPort connector.

Q: How does the USB Type-C Standard share its interface with DisplayPort?

A: The USB Type-C Standard includes provision for Alternate Modes, which involves repurposing of the connector pins and cable wires for other interface types. Discovery of Alternate Mode support and enablement is performed through leveraging the use of the USB Power Delivery protocol.

Q: What happens if I plug my display into a Type-C port that does not support the DisplayPort over USB-C?

A: No video data will be received by the display, so there will be no image on the screen. Doing this will not harm your device. A warning message will also be displayed on the screen of a USB product.

Q: How do I know which end of the cable to plug into my device?

A: The USB Type-C to Type-C cable is reversible, and so is the USB Type-C to DisplayPort adapter cable. These can be plugged in either direction. The USB Type-C to HDMI, DVI, VGA, and DockPort converters need to be plugged into a video source device that has the USB Type-C connector.

Q: I have a Mac with Thunderbolt that uses DisplayPort for video. Will there be a Thunderbolt to USB Type-C adapter to connect a DisplayPort monitor that uses a Type-C connector?

A: A Thunderbolt connector on a Mac or PC uses the standard mini DisplayPort connector and supports DisplayPort as well as Thunderbolt. So for the Thunderbolt connector, you can use the standard USB Type-C to mini DisplayPort adapter cable to connect to the monitor.

Q: Will products using the DisplayPort over USB-C be certified?

A: Yes. VESA and the USB-IF are working on a comprehensive certification program.

Q: HDMI announced HDMI Alternate Mode in September 2016.  How does this compare to DisplayPort Alt Mode?

A: According the HDMI announcement, the HDMI Alt Mode will deliver a native HDMI 1.4b signal across the USB Type-C connector.  This will allow the use of a simple cable to connect the USB-C enabled video source to an HDMI Display.  In addition to supporting HDMI display data, just like standard HDMI cables the HDMI Alt Mode will also support the HDMI Audio Return Channel (ARC), HDMI Ethernet Channel (HEC), and the Consumer Electronic Control (CEC) feature.

This means that HDMI Alt Mode is designed to provide connection of the USB-C enabled video source to a single HDMI enable monitor or TV.  DisplayPort Alt Mode can also support an HDMI display, but at an even higher refresh rate and color depth. In addition, DisplayPort Alt Mode can also support the power delivery and native USB connectivity provided by a native USB-C connector, and support VGA and native DisplayPort displays in addition to HDMI and DMI.  DisplayPort Alt Mode can also support multiple displays from a single USB-C output, and can operate over a standard USB-C cable.

Q: Can HDMI Alt Mode and DisplayPort Alt Mode devices and accessories be used interchangeably?

A: No, the types of signals used by HDMI Alt Mode are not compatible with DisplayPort Alt Mode.  For example, a USB-C to HDMI adapter cable that uses DisplayPort Alt mode can only be used with a USB-C video source device that supports DisplayPort Alt Mode.

Q: Will HDMI Alt Mode support 4K video like DisplayPort Alt Mode?

A: HDMI Alt Mode supports HDMI 1.4b which does support 4K video, but only up to 30 frames per second (it does not support HDMI 2.0). While this may be adequate for office PC applications, casual web browsing, and photo editing, 30 frames per second is not adequate for gaming and high quality video playback.  HDMI Alt Mode will support 60Hz at lower resolutions including 1080p.  In contrast to this, most PCs and other devices on the market today that support DisplayPort Alt Mode support 4K 60 frames per second, using uncompressed video, through the use of DisplayPort Alt Mode.  Utilizing the new DisplayPort 1.4 Standard, future DisplayPort Alt Mode devices will support 8K video at 60Hz in 4:4:4 pixel format, and 120Hz in 4:2:0 format.

Q: Can DisplayPort Alt Mode support a USB-C to HDMI Cable, like HDMI Alt Mode?

A: Yes, this type of DisplayPort Alt Mode accessory is known as a USB-C to HDMI protocol adapter cable.  Most people, however, prefer to use USB-C to HDMI protocol plug adapters (also called “dongles”) because they allow the use of an existing cable, and can be carried to use with an HDMI projector with an attached HDMI cable, for example.  This is why dongles appeared on the market before adapter cables.

Q: How do I know if a device supports DisplayPort Alt Mode or HDMI Alt Mode?

This information should be provided by the device documentation.  There is no indication yet regarding how HDMI Alt Mode devices will be labeled. Devices that support DisplayPort Alt Mode may also have the “DP” logo next the connector, in addition to the USB logo.

It should be noted, however, that even if DisplayPort Alt Mode is not identified, most video source devices on the market today that use the USB-C connector already support DisplayPort Alt Mode.  Products today claiming “video over USB-C” are typically using DisplayPort Alt Mode.

Q: Will future products on the market support DisplayPort Alt Mode, or HDMI Alt Mode?

DisplayPort Alt Mode is widely supported and provides a lot more connectivity options compared to HDMI Alt Mode.  Most PC chips and GPUs that support the USB-C connector also include Display Alt Mode support. The DisplayPort Alt Mode Standard was published in September 2014, developed in alliance with the USB-IF for the USB-C connector, and through close cooperation within the PC, table, phone, and display industries.  This is why, for example, DisplayPort Alt Mode is natively supported by a standard “full feature” USB Type-C cable.

Products adopting HDMI Alt Mode will likely continue to support DisplayPort Alt Mode.

Q: Can a device that supports DisplayPort Alt Mode also support HDMI Alt Mode?

A: Yes, USB-C devices can support multiple Alt Modes; just like all USB-C devices that support the Thunderbolt 3 Alt Mode also support the DisplayPort Alt Mode.  To add HDMI Alt Mode support to a device that already support DisplayPort Alt Mode, we imagine that an alternate USB-C configuration switch / signal mux would be needed in order to support the TMDS clock and data signals that are used by the HDMI signal.  In addition, the other sideband channels including DDC, and ARC, HEC and CEC, if supported, would need to managed.  HDMI Alt Mode compliance testing would also need to added, and the device OEM would likely need to be an HDMI Adopter and pay HDMI royalty.

Q: Will HDMI Alt Mode enable dock devices and dock functionality like DisplayPort Alt Mode?

A: Application of the HDMI Alt Mode will be limited to USB-C enabled video source devices; it will deliver video to a single HDMI display over a new type of HDMI cable.  Since is does not support power delivery nor native USB data transport, and only supports one display, it will not provide the functionality needed for dock device implementation.  And since it can only be connected to an HDMI display, and not a USB-C enabled display, the display cannot include the dock functions supported by DisplayPort Alt Mode including charging power for the connected device, nor a SuperSpeed USB hub.

Q: Since we already have DisplayPort Alt Mode, why was the HDMI Alt Mode introduced?

A: The HDMI Alt Mode is a competitor to the DisplayPort Alt Mode hoping to gain market share.  Unlike VESA, which is a non-profit association open to all companies, HDMI LLC is a private, for-profit company that generates revenue through the licensing and royalty collected from OEMs adopting HDMI in products.

 **DISPLAY STREAM COMPRESSION (DSC) FAQS**

Q: What is the VESA Display Stream Compression (DSC) Standard?

A: VESA, the Video Electronics Standards Association, has published a new Standard in 2014 that uses visually lossless image compression to increase the amount of data carried by a display interface data rate, saving power.

Q: What is meant by visually lossless?

A: By being visually lossless, a typical observer of a display, under typical viewing conditions, would in most cases not notice any difference or degradation of images or video after compression, when compared with the uncompressed image or video.

Q: Is DSC designed to be used with DisplayPort or other display interface standards?

A: DSC is an open standard that was developed in liaison with the MIPI Alliance for general purpose display interface compression. It is currently included for optional use in VESA’s Embedded DisplayPort (eDP) Standard v1.4, and MIPI’s DSI Specification v1.2, and is open for use in other display interface standards as well. VESA anticipates on-going liaison activity other parties interested in the DSC Standard as upcoming improvements or revisions arise.

Q: What are the main applications for the DSC Standard?

A: The initial application for DSC is portable, battery powered systems with an embedded display. DSC is used in the internal embedded display interface to both save system power, which extends battery life, and reduce the system form factor’s weight and cost by decreasing the number of interconnect wires. It also decreases the display’s frame buffer size, which further decreases cost. In the future, DSC will be used to further increase display resolution for external displays. For example, DisplayPort 1.3 will be able to support 8K video at 60Hz and 24-bit color using a low 2:1 compression ratio or 30-bit color using a low 2.5:1 compression ratio, which will provide visually lossless image quality (indistinguishable from the original image), unlike the use of chroma subsampling.

Q: How does VESA’s DSC Standard compare to other image compression standards?

A: Compared to other image compression standards such as JPEG or AVC, etc., DSC achieves visually lossless compression quality at a low compression ratio by using a much simpler codec (coder/decoder) circuit. The typical compression ratio of DSC range from 1:1 to about 3:1, which offers significant benefit in interface data rate reduction. DSC is designed specifically to compress any content type at low compression with excellent results. The simple decoder (typically less than 100k gates) takes very little chip area, which minimizes implementation cost and device power use, and adds no more than one raster scan line (less than 8 usec in a 4K @ 60Hz system) to the display’s throughput latency, an unnoticeable delay for interactive applications.

Q: What testing did VESA perform to determine that DSC is visually lossless?

A: During the development of DSC, the contributing VESA member companies performed ongoing visual tests to uncover visual compression artifacts using different image types and image motion. This testing was used to fine tune the DSC codec (coding / decoding algorithm). For the final DSC codec, the visual performance of DSC was evaluated through clinical testing by VESA in collaboration with member companies. The evaluation included a statistically significant number of observers who viewed many images over four image categories including artificial engineered images, text and graphics, such as street maps or different examples of printed material, people, landscape, animals and stills. Overall, observers completed nearly 250,000 subjective image comparisons. VESA members also concluded subjective testing as a far more robust method to verify visually lossless quality rather than using objective metrics, such as, PSNR which typically designates one value for an image. The results of this testing indicated that DSC met the visually lossless criteria set by VESA. The details of testing methodology and results will be published by VESA in early 2015.

Q: Does the implementation of the VESA DSC Standard require royalty payment?

A: The VESA DSC Standard is open and royalty free.

Q: Is there a VESA membership requirement to implement the DSC Standard?

A: The VESA DSC Standard was designed to be an open standard available for use by other video interface standards. The VESA DSC Standard, including the codec C source code files, is available from VESA for a nominal fee, and is available to VESA members for free.

Q: Does VESA plan to update the DSC Standard or publish other compression standards?

A: The current VESA DSC Standard is version 1.1, and it is likely that the VESA contributing members will make future optimizations and publish future updated versions that will be backward-compatible with version 1.1. VESA is also starting work on another display compression standard that will provide higher compression with the tradeoff of higher codec complexity.