

An Introduction to HDMI Video Matrix Technologies



In recent years, the HDMI specification has quickly become the de facto standard for professional A/V installations worldwide. Introduced in 2002, the High-Definition Multimedia Interface (HDMI) was founded by leading consumer electronics companies such as Panasonic, Hitachi, Philips, Sony, Toshiba and others. As the first uncompressed, all-digital interface that carries both audio and video signals, HDMI has shown to be flexible with backwards compatibility for DVI -- the video-only digital interface. The HDMI specification is widely utilized in consumer electronics, including display devices such as HDTVs and projectors as well as source devices such as DVD and Blu-ray players, cable/satellite boxes and video game consoles.

Evidence of HDMI's market penetration comes from a [recent iSuppli report](#) which forecasted that worldwide factory shipments of HDMI-enabled devices would rise from 477.7 million units in 2010 to 629.1 million in 2011 -- a solid increase of 44 percent. According to the report, "growth rates for the next three years will remain between 20 and 35 percent, with HDMI firmly ensconced in approximately 1.3 billion devices by 2014."

As high-definition video applications have continued to develop, the advantage of HDMI is that the interface is playing an increasingly important role in the professional A/V market. According to a recent report conducted by [Acclaro Growth Partners](#) on behalf of [InfoComm International](#), it was projected that audiovisual products and services would become a \$91 billion global industry by 2012. The report also found that the corporate, education and government markets are the three largest consumers of audiovisual products and services.

HDMI-Based Video Products Addressing Pro A/V Industry Needs

Video component hardware such as HDMI-based video switches and splitters play a key role in addressing the needs of the professional A/V market:

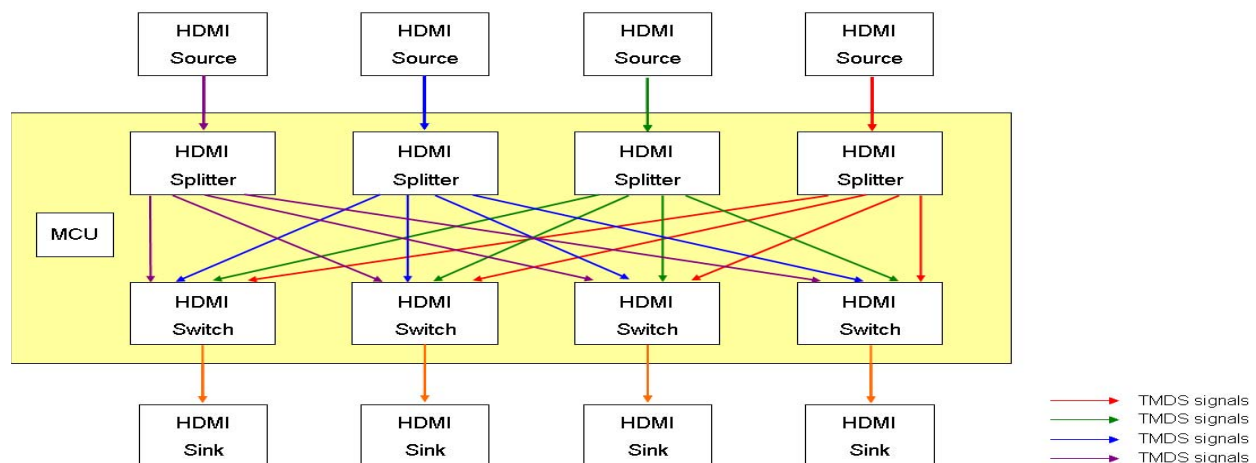
- **HDMI Video Switch** – by definition, an HDMI video switch enables users to conveniently display the video output of one to 16 computer systems or high-resolution video sources on a single monitor.
- **HDMI Video Splitter** – HDMI video splitters not only duplicate a single video source to multiple high-definition display outputs, but also boost the signal so it can be sent over longer distances without degradation.
- **HDMI Video Matrix Switch** – an HDMI-based video matrix switch is capable of routing and amplifying A/V signals from multiple sources to multiple output display destinations, allowing users to extend installations up to 1,000 feet while still maintaining excellent video quality.

With such routing variety and high-quality signal integrity, HDMI Video Matrix Switch technology offers the flexibility and features that professional A/V installers require for a range of audiovisual installations.

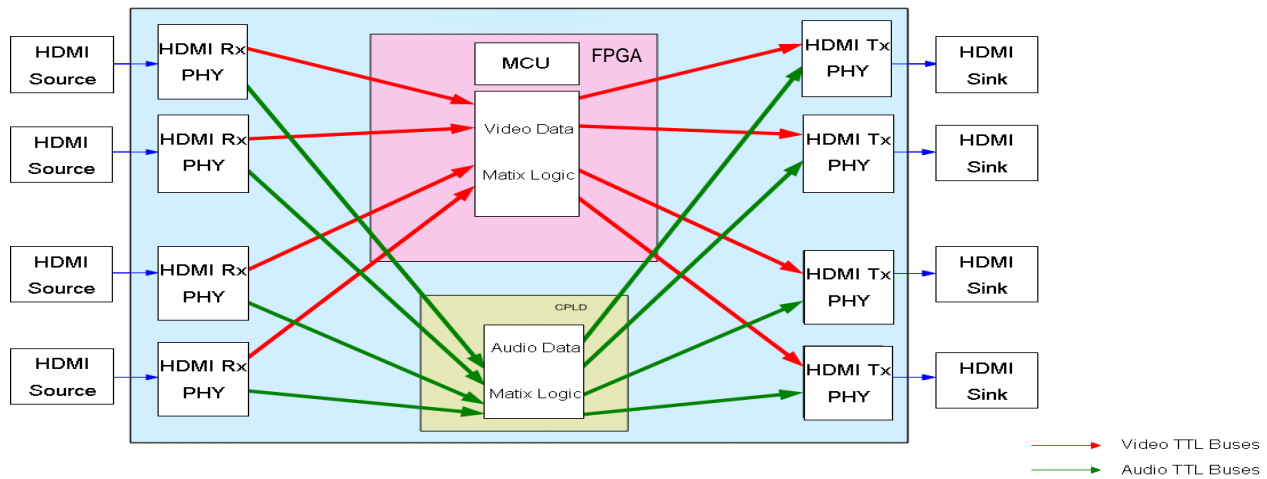
Introduction to HDMI Matrix System Architectures

Prior to selecting an HDMI Matrix switch, professional A/V installers and system integrators should be familiar with the three commonly used architectures.

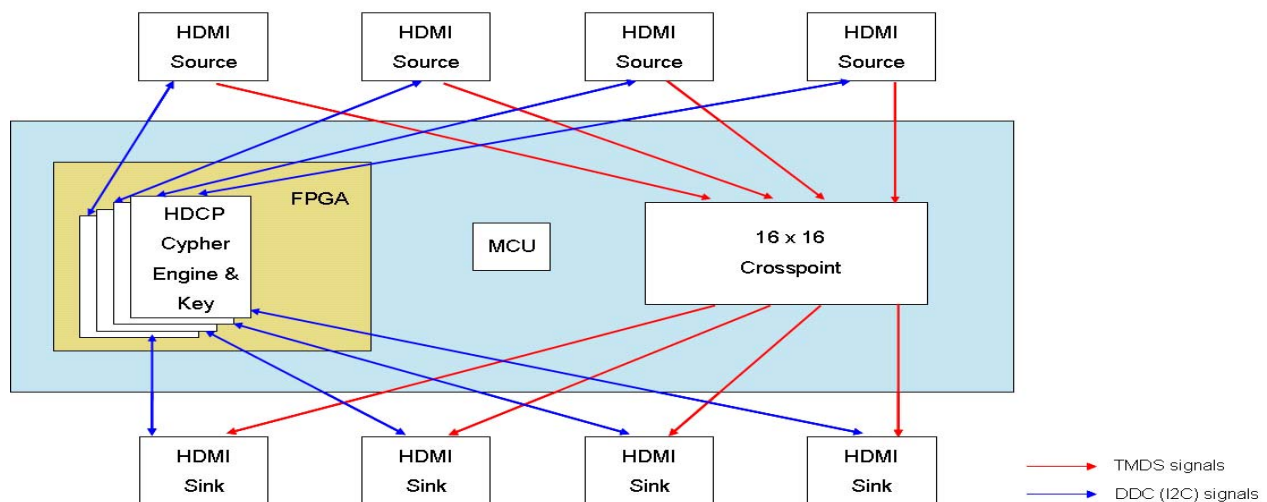
The first type is a **Splitter/Switch-based Matrix**. In this architecture, the TMDS (Transition-Minimized Differential Signaling) signals generated from HDMI sources are processed and received by an HDMI splitter chip and is then passed to each HDMI switch chip. The advantage of this architecture is lower BOM (bill of materials) costs. Additionally, the splitter chip can provide the HDCP (High-Bandwidth Digital Content Protection) key which improves HDCP development. The downside to this architecture occurs in Matrix systems greater than 2x2 where signal integrity (SI) issues are often experienced. With this architecture, sample applications include low-port environments such as 2x2 installations found in home theaters, small scale digital signage environments as well as financial applications.



The second type is **FPGA based (Field Programmable Gate Array) Matrix** where high speed TMDS signals are received by the HDMI Rx PHY chip and then converted into relatively low speed TTL (Transistor – Transistor Logic) buses separated for audio and video, which move the troublesome SI issues of the crossover points between TMDS signals to the easier handled SI issues of the crossover points between TTL signals. The benefit of this architecture lies in the fact that the signal quality of TMDS signals is maintained on the PHY chips which provides higher compatibility and cascade levels. The downsides to this architecture are higher cost and interconnection complexity since 4 pairs of TMDS signals are transformed to a 40-bit TTL video bus and a 10-bit audio bus.



The third type is **Crosspoint-based Matrix**. In this architecture, the TMDS signals are directly handled by a cross-point chip, which also provides equalizer functionality for compensating the signal attenuation and pre-emphasis function to boost up the single transition to the sink, which improves the quality of TMDS signals. The two advantages of this architecture are decreased TMDS interconnect complexity and improved SI via EQ (Equalizer) and pre-emphasis (PE) functions. The main weakness of this architecture is the associated high cost as well as lack of support for HDCP. This architecture is recommended for Matrix systems greater than 8x8, such as 16x16 or 32x32, suitable for meeting rooms, casinos and digital signage environments.



ATEN's HDMI Video Matrix Switch Portfolio – The VM0404H and VM0808H

ATEN's VanCryst™ line of professional A/V products provides all of the components needed to build a multitude of flexible, integrated solutions for a range of video-related applications. In addition to digital signage and home theater applications, the VanCryst line of products is also ideal for broadcasters, system integrators, and educators to extend and deliver high resolution audio and video signals. The VanCryst products are also targeted at manufacturing, healthcare, transportation, corporate conferencing and financial institutions.

The **VM0404H** is a 4x4 HDMI Video Matrix switch that offers a convenient solution to route high-definition video and audio from any of four HDMI sources to any of four HDMI displays.



The VM0404H enables users to connect four HDMI devices (such as an HD camcorder or satellite/cable box, Blu-ray player, home theater PC, standalone streaming media player, or gaming console) to four HDMI monitors, displays, projectors or HDTVs at the same time. The remote control and convenient front panel pushbuttons allow users to easily cycle through HDMI sources and displays, while the front-panel LEDs indicate the source device for each display at a quick glance.

The 8x8 version, **VM0808H**, is an HDMI Video Matrix switch capable of routing up to eight high-definition video and audio sources to as many as eight HDMI-equipped displays. Both models support high video resolutions for HDTVs at 1080p – and up to 1920 x 1200 (WUXGA) for PC monitors. Ideal for digital signage applications, both the VM0404H and VM0808H can be cascaded to support up to 64 and 128 HDMI displays, respectively.



With the VM0404H/VM0808H HDMI Matrix switches and compatible HDMI extenders, there is no limit to the flexibility of a professional A/V installation. Users are free to connect multiple HDMI devices to various HDMI displays at the same time. Additionally, utilizing the built-in bi-directional RS-232 serial remote port, the HDMI Video Matrix switches allow users to integrate a high-end control system for the A/V installation.

Applications of VM0404H and VM0808H

The VM0404H and VM0808H HDMI Video Matrix switches can be leveraged in a variety of environments such as:

- **Home Entertainment:** With more and more high-definition devices entering the home theater market, the need for simultaneous access to different A/V sources has become increasingly important.
- **Medical/Hospitals:** From high-quality static imaging required by diagnostic displays to closed-circuit health information content broadcast throughout a hospital's waiting area, there are many uses for ATEN's professional A/V solutions in the healthcare industry.
- **Education:** In a classroom setting, an HDMI Video Matrix switch can be leveraged to transmit examination questions (video and audio) from remotely located computers to as many eight classrooms where students can read the questions from multiple high-definition monitors.
- **Restaurants:** For sports bars and other restaurants that need to display various sports programming to several displays, an HDMI Video Matrix switch such as the VM0404H and VM0808H can be leveraged.
- **Digital Signage:** A video installation in a retail environment allows user to enhance selling power with in-store and shopping mall digital advertising. ATEN's professional A/V solutions, including the VM0404H and VM0808H, are flexible and scalable, allowing digital signage installations to be tailored to meet the needs of specific locations or demographics.



Conclusion

With the HDMI specification firmly supplanting older technologies such as VGA and DVI, research has pointed to a growth trend of HDMI-equipped devices as well as an uptick in the global audiovisual market. HDMI Video Matrix switches offer better signal strength and more sophisticated routing capabilities, addressing the sophisticated needs of today's A/V professionals and installers.

A/V professionals are encouraged to research the different technologies and architectures outlined in this article before selecting an HDMI-based Video Matrix switch, as these solutions offer diverse benefits and features for varying needs. It was concluded that FPGA-based Matrix architectures, due to less SI issues, are recommended for installations requiring either a 4x4 or 8x8 system.

As part of ATEN's VanCryst line of professional A/V solutions, both the VM0404H and VM0808H, HDMI-based Video Matrix switches, should be shortlisted by A/V integrators. From education to home theater and restaurants and digital signage, there is no shortage of environments where the VM0404H and VM0808H would thrive.

For more information on ATEN's HDMI Video Matrix switch portfolio, including the VM0404H and VM0808H, please visit <http://www.aten.com>.

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