Not Just a Black Box

10 considerations for choosing a digital media playback solution

BY MARTY KARP

When choosing a digital media playback system, a wide range of factors bear consideration, including video outputs and capture inputs, video codecs, audio, types and volume of content, and synchronization requirements. Your server network and how video and audio signals are distributed are also important aspects of creating stabile playback.

Choosing the best media server and system configuration for your needs is all about addressing your problems, goals, physical layout, and technology environment.

To start, you may use projectors to project on buildings, stage scenery, screens, or surfaces. Selecting the appropriate projectors for adequate light output, and lenses for their throw ratio, is based on factors such as projector placement to achieve full coverage of the projection surface, the distance (throw) to the projection surface, and ambient light. And to accomplish full coverage with adequate light output often requires multiple projectors.

In live theatre projectors are the most often used display type, but media servers can also be running an LED wall built out of LED tiles and LED processors, or a number of monitor displays running either individually or configured into a video wall. Although these are similar systems when it comes to digital media servers, nuances exist for different display types.

Media servers are not one size fits all; in fact, they are far from it. Best-in-class hardware could offer a solution for every possible need, but could be costly and provide more bells and whistles than necessary for the application. Server choice is affected by a number of factors, starting with the level of performance and the raw horsepower needed, as well as the features and options required to create the desired playback solution.

Following are considerations when choosing your system.

1. Quantity of outputs

A stage production with three projectors would obviously need a media server with three outputs, but those three outputs could vary significantly. If you're using projectors set to standard definition (SD) resolution, then each output is less than half a million pixels. An HD output of 1920 by 1080 is roughly 2 million pixels per output. If you are outputting UHD (4K), the system is dealing with 8-9 million pixels per output. Just multiply that number of pixels by the number of projectors to get a sense for the overall performance requirements of the system. It's all about the number of pixels to be processed, and how fast. We sometimes use the word "bandwidth" to qualitatively describe performance level.

Resolution is one element, but also

Light Harvest's 2019 LUMA Festival entry "The Awakening," projected onto 95 Court Street in Binghamton NY. | Photo by Mark Doyle/ USITT.

consider frame rate. How fast do those pixels need to change color and intensity? If a system is running at 30 frames per second, this is different from 60 frames per second, meaning pixels potentially change at a faster rate. This also impacts the performance requirements for the computer.

2. Encoding guidelines

Video files are typically very large and encoded using a compression scheme, known as a codec. The codec choice will impact computer operation, because some codecs rely more on the capabilities of the CPU, while other codecs rely more on the capabilities of the graphics card, or GPU. Uncompressed video files place more demand on the computers and require more "bandwidth," as well as storage. It is preferable to compress files into something more compact and manageable. Codec selection impacts the performance requirements, and whether the CPU or the graphics card plays a greater role.

Typically, a particular media server platform will have guidelines for encoding to achieve the best results. It's important to know which platform is being used and the associated encoding guidelines. Additionally, there may be different terminology used for the same parameters among different platforms and codecs. For example, in WATCHOUT, bi-directional frames are called B-frames, but in other platforms B-frames may be called N-frames or M-frames.

3. Frame sync and genlock

Synchronization is another important consideration for multi-output media servers. The graphics card, let's say it's a 4-output or 6-output card, will usually have resident software synchronization capability. However, hardware-assisted synchronization is required under certain circumstances, so the addition of a "sync card" to facilitate frame sync, or genlock using a signal generator, may be necessary to perfect a seamless appearance across multiple display devices. This may be especially true when networking multiple servers together.

An LED wall with multiple LED processors is just one example of an application that requires hardware-assisted sync. The goal is to have pixel-to-pixel synchronization across the entire wall regardless of the number of processors. Also, multiple projector blends with less than 15 percent overlap may sometimes require hardware-assisted sync.

Maxin1osity's "Pandora's Box" entry in the 2019 LUMA Festival, projected onto 79 Collier Street, in Binghamton, NY. | Photo by Mark Doyle/ USITT.

For scenic projection on a stage or when projecting on buildings, the projection surfaces are fairly imperfect. Viewers are less likely to see the visual imperfections caused by less-than-ideal frame synchronization. In contrast, when a number of monitors are configured in a video wall, all butted up against each other with no bezel, a totally seamless look is important. Hardware assist adds that necessary frame synchronization.

4. Content complexity

Demanding applications require more digital horsepower. An arena concert with a lot of fast-moving content and multiple simultaneous cross-fades would use more computer resources than relatively static applications like scenic projection in a live theatre production.

Also, some of the processes might be handled outside of the computer. For example, some newer professional-grade projectors can communicate with each other; they network together and perform edge-blending within the projectors so that the media server doesn't need to. It becomes a balance between the resources being used in the computer versus the built-in features of the projector. So if you are using a light-duty server, it may be beneficial to try to edge-blend with the projectors first, if that capability exists.

5. EDID management

Several other elements affect the hardware and performance requirements of your media server. For example, EDID (Extended Display Identification Data) management helps maintain a functional connection to the display devices in the event of a signal loss or glitch somewhere in the signal chain. Higher-end graphics cards typically have the capability for EDID emulation. Most of the time, using the on-board EDID management capability works just fine, although it is another point of system resource usage. With a light-duty media player, you may wish to use a stand-alone EDID manager for each display device.

6. Live capture

Another feature that may be desirable is live capture input. Traditionally, this is handled by adding capture cards to the

media server if the server has the card slots and "bandwidth" to handle the additional load. One of the more common uses is IMAG (image magnification) in which a live camera with an SDI output is ingested by the server and displayed as a PIP (picture-in-picture) window or full-screen. Or, streamed content from the Internet can be taken from the HDMI or DisplayPort output of a PC and captured by the server for display as well. This method can also be used to project PowerPoint presentations from a PC.

The demands of capturing inputs on the server need to be determined as well. That includes the quantity and type (SDI, HDMI, DVI, DisplayPort) of physical inputs, the resolution and frame rate of each input, and the maximum number of captured inputs to be live at the same time. Obviously, 4K inputs create larger resource demands than HD inputs. Network inputs via the NDI standard are becoming more common these days. These require that the captured signal comes from an NDI camera or device, or that it goes through an NDI convertor. But it does eliminate the need for capture cards as the signal is ingested via a network port and can more easily be distributed to multiple servers on the network.

All of these parameters, features, and system elements lead into a discussion of server architecture: the CPU, graphics card, amount of storage needed, RAM, and overall level of performance required to accommodate different production situations. So, it's important to ask, what do you really need? What are you trying to do? What are your inputs or outputs? By defining all of these different aspects of the system, you can configure the best choice for adequate performance and functionality to do the job without excessive cost or equipment.

7. The display network

Ideally, media servers should be on a dedicated wired network. Since Wi-Fi is collision-based, meaning that different things are happening simultaneously over the network, Wi-Fi is not generally recommended. Video prefers an open pipeline. Unmanaged network switches provide an open conduit, which is important for moving a lot of bits without interruption. Typically, a gigabit network switch is recommended. But with increased use of 4K and higher resolution content,

and 4K display devices, a 10-gigabit network may be desirable for speed and efficiency. That requires all components on the network be equipped with 10-gigabit network interfaces. These are becoming more common in the live events industry due to the demand for 4K.

If a managed network switch is necessary, correct configuration and settings are extremely important. Also, energy-saving settings don't work well due to built-in intelligence that tries to say when the network is engaged and when it isn't. Turn off the energy saving settings for uninterrupted data flow.

8. Signal extenders

A wide variety of video signal extenders are available to connect your media server to your projectors or other display devices. A signal extender is needed when sending video signals farther than 15-20 meters over a straight DVI or HDMI cable run. Make sure you understand the EDID functionality for your particular type of signal extender and remember that all devices in the signal path must be configured for the same resolution and frame rate. Compatibility along the entire signal chain is required.

HDBaseT often is used for runs up to 100 meters due to simplicity and low cost, plus the ability to piggyback control signals over the CatX cable carrying the video signal. Cat6a or higher-rated network cable is important. Many professional-grade projectors, as well as other display devices, now have native HDBaseT inputs, which is a good solution for low-latency point-to-point video signal transport.

More costly fiber-optic extenders are capable of very long runs, have strong immunity to EMI and RFI, and can be purchased with sheathed jackets for mechanical durability in difficult environments. Fiber extenders are ideal for arenas. Some fiber extenders can carry HD signals up to 2.5 kilometers, and 4K signals up to 0.6 kilometers.

SDI cables can also be used for longer runs. The SDI standard originated in the broadcast industry and is relatively cost-effective when dealing with HD signals, and it makes use of commonly available coaxial cable with BNC connectors. This standard is referred to as 3G-SDI for its 3 gigabit/second bandwidth. For transporting 4K signals, the 12G-SDI standard involves more costly transmitters and receivers, and higher-grade coaxial cables. Or, four 3G-SDI cables can be ganged to carry 4K signals as well. Some projectors and display devices will have native SDI inputs.

A few brands of moderately priced HDMI fiber ribbon cables come in lengths up to 100 meters, with the added advantage of not requiring external power. They are convenient and lightweight, but are relatively delicate, so be careful with their handling and storage. A potential downside is that they pull their power off the graphics card, which can be detrimental depending on system performance demands.

In the future, we will see AV-over-IP solutions based on standards being developed by the SDVoE Alliance. Network-distributed video (and audio) will be feeding our display devices. But for the time being, point-to-point connections are required for getting video signals to your displays.

9. Audio

You may also have audio tracks to accompany the video. There are several ways to incorporate audio and it varies slightly for different media server platforms and for different hardware. The motherboard may be equipped with analog audio and S/PDIF outputs. While this may be cost effective, it will typically require settings and control via the operating system interface. For greater control and flexibility, various other analog and network-based audio options are available. Whatever the audio requirements are, audio will utilize some of the media server's resources as well, so understand your audio needs up front.

A low-cost USB audio interface/preamp box is often used for up to 10 balanced line-level analog outputs. Analog PCIe audio cards can also be installed in media server hardware for more integrated solutions.

Network audio has become very popular and can also be integrated into the server with PCIe Dante and AES67 cards, depending on the desired standard. External Dante and AES67 servers are available as well.

10. Show Control

Lastly, consider your scheduling and control needs. Do you want to control media cues from your lighting board? Do you want your media server to be able to trigger a lighting cue? Do you want to have a very simple interface for non-technical staff to have manual control? Do you have a device that outputs network IP commands to trigger a cue? As an example, think about contact closures on a stage, such as a switch. A performer opens or closes a door or steps on a sensor on the stage to trigger a media event at that exact moment. Many options are available for show control, ranging from software to hardware solutions. And some media server platforms may have embedded show control features.

Also consider remote access needs. Will you need to troubleshoot or make content changes or scheduling changes remotely? This is sometimes desired in permanent installations. Is it safe to have your media server connected directly to the Internet or do you need a different way in to the system?

TeamViewer is a commonly used app for this purpose, though other apps are available that may provide greater functionality for a cost. As noted earlier, it's best to keep the media server network isolated from the Internet, so be sure to make remote connections through a separate network port. As always, perform small scale tests, especially if operating online, to make sure nothing goes wrong on the display network side of the system.

Media playback systems are not a network of black boxes that all do the same thing. By understanding your specific needs and the relevant parameters, you'll be better able to identify the system solution best suited for your needs.

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