VESDA Display Standards Updates

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Agenda

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

- Monitors, PCs and laptops
- Smartphones and tablets
- Automotive
- Gaming consoles and headsets
- Digital projectors
- Digital signage / kiosks
…As Well as Many Aspects of Display Technology

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

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

Display Capability Parameters
- DisplayID
- Extended Display Identification Data (EDID)
- Multi-Display Interface
VESPA Membership Continues to Grow
Historical Membership by Region

10 Year Flip from US to Asia Dominant

The chart shows a significant shift in membership from the US to Asia over a 10-year period. In 2008, the US had the highest membership with 51%, followed by Asia with 41%. By 2018, Asia had increased to 54%, while the US dropped to 36%. Europe remained relatively stable at around 10% throughout the period.
VESAS Asia Membership

Asia Member Distribution of 150 Members

- Japan: 38%
- South Korea: 32%
- China: 21%
- Taiwan: 9%
VES A 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…

Canon  CASIO  EPSON  FUJITSU  Innotech Corporation

JDI  JAE  JVC KENWOOD  maxell

MegaChips  Mitsubishi Electric  muRata  NEC  Nintendo

Panasonic  Renesas  RICOH  ROHM Semiconductor

SHARP  SONY  TOSHIBA

…and many others!
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
# New DisplayPort Link Rates

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

DisplayPort 2.0 is backward compatible with DP 1.4a and all earlier versions.
## DisplayPort 2.0 Resolution Capability (Single Display Examples)

<table>
<thead>
<tr>
<th>Port Configuration</th>
<th>DisplayPort 1.4a</th>
<th>DisplayPort 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>No Compression</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Lanes, max link rate</td>
<td>5K (5120x2800) @60fps 24bpp</td>
<td>10K (10240x4320)@60fps 24bpp</td>
</tr>
<tr>
<td>2 Lanes, max link rate</td>
<td>4K (3840x2160) @60fps 24bpp</td>
<td>8K (7680x4320)@30fps 30bpp</td>
</tr>
<tr>
<td><strong>With Compression (DSC)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 Lanes, max link rate</td>
<td>8K (7680x4320)@60fps 30bpp</td>
<td>16K (15360x8460)@60fps 30bpp</td>
</tr>
<tr>
<td>2 Lanes, max link rate</td>
<td>5K (5120x2800)@60fps 24bpp</td>
<td>Key: 10K (10240x4320)@72fps 30bpp</td>
</tr>
</tbody>
</table>

**Notes:**
- 2 Lane configuration is common for USB-C DP Alt Mode
- All above modes assume full 4:4:4 color encoding
- 30bpp is required for DisplayHDR operation

**Key:**
- DSC = Display Stream Compression
- fps = frames per second
- bpp = 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
VESPA 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
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.
VES A C e r t i f i e d D is p layHDR
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 [https://displayhdr.org](https://displayhdr.org)
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
VESDA 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
VESAt 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

• **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 end-user 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
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 its DFPs

USB-C Connector(s)
- USB2
- USB4
  - with fallback to USB3
  - Support for DP Alt Mode
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.

USB-C Connector(s)
- USB2
- USB4
- with fallback to USB3
- Support for DP Alt Mode
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 testing.
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
VESAt.org
Backup
Questions?

Demo Station Overview
THANK YOU
displayport.org
vesa.org