

VESA Display Standards Updates

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Agenda

- VESA Overview
- DisplayPort Overview
- Compliance Testing
- USB4 DisplayPort Considerations
- Summary



VESA OVERVIEW

About VESA



- Global industry alliance with more than 290 member companies
- Leading PC/computer, display, hardware, software, and component manufacturers worldwide
- Mission to develop, promote and support ecosystem of vendors and certified interoperable products for the electronics industry
- Develops Open standards, contribution is open to all companies at all stages of development as well as promotion and marketing

VESA Standards Enable Many Market Segments...







Gaming consoles and headsets

Monitors, PCs and laptops



Smartphones and tablets



Automotive



Digital projectors



Digital signage / kiosks



...As Well as Many Aspects of Display Technology

- DisplayPort
- Embedded DisplayPort
- DisplayPort Alt Mode (Native DisplayPort over USB-C, used with USB 3)
- DisplayPort Tunneling (USB4 and Thunderbolt)
- Vehicular DisplayPort (VDP) – In definition



- Display Stream Compression (DSC)
- VESA Display Codec for Mobile (VDC-M)



Display

Interfaces

- Standardized Display Performance Measurement
- DisplayHDR Certification (High Dynamic Range)



- DisplayID
- Extended Display
 Identification Data
- Maltebisplay Interface

VESA Membership Continues to Grow





Historical Membership by Region

10 Year Flip from US to Asia Dominant

Europe US Asia





VESA Asia Membership

Asia Member Distribution of 150 Members





VESA Local Asian Support Capability

- VESA has long had a dedicated Japan Task Group with charter to promote the development of design tools and reference guides, PlugTests, educational seminars, and other activities for the benefit of VESA member companies, particularly those in Japan.
- **NEW:** VESA has added to its local support to Asia to address growing regional membership needs
- China (Mainland) and Taiwan are the fastest growing areas for VESA's membership.
- Kellen is VESA's Representative for all Chinese speaking areas of Asia
- This partnership will provide members with a communication option in their native language. Kellen will handle membership related activities including, new membership requests, renewals, PlugTest and event support and translation of VESA member messaging, etc.



Strong Support from Local Members

More than 40 member companies from Japan including...





DisplayPort [™] Overview



DisplayPort Market Penetration

- DisplayPort adoption grew significantly in 2019
- DisplayPort and DisplayPort Alternate Mode over USB-C
 - The common monitor interface for personal computers
 - Commonly supported on the USB-C interfaces supporting USB 3
 - Mandated for USB4 and Thunderbolt
- Embedded DisplayPort (eDP)
 - ~95% penetration in notebook PCs, used in many high-end tablets and now automotive



DISPLAYPORT[™] 2.0



DisplayPort 2.0 Summary

- DisplayPort v2.0 was released in June 2019
- Major features added:
 - Increase in data bandwidth performance (almost 3X)
 - DSC support mandated
 - MST (Multi-Stream Transport) is now standard protocol
 - Expanded Tunneling capability
 - Panel Replay, similar to PSR (Panel Self Refresh) used for eDP



- DisplayPort 2.0 enables up to 3X increase in video bandwidth performance
- First standard to support 8K resolution (7680 x 4320) at 60 Hz refresh rate with full-color 4:4:4 resolution, including with 30 bits per pixel (bpp) for HDR-10 support
- Beyond 8K resolutions achieved with maximum link rate to up to 20 Gbps/lane and more efficient 128b/ 132b channel coding

DisplayPort[™] EVOLUTION OF DISPLAYPORT DATA BANDWIDTH





New DisplayPort Link Rates

Parameter	DP 1.4a Published April 2018	DP 2.0 Published June 2019	Notes
Supported Link Rates (Gbps, each lane)	1.62 2.7 5.4 8.1	1.62 2.7 5.4 8.1 10 13.5 20	8b10b coding 8b10b coding 8b10b coding 8b10b coding 128b132b coding 128b132b coding 128b132b coding 128b132b coding
Max payload rate (4 lanes)	25.92 Gbps	77.36 Gbps	Speed increase x2.98

DisplayPort 2.0 is backward compatible with DP 1.4a and all earlier versions.



DisplayPort 2.0 Resolution Capability (Single Display Examples)

	Port Configuration	DisplayPort 1.4a	DisplayPort 2.0
	No Compression		
	4 Lanes, max link rate	5K (5120x2800)@60fps 24bpp	10K (10240x4320)@60fps 24bpp
	2 Lanes, max link rate	4K (3840x2160)@60fps 24bpp	8K (7680x4320)@30fps 30bpp
	With Compression (DSC)		
	4 Lanes, max link rate	8K (7680x4320)@60fps 30bpp	16K (15360x8460)@60fps 30bpp
Ν	2 Lane configuration is common for US	5K (5120x2800)@60fps 24bpp Key	: 10K (10240x4320)@72fps 30bpp
•	All above modes assume full 4:4:4 colo 30bpp is required for DisplayHDR oper	or encoding • fr ation • b	pp = bits per pixel



DP 2.0 Mandates Support for Display Signal Compression (DSC)

- VESA released DSC 1.2a in January 2017.
- DSC is now the industry standard data compression across the display interface.
- DSC was purposely designed to offer low latency, low complexity codec for visually lossless image compression to increase the amount of data carried by a display interface data rate, saving power.

Key features include

- Native 4:2:0 and 4:2:2 coding, Up to 16 bits per color, High Dynamic Range (HDR)
- DSC is mandated in DP 2.0 specification and is a powerful feature to allow designers to optimize BW, performance and power for Native DP, DP Alt Mode products and tunneled DP over USB4.



Optimization for Shared Interface Use

- Numerous specification enhancements to simplify the use of DisplayPort as an ingredient in the following interface examples:
 - The USB-C connector, using the DisplayPort Alt Mode (DP Alt Mode)
 - VESA Mobility DisplayPort Standard (MyDP)
 - VESA Embedded DisplayPort Standard (eDP)
 - ThunderBolt 3.0
 - Wireless interfaces



Compliance Testing



VESA PlugTest Events

- Provide significant value to member companies, particularly as new capabilities and products are deployed.
- Demonstrate and improve Traditional Interoperability
- Test Native DP and DP Alt Mode over USB Type-CTM products
 - HBR3, DSC, FEC, DisplayHDR and other new capabilities
 - Verify Test Equipment Correlation
- VESA hosted two successful PlugTests in 2019 (Taiwan and US)
- VESA plans to host at least two PlugTests in 2020
 - Taipei, Taiwan: Q1 2020 (Tentative)
 - Burlingame, CA: Q3 2020 (Tentative)



DP 8K Cable Specification and Certification

- Developed as part of DP 1.4a specification update
- DP8K Certified cables provide added assurance of smooth operation and full compliance at the higher link rates
- Dozens of DP 8K cables have been certified since launch of program

VESA Strengthens 8K Video Resolution Ecosystem with Market-ready DP8K Certified DisplayPort Cables

Posted on January 3rd, 2018

DP8K cables are guaranteed to support HBR3, the highest bit rate supported by DisplayPort version 1.4; new DisplayPort developments on the horizon offering even higher bandwidth levels SAN JOSE. Calif. [...]



DSC Compliance Testing

- VESA released DP 1.4a DSC CTS v1.0 in July 2019
- Compliance testing of DSC began in October 2019 for sources and sinks that support this feature
- Updates and increased test coverage are included in DP 1.4a DSC CTS v1.1 that will release this month.



VESA Certified DisplayHDR



DisplayHDR Summary

- Industry's first open HDR specification for LCD and emissive (OLED/ microLED) displays with a fully transparent testing methodology
- More than 125 display models certified under logo program to date
- More details available at <u>https://displayhdr.org</u>

VESA Defines New Standard to Help Speed PC Industry Adoption of High Dynamic Range Technology in Laptop and Desktop Monitor Displays

DisplayHDR is industry's first open HDR specification with a fully transparent testing methodology

SAN JOSE, Calif. – December 11, 2017 – The Video Electronics Standards Association (VESA[®]) today announced it has defined the display industry's first fully open standard specifying high dynamic range (HDR) quality, including luminance, color gamut, bit depth and rise time, through the release of a test specification. The new VESA High-Performance Monitor and Display Compliance Test Specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displays appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initially addresses the needs of laptop displayes appeared on the standard specification (DisplayHDR) initiall

DisplayHDR Certified Products

- Certified DisplayHDR performance tiers
 - DisplayHDR 400
 - DisplayHDR 500
 - DisplayHDR 600
 - DisplayHDR 1000
 - DisplayHDR 1400
 - DisplayHDR True Black 400
 - DisplayHDR True Black 500
- DisplayHDR CTS and test tool are available to all companies
- Test tool app available on Microsoft store for public download











VESA Technology Development Areas



Update on Embedded DisplayPort

- Current version is 1.4b (published Oct 2019)
- Version 1.5 to be published by early 2020
- Version 1.5
 - Will add capabilities from DisplayPort 2.0
 - Further refinements in Panel Self Refresh
 - Other refinements



Vehicular DisplayPort (VDP)

- Adapt DisplayPort interface for Automotive Display applications
 - Incorporate features that are unique to DP and eDP to enhance automotive display system flexibility
 - Includes allowing either end-to-end transport, or longer transport through SERDES
 - Add new capabilities based on automotive specific-requirements including:
 - Safety
 - Security
 - Interconnect optimization
 - Long-reach SERDES transport compatibility
- Maintain compatibility with DP and eDP as much as possible
 - Allow VDP-enabled SoCs and displays to serve multiple markets



VESA technology development

- VESA members are collaborating on several key technology areas
- AR/VR Task Group
 - Focused on creating solutions roadmap to meet performance, power and implementation requirements for future AR/VR needs
- Vehicular Task Group
 - Working with automotive industry to address needs for high-resolution performance in this market segment
 - Working on VDP specification



USB4 DisplayPort Considerations



USB4 Overview

USB-IF Announces Publication of USB4™ Specification

Beaverton, OR, USA – September 03, 2019 – USB Implementers Forum (USB-IF), the support organization for the advancement and adoption of USB technology, today announced the publication of the USB4[™] specification, a major update to deliver the next-generation USB architecture that complements and builds upon the existing USB 3.2 and USB 2.0 architectures. The USB4 architecture is based on the Thunderbolt[™] protocol specification recently contributed by Intel Corporation to the USB Promoter Group. It doubles the maximum aggregate bandwidth of USB and enables multiple simultaneous data and display protocols.

The development of the USB4 specification was <u>first announced in March 2019</u> by the USB Promoter Group. It is now officially published by USB-IF and available for download at <u>www.usb.org</u>.

Key characteristics of the USB4 solution include:

- Two-lane operation using existing USB Type-C[®] cables and up to 40Gbps operation over 40Gbps certified cables
- · Multiple data and display protocols that efficiently share the maximum aggregate bandwidth
- Backward compatibility with USB 3.2, USB 2.0 and Thunderbolt 3

- USB4[™] released in August 2019
- USB PD 3.0 and USB Type-C[™] 2.0 released in August with USB4 support added
- DP Alt Mode (multi function) required for USB4 products



USB4 Overview

- Runs over USB Type-C® interconnect
- Tunnels USB3, PCIe and DP protocols
- Signaling rates of 10 or 20 Gbps (10 to 40Gbps aggregated b/w)
- Helps converge USB Type-C connector ecosystem to minimize enduser confusion





USB4 DisplayPort Considerations

- The USB4 product types of interest for DisplayPort are USB4 Host, USB4 Hub and USB4 Device
 - USB4 Hosts and Hubs must support DP Protocol Tunneling, with support optional for USB4 Devices
 - USB4 Host and Hubs *must support DP Alt Mode on downstream facing ports* USB Device





USB4 Host - DisplayPort Requirements

- USB4 Host DisplayPort requirements are fairly straight forward
- USB4 Host **Must** Support:
 - USB4 Fabric Configuration: Minimum of 2 lanes at 10 Gbps (Gen 2 x 2)
 - USB 3.2 Data Transport, USB 2.0 Native
 - DisplayPort
 - DisplayPort tunneling through USB4
 - DisplayPort Alt Mode on all of it's DFPs





USB4 Hub – DisplayPort Requirements

- A USB4 hub is required to support DisplayPort Alt Mode on all of its DFPs.
- To connect to DisplayPort Sink, a USB4 hub contains a DP OUT Adapter that receives Tunneled DisplayPort traffic from a USB4 Port and sends it to a DisplayPort Sink via DP OUT Protocol Adapter





USB4 Device – w/DisplayPort Supported

- A USB4 peripheral device must support 20G USB4 operation (Gen2x2) and optionally 40G USB4 operation (Gen3x2)
- Testing the DP Sink Link Layer will offer new challenges for compliance USB-C Connect **USB4** Device USB2 USB2 Function USB4 USB3 USB4 USB3 Function Adapter **Device Router** USB4 Input **DP Output** DisplayPort Sink or **Branch Function** Port Adapter

PCle

Adapter

PCle

Function

These functions are optional and depend on device features



Summary



Summary

- Product shipments and certifications on DP 1.4 based products continue to grow
- DP 2.0 product development and certifications expected in 2020
- DisplayPort over USB-C is a game changer for small form factor and portable products and is rapidly becoming the defacto standard for laptops, tablets and handheld devices
- Momentum continues to grow for DisplayHDR product certification
- Development and adoption of new technologies continues to drive increases in VESA membership growth
- USB4 mandated DP Alt Mode support and PHY convergence will continue to accelerate adoption of DisplayPort technology



THANK YOU DisplayPort.org DisplayHDR.org VESA.org



Backup



Questions? Demo Station Overview



THANK YOU displayport.org vesa.org