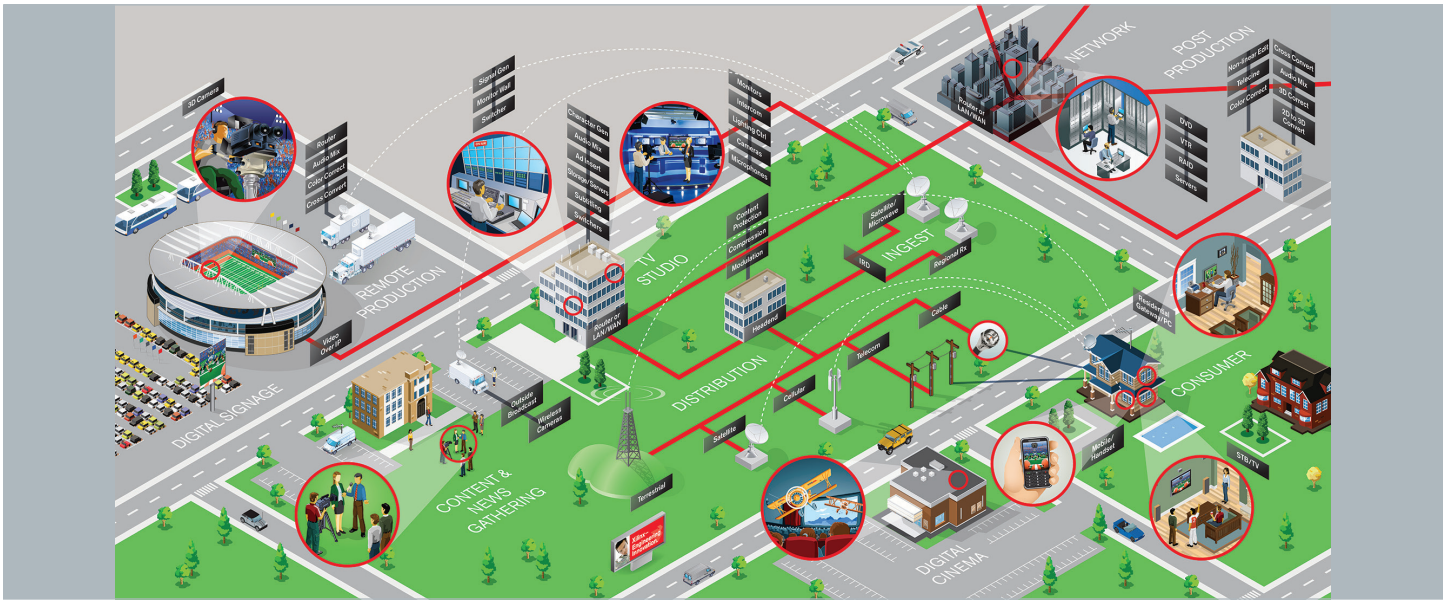
XILINX: A SMARTER VISION FOR BROADCAST

Over the last 30 years, consumers have witnessed a remarkable and rapid transformation of television broadcasting and the way we access media in general. If you were alive in the 1970s, you've seen just how far television has advanced from the days when analog broadcasts offered three primary channels with a picture quality that was only as good as the weakest link in the signal chain, from the camera shooting the event through the studio and numerous antennas to your TV. It wasn't a pretty picture, at least by today's standards.

With today's remarkable digital broadcast technology, each point in the broadcast chain is significantly more complex, but the resulting picture quality is exponentially better. What's remarkable is that experts say we haven't seen anything yet. In the next decade, smarter vision technologies, such as TVs with 4K2K resolution and the supporting broadcast and professional A/V technologies, will offer consumers a far more immersive viewing experience. These smarter vision technologies will make broadcasters and carriers smarter too, enabling them to tailor programming and sell advertising to audience members' individual tastes. Moreover, these smarter vision technologies will make broadcasters more efficient in their operations, enabling them to reduce operating expenditures. In addition, integrating intelligent vision with video analytics and metadata into the cameras will speed up postproduction work. This integration will also help in archiving and data-mining that video, so that in the future, when a producer is looking to find a particular piece of video content for a program under development, it comes easily to hand.

To help companies speed these smarter broadcast technologies to market, Xilinx is now delivering Smarter Vision solutions tailored to the unique needs of broadcast equipment manufacturers.

BROADCAST INDUSTRY LANDSCAPE



XILINX
ALL PROGRAMMABLE™

Xilinx Plays Central Role in Broadcast Innovation

Xilinx FPGAs have long resided at the heart of many major broadcast innovations, starting with enabling early standards definition and ratification, from design concept to implementation, and for prototype development right through to production. Xilinx devices provide the flexibility, scalability, and performance required to adapt to changing requirements faster. They reduce the risk of introducing new products and features, and ensure that equipment will remain in market longer, thanks to field upgradeability. In fact, Xilinx has been meeting equipment developers' needs for more than a decade, with a proven track record of technology leadership throughout the evolution of the digital broadcasting industry.

OVER A DECADE OF BROADCAST INNOVATION WITH XILINX DEVICES

YEAR	BROADCAST INNOVATIONS
2000	Standard definition is everywhere. MPEG-2 technology matures; Xilinx devices used in a variety of digital broadcast applications.
2001	Xilinx delivers SDI/HD-SDI solutions.
2004	Market introduces 1080i HD.
2005	H.264 compression widespread. Digital cinema emerging; Xilinx and broadcast alliance members launch JPEG2000, H.264 compression cores.
2006	Market introduces 1080p HD; Xilinx launches first 3G-SDI interoperability platforms.
2007	3G-SDI 1080p60 becomes ubiquitous. Video-over-IP applications appear; Xilinx introduces first programmable Video-over-IP offering
2008	4K digital cameras, flexible digital signs debut (Beijing Olympics); Xilinx active in EthAVB development, moves JPEG2000 into broadcast.
2009	3D video transmission to the home begins, analog switch-off starts; DVB and ATSC modulators built on Xilinx FPGAs.
2010	4K and 8K ultra-high def is emerging; Video IP takes off; Xilinx supports 10-Gbps network solutions, higher pixel counts.
2012	London Olympics becomes the most-watched online event in history. YouTube and Netflix drive Internet bandwidth explosion; Xilinx at the heart of 100GbE and 400GbE wired networks.
2013	4K TVs on the market, HEVC emerging to enable more efficient OTT, mobile and 4K delivery; Xilinx provides HD-to-4K smarter upscaling and Xilinx alliance members develop HEVC smart cores.

Xilinx—Making Video Equipment Smarter

To better serve these innovators in the broadcast and professional A/V markets, Xilinx is introducing its portfolio of Smarter Vision solutions. Xilinx's 28nm All Programmable FPGAs, SoCs, and 3D ICs serve as the foundation of the Smarter Vision solutions for broadcast. Xilinx is complementing these devices with a supporting infrastructure that includes the Vivado™ HLS (high-level synthesis) tool in the Vivado Design Suite, IP Integrator tools, OpenCV (computer vision) libraries, SmartCORE™ IP, and specialized development kits.

The Vivado HLS tool allows customers to develop highly complex algorithms in C/C++ and translate them into VHDL and Verilog; from there, they can be run in FPGA logic on Xilinx All Programmable devices. For designs targeting the Zynq™-7000 All Programmable SoC, the tool is especially effective in that users can run their algorithms on the device's ARM® dual-core Cortex™-A9 MPCore™ processor, and using Vivado HLS, compile all or a portion of each algorithm to HDL and run it on the FPGA logic portion of the device. In doing so they can find what mix or configuration runs best for their application and achieve greater overall system performance for their designs.

Another key component of Xilinx Smarter Vision offerings for broadcast is Xilinx's support for the OpenCV libraries. OpenCV is an industry-standard library of algorithms from OpenCV.org used in embedded vision applications such as smart cameras and sensors. Embedded vision developers across the world actively contribute new algorithms to the open-source library, which now contains more than 2,500 algorithms written in C, C++, Java, and Python. Algorithms in the library range in complexity from simple functions such as image filters to more advanced functions for analytics such as motion detection. Users can take these algorithms written in C or C++; modify function calls from OpenCV to HLS; and then, using Vivado HLS, synthesize or compile the algorithms into RTL code optimized for implementation in the logic portion of the Zynq-7000 All Programmable SoC.

With the release of Xilinx's Open Source library, Xilinx has essentially given customers a head start. Using Vivado HLS, Xilinx has already compiled more than 30 of the most-used embedded vision algorithms from the OpenCV library. Customers can quickly make processor vs. logic trade-offs at the systems level and run them immediately in the Zynq-7000 All Programmable SoC to derive the optimal system for their given application.

In addition, Xilinx's Smarter Vision solutions include a library of SmartCORE IP tailored for broadcast applications. Intelligent transport of media content is now possible with the availability of SmartCORE IP for video-over-Internet Protocol standards, including SMPTE 2022. This core improves robustness over wide-area distribution links through the use of forward error correction (FEC). Another SmartCORE, for IEEE Ethernet AVB (Audio Video Bridging), guarantees quality of service through tight timing, synchronization, and guaranteed bandwidth availability in local-area networks (e.g., a studio or stadium). These standards-based cores ensure that the transport of valuable content is done with lower capital and operating expense, but without sacrificing the quality of delivery or interoperability.

Xilinx devices also enable the earliest possible adoption of emerging display standards, such as DisplayPort 1.2 and the upcoming HDMI 2.0 video/data interfaces, which are expected to be implemented in all 4K professional monitors and TVs. These interfaces will enable more lifelike and immersive viewing capabilities in the home. Having higher-resolution screens with frame rates of 4K and higher is enabling a counterintuitive trend in the market. It now means that consumers can sit much closer to larger screens for a more engaging and entertaining viewing experience. At the same time, the emergence of codecs such as HEVC (High Efficiency Video Coding) will enable the delivery of rich 4K content to the home via the Internet first, followed by the traditional methods of cable, satellite, and terrestrial.

To enable the faster development of these Smarter Vision systems, customers can implement cores from the SmartCORE IP suite and algorithms from the OpenCV library into their designs quickly using the IP Integrator tool. This modern plug-and-play IP environment allows users to work in schematics or, if they prefer, a command-line environment.

IP Integrator is not only device aware, but kit aware too. So when a designer selects the Xilinx Zynq-7000 SoC Video and Imaging Kit, and instantiates a Zynq-7000 All Programmable SoC processing system within IP Integrator, Vivado Design Suite will preconfigure the processing system with the correct peripherals, drivers, and memory map to support the board. Embedded design teams can now more rapidly identify, reuse, and integrate both software and hardware IP, targeting the dual-core ARM processing system and high-performance FPGA logic.

Smarter Vision Reference Design Platforms for Broadcast

Xilinx offers broadcast-specific design platforms that integrate all the hardware and software elements manufacturers need to quickly build systems and fully verify performance for a broad range of video creation and distribution applications.

The Xilinx broadcast reference designs and SmartCORE IP address the need for greater system memory bandwidth, improved multichannel video performance, and lower power consumption. Xilinx platforms simplify development of complete broadcast audio and video solutions. This includes intelligent transport interfaces, such as SMPTE serial digital interface (SDI) support for standard-definition (SD), high-definition (HD), and 3G-SDI (full HD) standards, as well as aggregation of multiple SDI channels over new 10-Gbit video-over-IP technologies, DisplayPort 1.2, and the upcoming HDMI 2.0. The latter interface will support 4Kp60 video, whereas HDMI 1.4a offers up to 4Kp30 support today. Xilinx has developed the Real-Time Video Engine where multiple video-processing chains are supported utilizing multiple SmartCORE IPs including deinterlacers, scalers, and on-screen displays that buffer this video into memory utilizing sophisticated SmartCORE video DMA engines. These SmartCOREs also support the latest H.264 and H.265/HEVC codecs for full HD and 4K video.

Xilinx's common platform approach for broadcast audio, video, and network connectivity applications enables broadcast equipment engineers to be more productive. These designers can focus on creating new and improved video-processing and codec algorithms rather than spending the majority of their time performing mundane tasks such as implementing standard interfaces or memory infrastructures. The ability to develop custom devices with exceptional performance and a competitive bill-of-materials (BOM) cost has opened the door for innovation across broadcast markets. Unlike standard off-the-shelf ASSPs that offer little differentiation, or ASICs that require high order quantities and hefty upfront development costs, Xilinx FPGAs—and particularly the Zynq-7000 All Programmable SoC—offer the optimum balance of hardware and software performance, features, and system integration. In this way, Xilinx devices deliver the flexibility needed to adapt quickly, along with the freedom to innovate.

Transforming the Broadcast Industry Through Innovation

Over the last decade, Xilinx All Programmable solutions have enabled the broadcast industry to create and bring to market numerous innovative video, audio, and networking technologies. Indeed, when you switch on your TV, it's highly likely that the video and audio content you see and hear has traveled through equipment that contains Xilinx FPGAs. Xilinx remains committed to helping broadcast equipment manufacturers quickly bring to market next-generation innovations by offering a wide array of broadcast-specific platforms. These solutions address multistandard video, audio, and network interfaces. They include the highest-quality audio and video codecs; real-time video processing beyond HD; and high-speed DSP for low-cost per-channel transmission and modulation. These Smarter Vision capabilities guarantee limitless industry innovation. And with Vivado HLS, IP Integrator, and the Zynq-7000 All Programmable SoC, time-to-market is faster than ever.

With access to such comprehensive platforms, broadcast and professional A/V equipment engineers can focus on differentiation and innovate with emerging, sophisticated technologies that have the potential to move the broadcast industry forward in exciting new ways. Because the broadcast industry strongly influences other markets, transformational advances in broadcast video technology will also undoubtedly have a positive ripple effect throughout other video markets and the electronics industry as a whole, further enriching all our lives.

Take the NEXT STEP

For more details on Xilinx solutions for the broadcast industry,, please visit: **www.xilinx.com/broadcast**

Corporate Headquarters

Xilinx, Inc.
2100 Logic Drive
San Jose, CA 95124
USA
Tel: 408-559-7778
www.xilinx.com

Europe

Xilinx Europe
One Logic Drive
Citywest Business Campus
Saggart, County Dublin
Ireland
Tel: +353-1-464-0311
www.xilinx.com

Japan

Xilinx K.K.
Art Village Osaki Central Tower 4F
1-2-2 Osaki, Shinagawa-ku
Tokyo 141-0032 Japan
Tel: +81-3-6744-7777
japan.xilinx.com

Asia Pacific Pte. Ltd.

Xilinx, Asia Pacific
5 Changi Business Park
Singapore 486040
Tel: +65-6407-3000
www.xilinx.com

XILINX
ALL PROGRAMMABLE™