



VESA

Video Electronics Standards Association

DisplayPort Overview for Industry

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Why Do PCs Need a New Digital Display Interface?

- ✓ Existing PC digital display interconnects are not future proof:
 - *Internal interface (inside notebooks and monitors) requires more wires to add bandwidth, and is one way only*
 - *External interface is not extensible, and is incompatible with the internal interface, requiring signal translation inside all monitors*
- ✓ A common digital interface is needed to address emerging PC needs and reduce complexity and cost in monitors
- ✓ DisplayPort is this next generation digital interface....



Outline

- ✓ Industry Objectives
- ✓ Product Benefits
- ✓ Interoperability
- ✓ Timeline
- ✓ Technology



DisplayPort Industry Objectives

- ✓ Key PC industry influencers identified need for a new unifying digital display interface:
 - Dell and HP: the two largest PC OEMs
 - ATI and NVIDIA: leading graphics technology suppliers
 - Samsung, Philips, and Genesis: leading display technology providers
 - Molex and Tyco: two of the largest connector suppliers
- ✓ The objective is to provide a cost effective, scalable, industry standard which consolidates external (box-to-box) and internal (LCD panel) display connections



DisplayPort: Open, Extensible, RAND

✓ Open Standard

- Administered by VESA, an independent standards body
- DisplayPort adoption open to non-VESA members
- Sustainable standard: future versions/enhancements planned
- Future modifications to specification done thru a transparent process

✓ Architected for Future Needs

- Any VESA member can suggest improvements and vote on future specifications
- Changes are visible to and influenced by members (vs. implemented behind closed doors)

✓ Reasonable and Non-Discriminatory Licensing:

- VESA IPR Policy (#200B): “any *Necessary Claims* under *Specifications* shall be available under license to all *Implementers* on *RAND* terms”
- DisplayPort promoter group is committed to royalty-free
- No restrictions on field of use



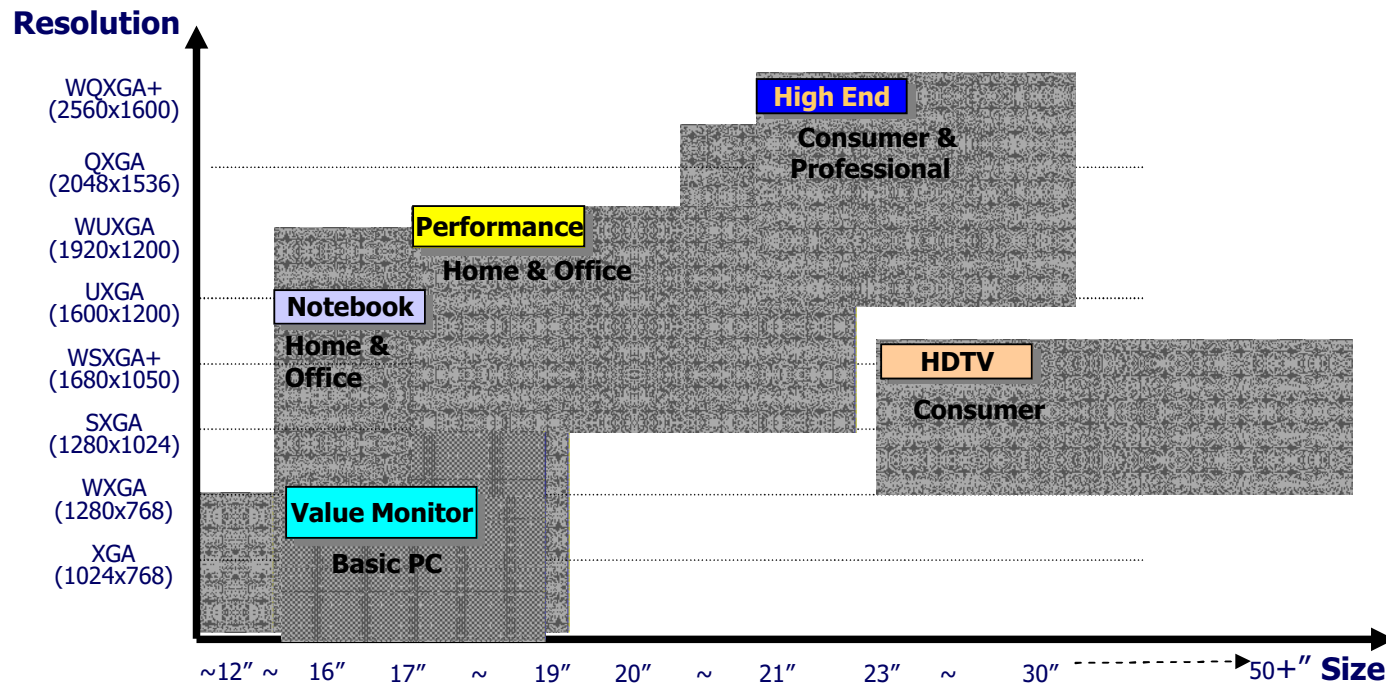
DisplayPort Top Level Objectives

- Unify external and internal display interfaces
- Provide scalable performance in terms of resolution, color depth, and refresh rate over fewer wires to support emerging display needs
- Provide a future foundation for new display usages
- Provide a small, user friendly external connector
- Accelerate deployment of protected digital outputs on PCs to broadly support authorized viewing of protected content
- Enable a digital display connection as a viable alternative to VGA



Displays Landscape

DisplayPort addresses the need to scale in performance from high volume, low bandwidth entry PC monitors and notebook panels, up to niche high end consumer and professional displays via a single transmitter, receiver, and connector





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DisplayPort Benefits

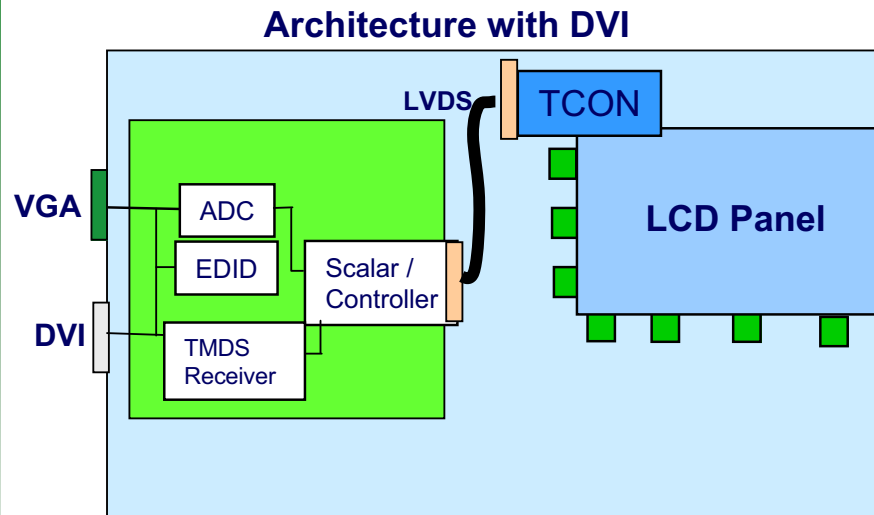
DisplayPort delivers product benefits across a broad range of application areas...

Application Area	Benefit
Monitors 	<i>DisplayPort enables cost reduced digital LCD monitors with direct drive panels and also supports high resolutions and colors through a single interface</i>
Notebooks 	<i>DisplayPort addresses notebook PC need for a low profile external display connector, and reduces cost of the internal cable to the panel</i>
Desktops 	<i>DisplayPort provides a path for chipset integration to enable native digital output from all platforms</i>
Workstations 	<i>DisplayPort can support quad output at QXGA resolution and 30-bit color, enabling further innovation in workstation graphics and high-end displays</i>
Future Needs 	<i>DisplayPort provides an extensible feature set focused on meeting future display application needs such as for real time communications and advanced TV designs</i>

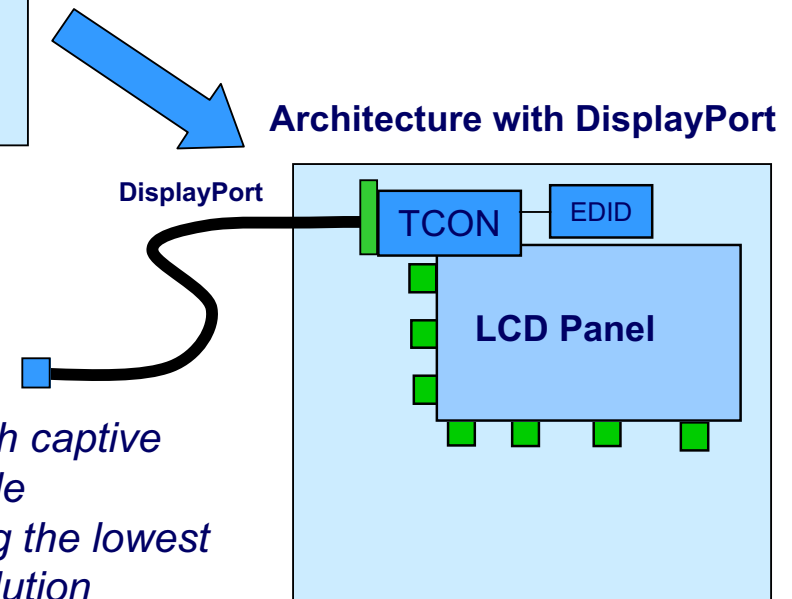


Display Benefits – Entry Monitors

Today, monitor controllers support analog VGA/DVI input, while panel timing controllers support LVDS inputs. Driving monitor panels directly is not feasible.



DisplayPort allows integration with the panel, eliminating the need for non-panel electronics in the monitor design.



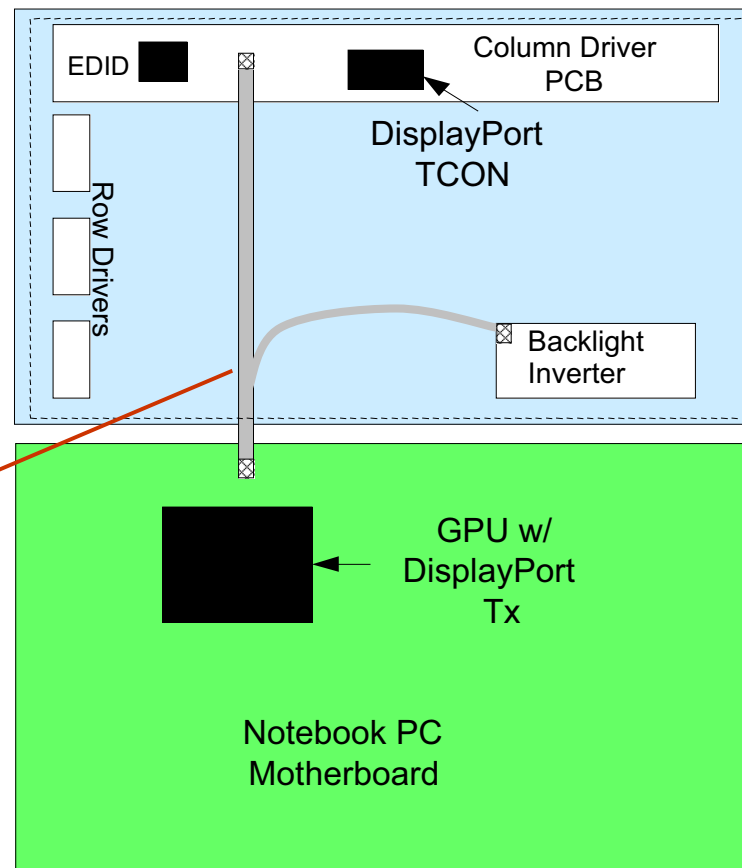
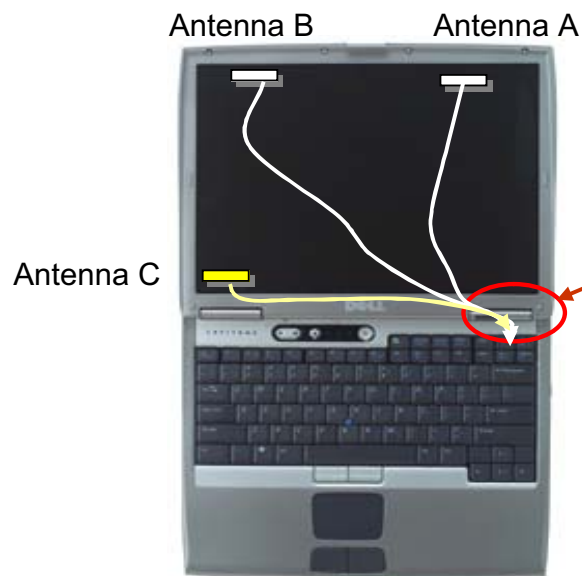
A detachable monitor with captive cable can run over a single DisplayPort lane, enabling the lowest cost flat panel monitor solution

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Notebook Benefits

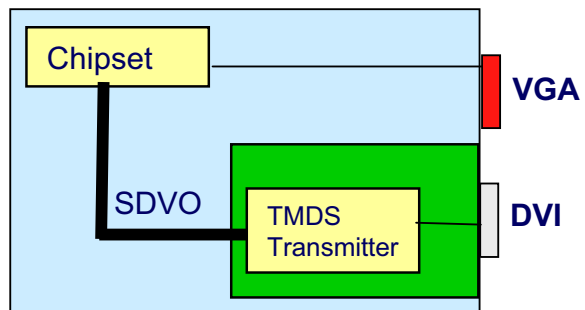
DisplayPort reduces the number of drive wires needed to the panel from 16 to 2 for XGA resolution, and from 20 to 8 for greater than UXGA resolution...reducing cable cost and freeing up hinge space for wiring needed to support emerging PC applications



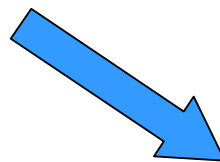


Video Source Benefits

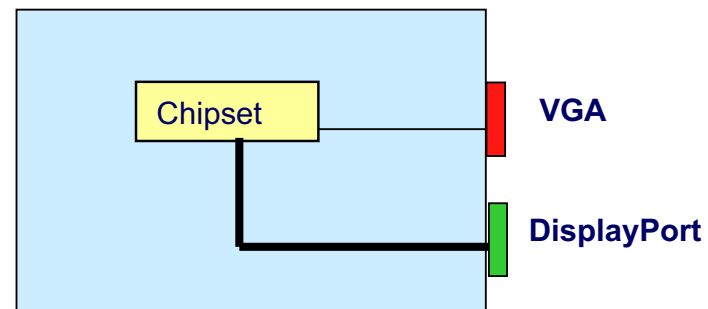
Source Architecture with DVI



DisplayPort addresses the need for sub 90nm process integration, and is electrically very similar to PCIe, thereby removing the need for extra cost silicon.



Source Architecture with DisplayPort

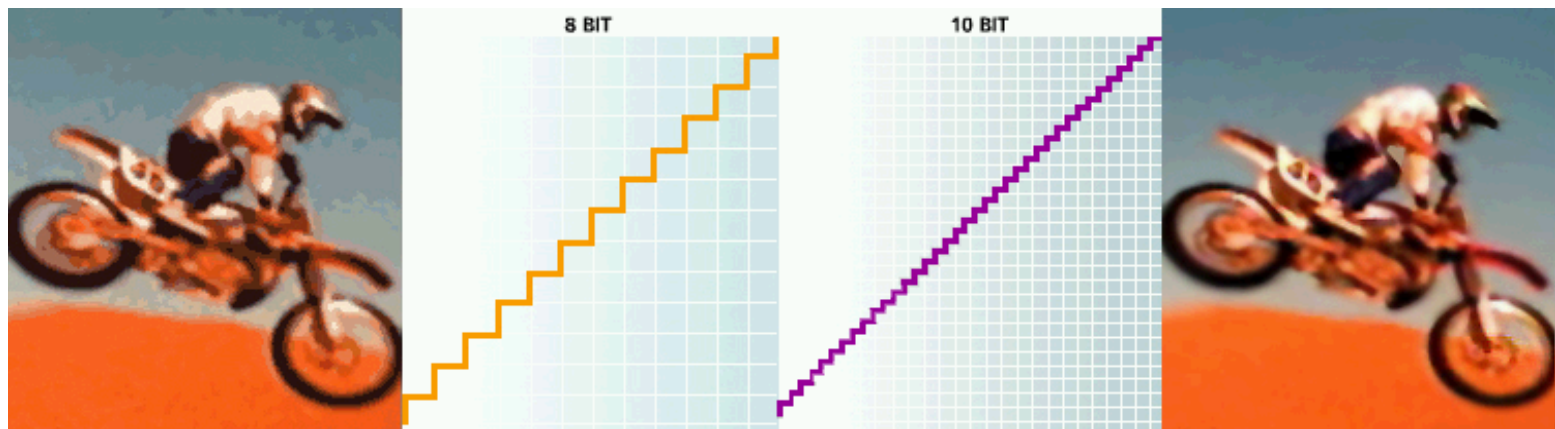
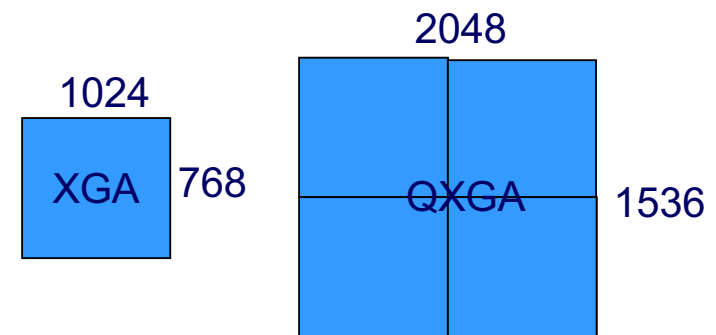




Workstation Benefits

DisplayPort enables a workstation to drive a QXGA display at 30 bit color through a single transmitter, receiver, and connector.

The DisplayPort performance improvement will enable further innovations to occur in displays for better support of gaming and high definition content.





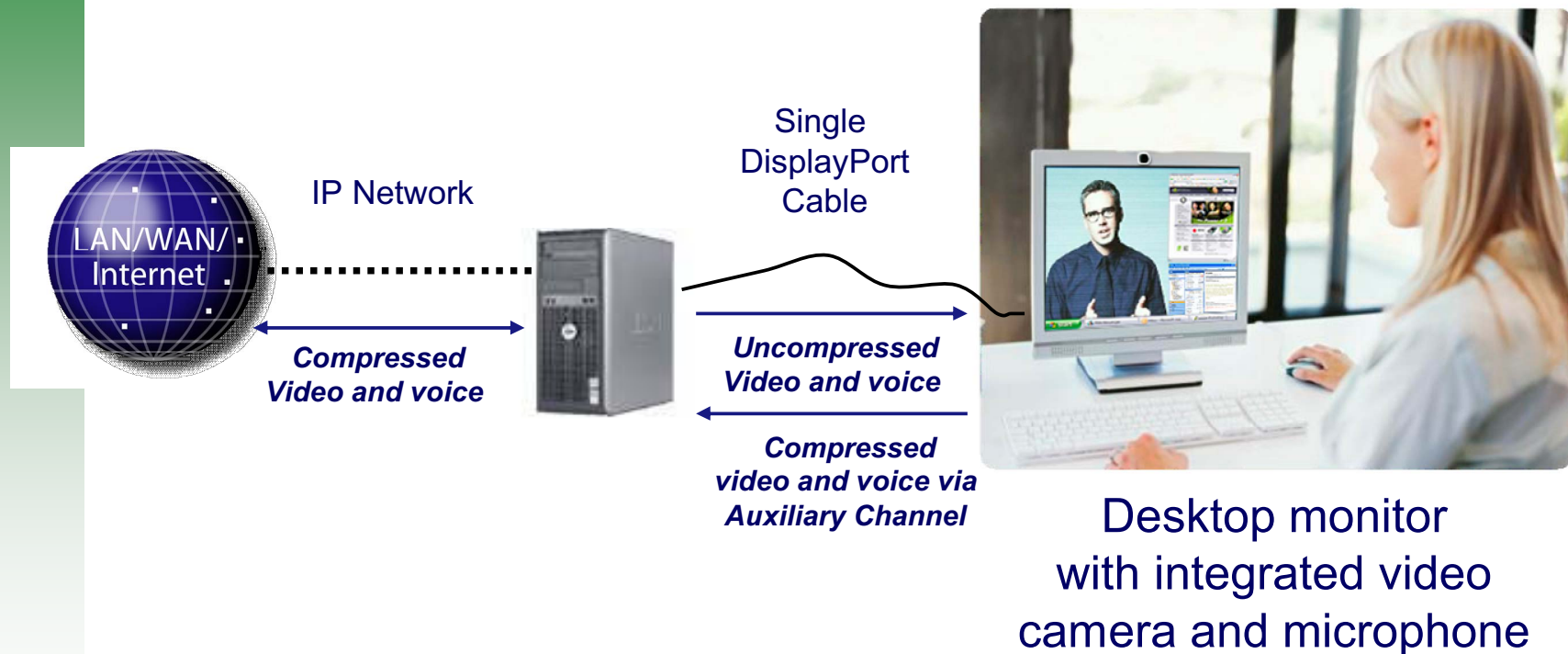
DisplayPort Enables Future Application Innovation

- ✓ Micro-Packet architecture enables transport of multiple A/V streams for emerging applications
 - *PiP and split screen streams over a single cable*
 - *Daisy chaining displays - Up to 6x 1080i and 3x 1080p streams on a single connector*
 - *Inclusion of meta-data packets, such as PSIP*
- ✓ High speed, robust auxiliary channel supports two way communication applications
 - *Bi-directional audio – microphone, audio chat, VoIP*
 - *Low bandwidth video backchannel for webcam applications*
 - *Twitch game control without lag*
 - *Transparent channel for remote control pass through*



DisplayPort Extensibility for Future Applications

DisplayPort's micro-packet architecture enables future applications such as real-time communications to be accommodated over the same physical interface

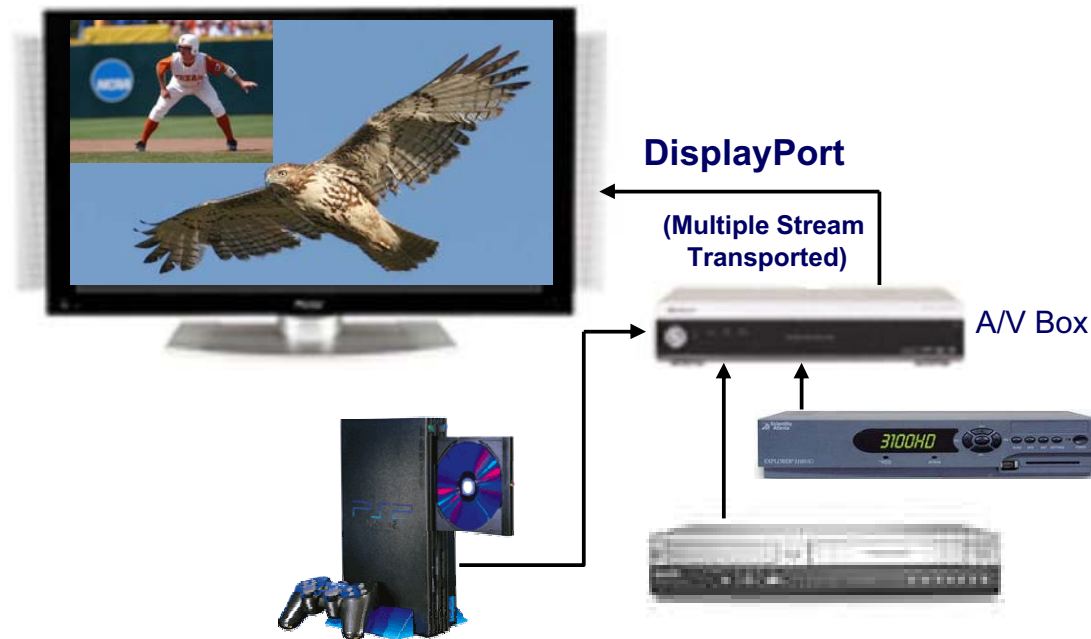




DisplayPort Future Benefits for TV Design

DisplayPort's micro-packet architecture allows multiple A/V output streams to be carried over a single connection to the TV, simplifying modular TV designs, while enabling further innovation in TV processing

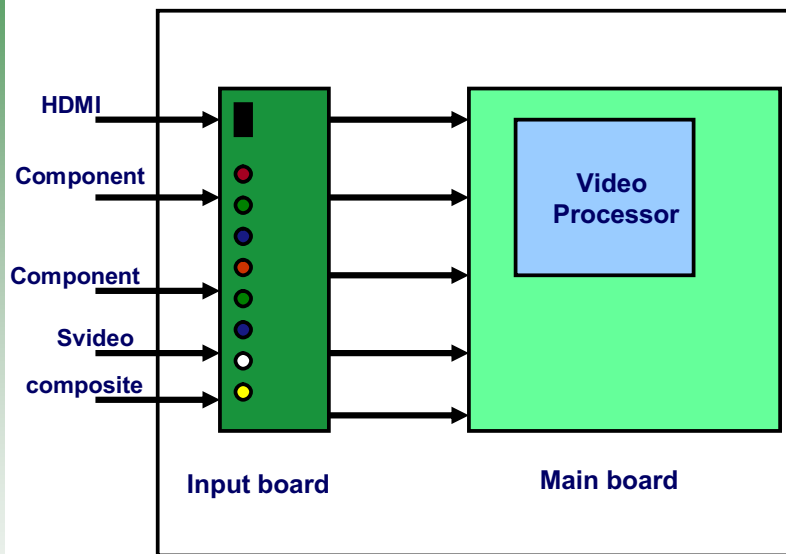
Optimal image processing performed on video, film, and graphics, independently.



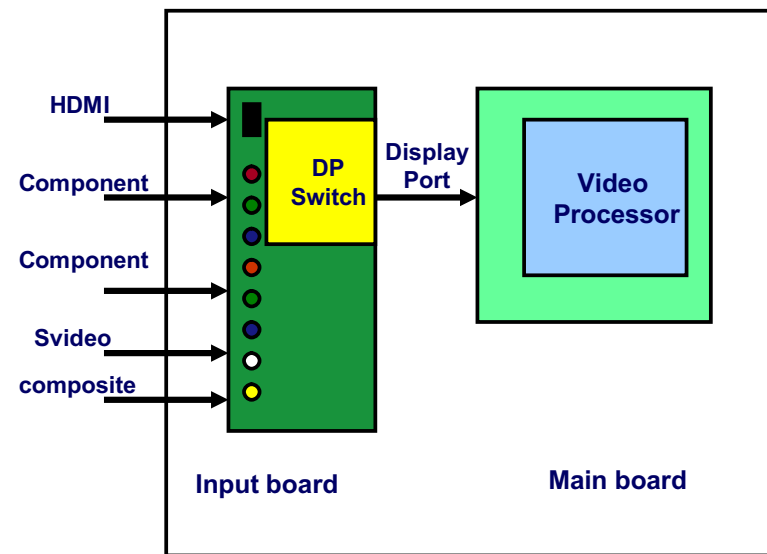


DisplayPort Future Benefits for TV Design

DisplayPort's micro-packet architecture also may provide future benefits for TV internal design, by simplifying connectivity inside the TV.



With current TV architecture, the Video Processor must have numerous connections between the input board and the main board for supporting PIP/PAP of any combination, adding cost and complexity to the internal TV design.

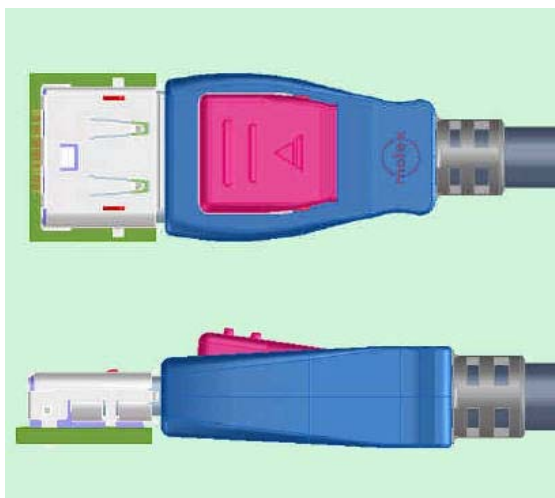


With DisplayPort, the Video Processor may receive multiple input streams via one board-to-board connection, thereby greatly simplifying the internal TV design.



DisplayPort External Interface Benefits

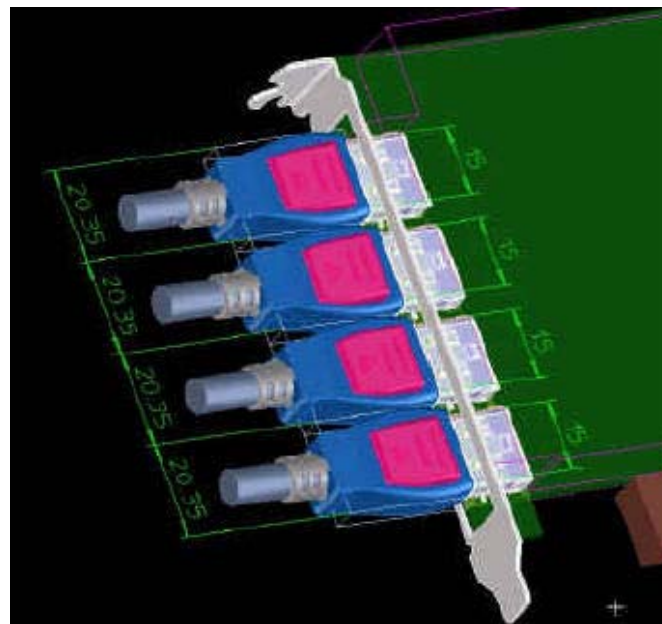
The external DisplayPort connector is considerably smaller than DVI, and is easy to connect without need for thumb screws



DisplayPort 1.0 has more than 2x the performance of DVI

DisplayPort supports cables up to 15m long

The connector is designed to support 2x the performance of DisplayPort 1.0 via future upgrades

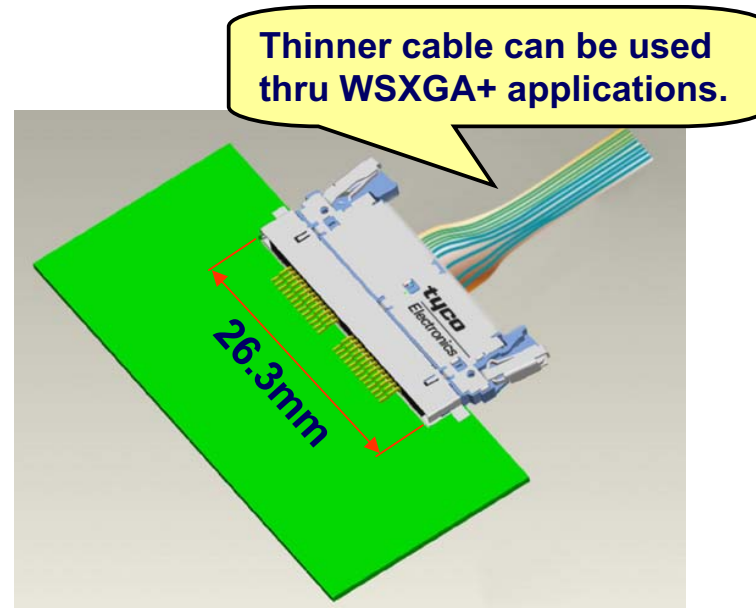
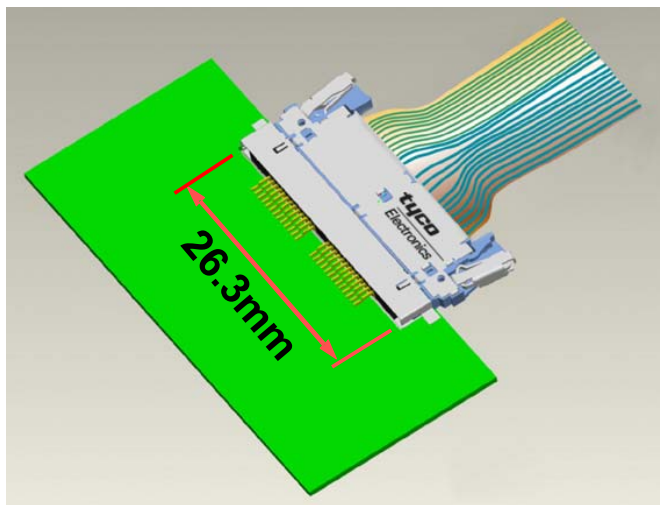




DisplayPort Internal Interface Benefits

The internal DisplayPort connector is 30% smaller and supports 3.8x more performance than the present LVDS 8 bit/color connector

- *Ultra slim plug and receptacle*
- *Low profile 1.1mm above PCB*
- *Easy connect positive latch*
- *DisplayPort supports internal cables lengths of 610mm (24")*



One connector accommodates all applications from small notebooks up to large TV panels.



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Interoperability Approach

DisplayPort is designed to enable cost effective translation to existing digital formats when needed...

- ✓ Dual-standard transmitters and receivers can be technically realized in the design of custom integrated circuits
 - An adapter to connect a DisplayPort output to existing displays is feasible given the pin-outs of existing standards
- ✓ The DisplayPort connector provides a power pin for enabling “self-powered” adapters as an option for enabling external translation
 - An “adapter” or “dongle” with active components for format, CP translation and/or level shifting may be technically realized for format interoperability
- ✓ ***Choice of the interoperability solution to use in any given implementation is manufacturer specific***





DisplayPort Compliance Direction

- ✓ DisplayPort compliance specification
 - Source, sinks, cables, and repeaters
 - Physical layer, protocol layer
- ✓ Content protection compliance specification
- ✓ Targeting use of independent test centers for compliance testing and certification
 - Objective is to use impartial entities
- ✓ Compliant products will be eligible to receive a DisplayPort logo
- ✓ Periodic plug fests for interoperability testing
 - To include interoperability of copy protection



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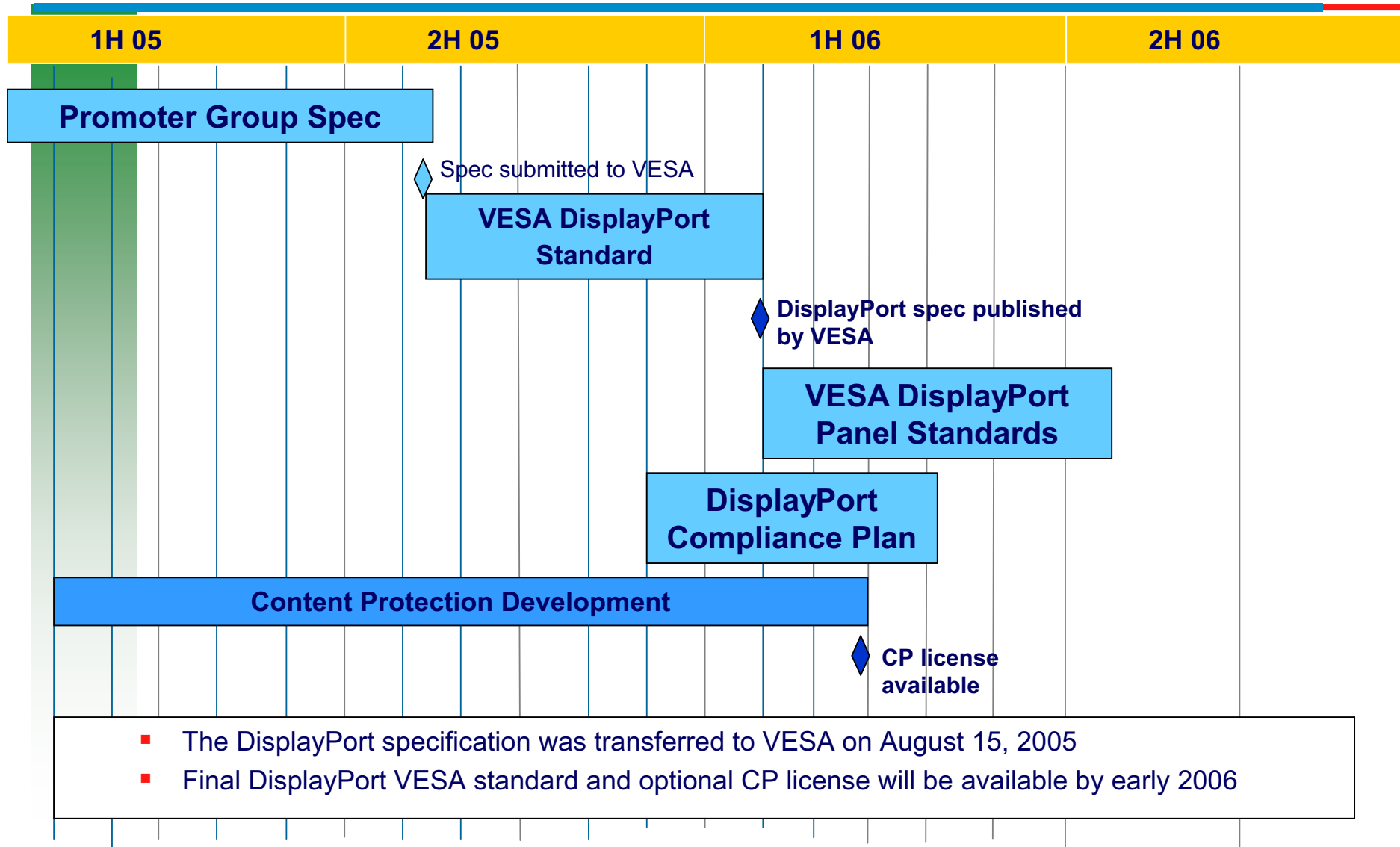


Target Timelines

- ✓ Targeted VESA approval of DisplayPort is 2Q06
- ✓ DisplayPort content protection readiness and approval is slated for 2Q06 (Philips)
- ✓ First silicon availability target is 2H06
- ✓ First product launches into market targeted for 2H06



What is the DisplayPort Schedule?





DisplayPort Deployment Scenario

- ✓ PC market will spearhead the deployment of DisplayPort
- ✓ HDMI will remain the connector of choice for connecting CE equipment
- ✓ An installed base of DisplayPort devices plus rich application options create a compelling reason for CE equipment to add DisplayPort connectivity in the future



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Technical Overview

- ✓ **Bandwidth and lanes**
 - All lanes carry data (no dedicated clock lane)
 - Link rate: either 2.7Gbps or 1.62Gbps per lane, based on link quality
 - Flexible number of lanes, 1, 2, or 4, depending on device capability
 - Link capacity for 4 lanes, 10.8 Gbit/sec (2.2x bandwidth of DVI for an equal number of wires)
 - Freely trade pixel depth with resolution and frame rate
- ✓ **1Mbit/sec bi-directional auxiliary channel**
- ✓ **Micro-packet architecture**
- ✓ **Supports user transparent plug and play**
- ✓ **Low power and low EMI**
- ✓ **Support for long cables (15m) and a latching connector**
- ✓ **Full support of a variety of audio formats as optional feature**
- ✓ **Robust content protection system as optional feature**
- ✓ **Extensible to new PHYs, coding and content protection schemes**



Content Protection for DisplayPort

✓ Technology overview

- High speed encryption engine based on well known ciphers
 - 128 bits
- Standard RSA authentication
 - Revocation available
 - Key size; 2048
- Standard key exchange method

✓ Won't it take forever to get this done and approved?

- The development team has a track record of bringing standards of equivalent complexity to market in slightly more than 1 year
- It leverages known technologies and prior experience
- The content industry has been informed and supports the improvements this standard offers

✓ What will it cost?

- Competitive licensing and pricing to comparable standards



Content Protection for DisplayPort

- ✓ Technical improvements over existing standards
 - Modern ciphers for the fundamental encryption function
 - Simplified and effective revocation system
 - Does not place a burden on the surrounding system
 - Does not require a real-time connection to acquire revocation messages
 - Modern key establishment
 - “Crypto Lock” feature to recover from glitches
- ✓ Benefits for industry
 - Revocation mechanism
 - Source stores list of revoked items
 - Standard ciphers used
 - Little chance of obsolescence
 - Little chance of major attack
 - Inexpensive practical implementation
 - Simplified mechanisms
 - Inexpensive and simple key provision
- ✓ For end users, increased access to premium, high value content



For further information...

- ✓ For further information on how your company can participate in VESA's standards development efforts, please contact:
 - Bill Lempesis, Executive Director, VESA
Phone: (1) 408-957-9270
Fax: (1) 408-957-9277
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 - Keiko Sakimura, VESA Japan Committee Liaison
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 - VESA web site: www.vesa.org



✓ Question & Answer Period



Back Up Slides



DisplayPort – DVI Comparison

	DisplayPort	DVI
# of high-speed pairs 1680x1050@18bpp 1600x1200@30bpp 2048x1536@36bpp	1 pair 2 pairs 4 pairs	4 pairs 7 pairs N/A
Bit rate, per pair	2.7Gbits/sec, fixed rate (1.62Gbps option available)	Up to 1.65Gbps
Total raw capacity per 4-differential pair single link	10.8Gbits/sec	4.95Gbits/sec
AC-coupled for process migration (65nm ~ 0.35um)	Yes	No
Audio support	Yes	None
Aux. channels	1Mbps AUX CH, 500us max. latency	DDC, No max. latency limit
Channel Coding	ANSI8B/10B (Open)	TMDS (Proprietary)
Content protection	Philips's content protection optional	HDCP optional
Protocol	Micro-Packet-based; extensible in future to add features.	Digitized and serialized analog video raster
Internal connection	Included in first release of spec	No TMDS-based standards
EMI reduction method	No clock channel Reduced number of pairs Data scrambling Spread spectrum	Transition minimized coding during display active period
Controlling authority	VESA	DDWG (defunct)



DisplayPort – LVDS Comparison

	DisplayPort	LVDS
# of high-speed pairs 1680x1050@18bpp 1600x1200@30bpp 2048x1536@36bpp	1 pair 2 pairs 4 pairs	4 pairs 12 pairs 14 pairs
Bit rate, per pair	2.7Gbits/sec, fixed rate (1.62Gbps option available)	Up to 0.945Gbits/sec
Total raw capacity per 4-differential pair single link	10.8Gbits/sec	2.835Gbits/sec
AC-coupled for process migration (65nm ~ 0.35um)	Yes	No
Aux. channels	1Mbps AUX CH, 500us max. latency	None
Internal Connection	Included in first release of spec.	De-facto notebook standard
Power for 18-bpp XGA Tx Rx	72mW @ 1.8V (over 1 lane) 90mW @ 1.8V (over 1 lane)	99mW @3.3V 142mW @3.3V
EMI reduction method	No clock channel Reduced number of pairs Data scrambling Spread spectrum	Spread spectrum
Controlling authority	VESA	ANSI standard



Bandwidth Extensibility

- ✓ Gen2 (circa 2008 ~ 2009) anticipated to provide for 2x of Gen1 main link bandwidth per lane
 - Connector specifications defined with Gen2 extension in mind
 - Backward compatibility with Gen1 maintained
- ✓ Major upgrade of AUX CH bandwidth also feasible



Why not use DVI?

- ✓ DVI is not available with mainstream integrated graphics solutions
 - 60+% of the PC market uses integrated graphics solutions (source: Jon Peddie)
- ✓ DVI adoption on PCs has stalled
 - DVI has 34% market share on PC displays (source: DisplaySearch)
 - most of these are dual analog/digital units
 - Less than 40% of PCs today support DVI as shipped
- ✓ DVI 1.0 specification is frozen and cannot be updated
- ✓ DVI specification is not geared to unifying internal and external display connections...external focus only



Why not use LVDS or TMDS?

- ✓ Multiple numbers of LVDS Pairs are required to meet expanding resolutions
 - Notebook hinge cable is costly due to the number of pairs of Micro-Coax
- ✓ LVDS isn't readily scaleable. Higher bandwidth transmission requires more pairs of wires
 - Higher color depths/dot clock rates require a wider interface
- ✓ TMDS has higher bandwidth and less pairs than LVDS, but
 - Proprietary standard vs. industry standard
 - IP issues constrain design implementation and innovation
 - Limited number of suppliers
 - TMDS may have EMI and signal integrity issues at higher dot clock rates.