5 A/V TECHNOLOGIES THAT WILL DEFINE THE NEXT 5 YEARS

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ABSTRACT

Perhaps the most commonly desired quality when investing in or upgrading an A/V system is the ability of the installation to be "future proof." Future proof projects, if they existed, would anticipate new developments in technology and market direction. This would minimize negative consequences while simultaneously capitalizing on fresh opportunities. Of course it is impossible for anyone to completely and accurately predict the future.

In this paper we will analyze past and current industry and market trends in order to identify with confidence, those topologies and systems that are most likely to be of critical concern in commercial and consumer A/V system design and installation from now through 2018. In doing this we aren't predicting the future so much as we are identifying current trends and market forces and illuminating the most likely market outcomes. We will focus on the five technologies likely to show the greatest market growth and/or market impact on general A/V integration.

TABLE OF CONTENTS

Abstract 1
Introduction 1
DisplayPort 2
HDMI 3
MHL 3
HDBaseT 4
Miracast 4
Summary 5
References 5

INTRODUCTION

In the paper Putting Analog Sunset in Perspective [1] we explored the trend of an essentially global transition from analog to digital content and connectivity in A/V systems. We came to the conclusion that Bus Low Voltage Differential Signaling (BLVDS) and Multipoint Low Voltage Differential Signaling (M-LVDS) will likely be phased out of use, taking the ubiquitous analog Video Graphics Array (VGA) connection (DE-15 connector) with it. General industry opinion is in agreement with this conclusion, with many analysts noting that both analog VGA and digital DVI-D connectivity will be essentially discontinued and irrelevant to the industry by 2017. [2]

Analog VGA connectivity has been a staple of PC hardware since its introduction more than a quarter century ago. Originally developed as an evolutionary step in IBM's line of Monochrome Display Adapter (MDA) and Enhanced Graphics Adapter (EGA) technology, the Video Graphics Array became an industry standard because of its inclusion in the Very Large Scale Integrated Circuits (VLSI) built into the motherboard of the original PS2 series of IBM personal computers. [3]

On December 8, 2010 a joint press release from AMD, Dell, Intel Corporation, Lenovo, Samsung Electronics LCD Business and LG Display announced "intentions to accelerate adoption of scalable and lower power digital interfaces such as DisplayPort and High Definition Multimedia Interface® (HDMI) into the PC." The press release went on to say that Intel plans to "end its support for VGA by 2015." [4] Advanced Micro Devices (AMD) announced it would phase out support for DVI by 2015. [5] Since VGA and DVI have been the dominant video connections in PC and A/V applications for so long, the question became "what will replace them?"

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Changing a worldwide video connection standard doesn't happen in a vacuum. Each change will have effects that ripple through the industry, inspiring new and even more powerful changes as device connectivity is adapted to real world applications. Tying this technological evolution together is the requirement for universal inclusion of High Bandwidth Digital Content Protection (HDCP). There are now over 500 companies licensing HDCP technology, which is a specification developed by Intel Corporation to protect digital content from illicit use as it is transported across various digital interfaces. [7] In the digital world there are no copies, there are clones. The need to protect intellectual property rights and ensure the desired distribution and use of content, has spurred HDCP technology to become a critical component of every major system in the A/V ecosphere.

As it turns out, the replacements for VGA, DVI-D and other analog video connections aren't hard to identify. HDMI has grown to dominate in both consumer and commercial A/V connectivity since its introduction in 2003. DisplayPort was introduced in 2006 specifically as a replacement for analog VGA connections. [6] With the market shift favoring smaller, lighter, more efficient digital devices, the newly updated DisplayPort Multi-Mode (DisplayPort 1.2, typically marked as DP++) connection has become the de facto standard for accessing A/V content from desktop and laptop computers, ultrabooks, tablets and netbooks. The DisplayPort Mini connection is also at the heart of the next generation Thunderbolt connection.

HDMI and DisplayPort connections aren't optimized for mobile devices, structured wiring or wireless connectivity, so equivalent and compatible new formats have emerged for those applications. Mobile High Definition Link (MHL) and its closely related cousin SlimPort (also known as MyDP), offer wired solutions for integrating mobile devices such as tablets, phablets and smartphones into fixed A/V systems. Miracast provides a point-to-point wireless connection between the same classes of device.

We believe these are the five technologies that will have the greatest transformative impact on the business of A/V integration in the period from 2013 through 2018. Let's examine each in a little more detail.

DISPLAYPORT

DisplayPort is a digital display interface standard developed by the Video Electronics Standards Association (VESA) designed to facilitate the transfer of video, audio and data, between a source and sink device. DisplayPort 1.2 is capable of emitting HDMI or DVI-D TMDS signals through the use of a simple passive converter. DisplayPort has been HDCP compliant since the DP1.1 standard. [8]

The DisplayPort 1.2a standard was released in January of 2013 and includes support for Multi-Stream Transport (MST), Ultra HD resolutions and many more performance enhancements.

DisplayPort is replacing VGA connectivity on most computers because of its rich feature set, its compatibility with CMOS fabrication techniques and its compatibility with HDMI and HDCP technologies. DisplayPort was included in about 1-in-20 desktops and 1-in-50 laptops as of 2009. DisplayPort use is expected to be included in 19-of-20, or 95%, of all computers by 2014 as the industry continues to phase out LVDS. Much of this exponential growth in DisplayPort++ deployment is expected to occur in 2014 and 2015. [9]

While the three major vendors of central and graphics processing units—Intel Corp., AMD Inc. and nVidia—have moved to integrate DisplayPort into their current products, this doesn't signal a competition between DisplayPort and HDMI as A/V connectivity standards. Both interfaces will serve distinct markets. [10]

The DisplayPort standard defines an HDMI "compatibility mode," identified by the DP++ logo that allows devices so equipped to seamlessly switch to an HDMI output format when a passive adapter is connected. This ensures that computers and devices leveraging a DisplayPort connection remain compatible with the very large installed base of HDMI-enabled devices. [11]

According to International Data Corporation (IDC) analysis, DisplayPort market penetration will experience a compounded annual growth rate of 106% between 2009 and 2014. The firm, 'Research and Markets' stated in its "Global HDMI and DisplayPort-enabled Equipment Market 2012-2016" report that DisplayPort Multi-Mode market penetration would grow at a combined annualized growth rate (CAGR) of 31.6% over the four year period covered by the report. DisplayPort is quickly becoming a key technology of the A/V market, with no end to its growth in sight.

HDMI

HDMI LLC was founded by Philips, Silicon Image, Sony, Technicolor S.A, RCA, Toshiba and Panasonic in 2002. Their goal was to create a connector for digital A/V devices that featured a small form factor and was capable of transporting uncompressed digital video, multi-channel digital audio and control signals while maintaining backwards compatibility with the existing DVI-D standard. HDMI-enabled devices emerged into the market in 2003. [12]

HDMI is based upon, and includes compatibility with DVI-D functionality in its operational specifications. No active signal conversion is needed to allow an HDMI-enabled device to connect with a DVI-D single link-enabled device. Simple, passive adapter cables are all that's necessary, but the functionality of such a connection is limited to the lesser feature set included in the Digital Visual Interface standard. [13]

On September 4, 2013, HDMI LLC released the much anticipated HDMI 2.0 standard. HDMI 2.0 is backwards compatible with earlier versions of the HDMI specification, but addresses several parameters that provide increased performance and functionality. Specifically, the HDMI 2.0 standard includes the following: [14]

– 4K@50/60, (2160p), which provides compatibility with emerging Ultra HD and D4K video performance levels
– Up to 32 embedded audio channels for immersive audio reproduction
– Up to a nearly unprecedented 1536kHz audio sampling frequency, for the highest audio fidelity available in a playback format
– Simultaneous delivery of dual video streams to multiple users on the same screen
– Simultaneous delivery of multi-stream audio to multiple users (up to four)
– Support for the wide angle theatrical 21:9 video aspect ratio, which offers a 30% wider field of view
– Dynamic synchronization of video and audio streams

In the decade since its introduction, the HDMI Specification has been licensed by more than 1,300 HDMI Adopters who have gone on to manufacture over 3 billion HDMI-enabled products. [15] Despite this immense market penetration, the global HDMI-enabled equipment market is forecasted to grow at a CAGR of 19.7% over the period of 2012 to 2016. This growth will be driven by the near universal inclusion of HDMI connectivity in flat panel displays and video projectors. [16] Certainly HDMI technology will continue to be a driving force in the A/V market.

MHL

Mobile High Definition Link (MHL) is an HD video and digital audio interface for connecting mobile phones and portable devices to HDTVs and other display devices. The MHL standard was created by the MHL consortium, an industry group comprised of Nokia Corporation, Samsung Electronics Co., Ltd., Silicon Image Inc., Sony Corporation and Toshiba Corporation. The standard was released in June of 2010 with products first reaching the market in May of 2011. MHL currently has more than 200 adopters and the MHL ecosystem has grown to an installed base of more than 260 million products. [17]

MHL is, essentially, a technology that adapts a micro USB connection on a mobile device to an HDMI jack. An HDMI cable is then used to connect the dongle to a display. It is most emphatically not an HDMI signal, however. MHL is a 5-pin or 11-pin topology that requires an MHL-enabled display device to function. Since the HDMI connection is ubiquitous, it is only logical that it was chosen as a convenient physical layer connection. Many new flat panel displays and Android smartphones are including MHL technology. Today, MHL capability is included in more than 330 million devices. [18]

In August 2013, the MHL Consortium released the MHL 3.0 specification. The new standard supports Ultra HD (D4K) resolution, deep color, up to eight channels of digital audio, and support of peripherals including mass storage, keyboard, mouse and touch screen devices. [19] Many industry analysts project that MHL technology will continue to grow at nearly unprecedented rates, reaching an installed base of more than 1.5 billion products worldwide over the next 5 years. MHL is positioned to be a global solution for connecting mobile devices to fixed A/V assets.

HDBaseT

The HDBaseT Alliance was founded in 2010 by LG Electronics, Samsung Electronics, Sony Pictures Entertainment and Valens Semiconductor. HDBaseT technology was designed to offer an industry standard connectivity solution for extending HDMI digital video content beyond the 20 or so meters supported by native HDMI cabling solutions. While HDBaseT can also extend network connectivity, it is not an IP solution. Instead, it's a point-to-point A/V connectivity solution. HDBaseT technology uses a pulsed-amplitude modulation technique (PAM16) to send its trademarked 5Play™ content up to 100 meters over category cabling directly from the source to sink device. The 5Play™ feature set includes uncompressed digital video, digital audio, control signals, fast Ethernet up to 100Mb/s, and power. [20]

In August 2013, the HDBaseT Alliance released the HDBaseT 2.0 standard. This new standard expands the application of HDBaseT technology from the physical layer of the OSI model to all seven layers. Termed "HomePlay," the HDBaseT 2.0 specification adds networking, switching and control point capabilities, and defines point-to-multi point connectivity—thereby providing multi-stream support. This includes support for Ultra HD (D4K) video performance and for USB 2.0 control and data transfer. [21]

The HDBaseT Alliance more than doubled in size from 2012 to 2013. At the time of this writing there are more than 65 adopters, and HDBaseT technology is at the core of some of the most sophisticated and exciting A/V products in the industry. [22]

There are a number of factors that will drive HDBaseT adoption, making this one of the key growth technologies in the A/V industry. HDBaseT is positioned to support Ultra HD, a high performance system that delivers more than four times the resolution of current HD display technology. A recent report by Futuresource Consulting, a UK-based research firm, found several factors that will contribute to HDBaseT's impressive growth curve. Among these are HDBaseT's Ultra HD (D4K) compatibility, its reliable connectivity at distances well beyond the typical 20-meter limitation of HDMI's native connectivity, its use of a single category cable (Cat5e, Cat6 or Cat6a) and the accelerating industry-wide growth of high performance projectors and large screen displays. These market forces will drive a 50% combined annual growth rate in HDBaseT deployment through 2016. [23]

MIRACAST

Miracast is a peer-to-peer wireless "screencast" system, which leverages an 802.11ac radio link directly between the portable device and the display. In a Miracast connection, the devices are paired in a manner similar to that used for Bluetooth communications. Miracast is built on the foundation created by Wi-Fi Direct, a standard that enables devices to connect with each other without requiring a wireless access point. Connections are easy to set up and use since the devices choose the appropriate settings automatically. Miracast is an ideal solution for connecting mobile devices to fixed A/V assets in many situations where a wired connection is impractical, such as educational or workplace environments that are designed to enhance a "Bring Your Own Device" (BYOD) ethos.

Miracast is an industry-wide solution that was developed by the Wi-Fi Alliance. The Wi-Fi Alliance is a global non-profit industry association of hundreds of leading companies devoted to seamless connectivity. With technology development, market building, and regulatory programs, the Wi-Fi Alliance has enabled widespread adoption of Wi-Fi worldwide. The Miracast standard was released in August of 2012. [24]

"Wi-Fi CERTIFIED Miracast™ [was] developed with the support of a wide ecosystem of silicon, mobile device and consumer electronics (CE) vendors, to make sharing of screens including graphical, video and audio content across Wi-Fi devices seamless. After initially pairing two Wi-Fi devices, users can choose to stream content or mirror a display from one device (the source) to a second device (the display). Miracast allows users to establish a direct Wi-Fi connection between two devices, eliminating the need for an existing network." [25]

Miracast offers a unique level of integration flexibility in that it has theinherent ability to accommodate legacy A/V devices that do not have embedded Wi-Fi. This can be done by using a Miracast-certified dongle that provides a High Definition Multimedia Interface (HDMI) output. [25] Legacy source devices may be handled by a USB-to-Miracast dongle.

Miracast is already included in hundreds of millions of devices that offer Wi-Fi Direct connectivity. It is a software-based standard that requires no changes in the underlying 802.11 hardware, and it is this feature that is driving Miracast to be included not only

in smartphones, tablets, phablets and portable devices, but also in flat panel displays, video projectors, A/V switching systems and even automotive technology. The growth of Miracast technology is expected to be explosive. IHS iSuppli reports forecast over 1.5 billion Miracast-enabled devices will ship in 2016 alone! [26]

SUMMARY

In the A/V universe—a market space that, from our perspective, includes both consumer electronics and the commercial audio-visual presentation and support systems found in corporate, educational, governmental or healthcare facilities—the dominance of analog A/V connectivity technology has ended. For half a century we've relied on variations of composite and component analog video connections—including VGA computer monitor connections. Market forces have conspired to make the continued deployment of these dependable connections impractical, if not impossible.

The next generation of students and workers, customers and colleagues will bring to this industry the perspective of the "digital native." For A/V installations to remain relevant and to enhance productivity, we must incorporate the natural expectations of this group of stakeholders. We must work to integrate mobile and stationary devices and networks, integrate A/V, IT and telephony functionality, integrate work and personal technology, and integrate cloud and premise storage. Accomplishing this objective will require a new class of device connectivity to be deployed.

In this paper we've worked to identify the five connectivity systems that are best positioned to make the largest and most profound changes in A/V technology. We have identified DisplayPort 1.2 as is the new industry-wide standard for accessing A/V content from IT devices. We've named HDMI 2.0 as the global standard for accessing A/V content from multimedia devices. We've singled out MHL as the emerging industry standard for connecting mobile devices to fixed installations. We've determined that HDBaseT will become a world standard for transporting digital multimedia content from 20 meters to 100 meters and more. Finally, we've recognized Miracast as the most likely industry standard for ex-network wireless peer-to-peer A/V connectivity. Finally, we've demonstrated that each of these solutions has been forecast to experience double-digit annualized growth and development.

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