Blending Technologies for Image-Based Lighting

LED wall construction

TECHNOLOGIES FOR IMAGE-BASED LIGHTING

Creating interactive lighting effects to match a virtual production environment is a hugely powerful technique, but it can require new technology and technique. Generating useful picture data and transporting it from camera, computer or playback device to a video wall and an array of production lights will involve a chain of several pieces of equipment, which will all have a wide variety of capabilities, requirements and configuration options.

TYPICAL VIDEO WALL CONFIGURATION

Most LED video walls, including types used for advertising display, are built from a large array of rectangular panels which are generally a foot or two on each side. Each panel has a decoder board, which is often a plug-in module matched to a particular processor. Processors are rack-mounted modules often in a nearby machine room, connected to the panels via a computer network such that more than many panels can be controlled via a single connection to the processor. Fiber-optic interconnects are preferred for their high bandwidth and reliability, especially in situations where large video walls require many groups of panels, connected via many cables to many processors.

The processor will have a video input of a common type such as HDMI or SDI by which it receives video images, splitting that data up to feed each panel. Each processor will typically be connected to a server (simply a powerful computer), which might render a real time 3D simulation, play back pre-recorded video, or source images from almost anywhere, depending on the requirements of a particular job. Variations on this setup include servers with more than one graphics board feeding more than one processor; some processors might handle more than one input at a time, and different processors might handle different numbers of panels.

THE NUMBERS

Low-level details of how a virtual production video wall is configured will usually be handled by specialists from the facility concerned, and not the responsibility of the lighting or electrical departments. Even so, because the video wall is providing at least some light to the scene, responsibilities will inevitably cross over and create a need for close collaboration. Key specifications of the video wall include multiplexing and refresh rate. These affect flicker behavior and how finely-controlled the brightness of individual LED emitters can be, which affects both overall brightness control and the ability of that particular video wall to display finely-graduated tones without visible banding.

Credit: Orbital Virtual Studios

Multiplexing is a technique by which more than one individual LED emitter can be controlled by a single microchip inside the panel. Because of the huge number of emitters involved, panels will illuminate them row by row, often in groups of 8 or 16 rows sequentially, at very high speed. Lower numbers are better, meaning more of the emitters are on simultaneously. This potentially increases brightness and reduces the visibility of flicker and horizontal banding, potentially allowing the taking camera to operate in a wider variety of shutter and frame rate combinations.

Refresh rate applies to video walls in a slightly different sense than it does on computer monitors. On a desktop LCD display, refresh rate and frame rate are synonymous. On an LED video wall, the term generally refers to the technique used to change the brightness of emitters by turning them on and off rapidly - pulse width modulation. Here, higher numbers are better, because the more often the emitter can be switched on and off, the finer the resulting brightness control. Common refresh rates include 3840Hz and 7680Hz, which are not to be confused with the 3840- and 7680-pixel widths of UHD and 8K images.

Together, these factors imply that reducing brightness significantly may also reduce the ability to display finely-graduated tones, and that the refresh rate of the video wall may interact with choices of frame rate and shutter timing in ways which require configuration changes in several pieces of equipment.

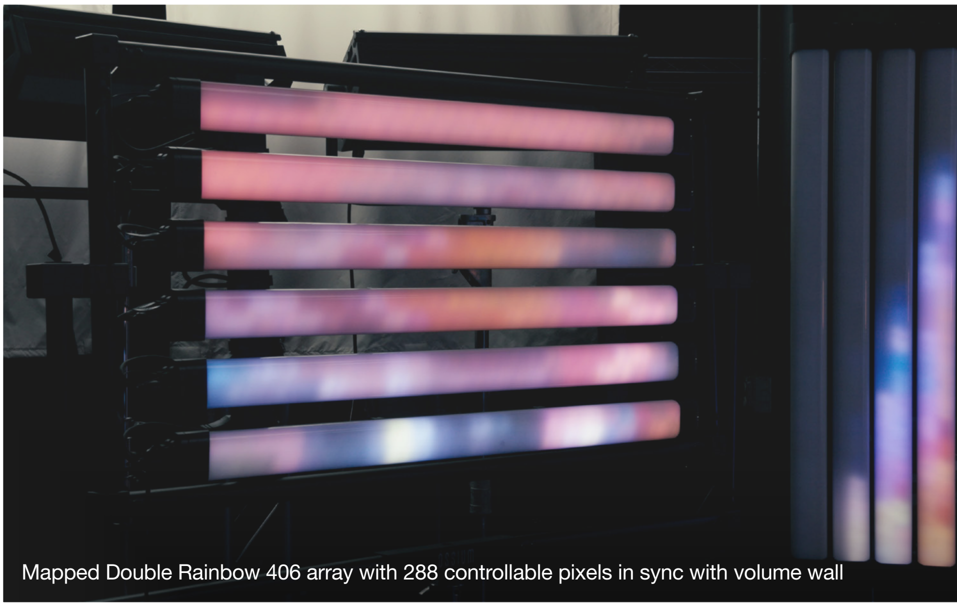
Production lighting devices, meanwhile, generally won’t have these concerns.

CHOOSING PRODUCTION LIGHTS

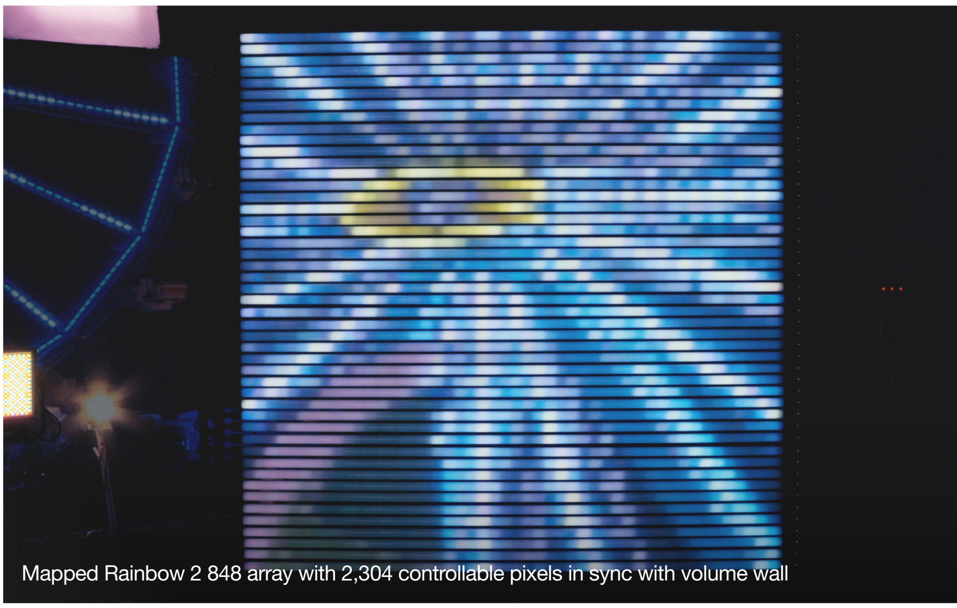
In principle, any lighting device which can be controlled using a common lighting control protocol can become part of an image-based lighting setup, although LED-based lights are highly controllable and react quickly to inputs. Otherwise, the production lights chosen might be as varied according to the needs of the cinematographer, as on a conventional set. Image-based lighting might mean something as simple as a single hard source simulating sunlight, with its color automatically matched to a virtual light source.

Probably the best-known application of image-based lighting involves arrays of lights each with many individually-controllable pixels, often in the form of tube style lights each implementing pixels a couple of inches across. A bank of many such tubes creates a low-resolution video display, with the intent of casting believable, interactive animated light, with high color quality, on real-world foreground objects. Similar things can be achieved with arrays of LED panel lights or even LED-based space lights, trading off the number of lights to rig against the resolution of the resulting interactive lighting setup. The required resolution depends on the intended setup; simulating hard sunlight requires more than simulating an overcast day exterior.

Source media files sent to lighting fixtures



Mapped Double Rainbow 406 array with 288 controllable pixels in sync with volume wall



Mapped Rainbow 2 848 array with 2,304 controllable pixels in sync with volume wall

VIDEO TO CONTROL LIGHTING

The final image feeding the video wall's processors may come from sources as simple as a laptop replaying conventional footage, various kinds of dedicated media server, or an array of servers rendering real-time 3D environments.

Rainbow 2 848 array simulating fire in sync with video wall

Those rendered images might be tens of thousands of pixels wide and at high bit depths, and generated in real time at high frame rates. That's very demanding by the normal standards of film and television effects work, which is one reason the video wall is often fed by several servers at once.

Generally, the area of the video wall currently in view of the taking camera – the frustum – will be drawn to accommodate the current position and orientation of that camera. That will change, perhaps rapidly, as the taking camera pans and tilts. The rest of the wall typically displays an image rendered from a virtual camera from a fixed position selected to create a reasonable approximation of the virtual scene in the immediate vicinity of the real world scene. Occasionally that virtual camera may be moving through the virtual world, perhaps to simulate a jet fighter's flight, but it will not generally pan and tilt to match the movement of the taking camera.

Either way, that image will be the basis for most interactive lighting, simulating light cast on real-world objects by the nearby region of the virtual scene. Sometimes, that image can also be used as a source of data to control image-based lighting, so that production lights will react to things which are visible on the video wall. At the same time, that approach means that things which are not visible on the wall can't be used to control lighting.

That's particularly true in common situations such as creating skylight, where production lighting might be rigged overhead to simulate the purple-orange overhead sky of a sunset. In virtual production studios without an overhead video wall, a virtual camera view looking directly upward may not be available unless it is specifically requested.

In that situation, a server may be able to generate additional images of the environment on request, depending on the required resolution of that image and the availability of extra hardware to render it. One key factor is whether the design of the virtual environment actually defines what that region of the virtual world looks like. That concern may require consultation at the design stage to ensure that virtual world actually defines the appearance of things such as the sky, which may not appear on the video wall, but which image-based lighting may later need.

Image-based lighting might operate based on images from many sources, and can create highly convincing interactive lighting as well as innovative special effects. What comes out of a rendering server, though, is just numbers, and the task of getting those numbers from a DVI or SDI cable to a light, with meaningful results, can involve unusual techniques. Next, we'll consider the practical implementation of image-based lighting, particularly as it can involve intelligent lighting specialists and lighting desk operators.

Double Rainbow 406 Ossium array

QUASAR SCIENCE SOLUTIONS

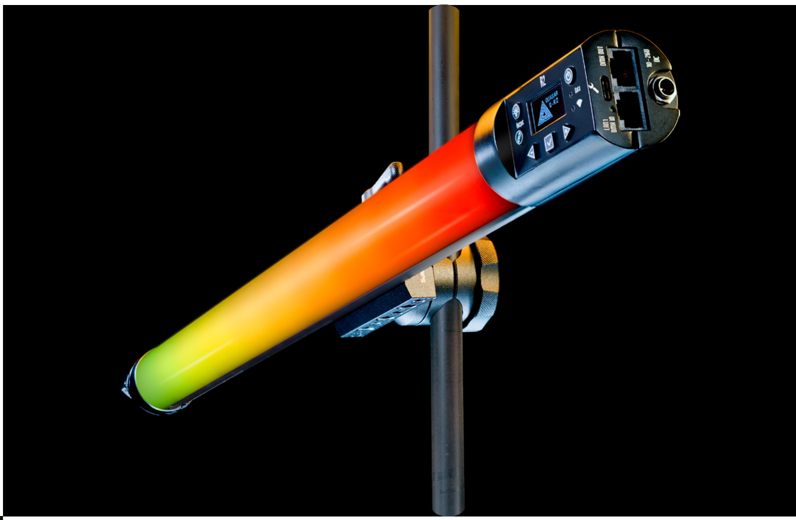
Image-based Lighting (IBL) is transforming the way DPs, console programmers, and technicians approach set lighting. Using the same assets projected onto the volume wall, IBL creates pixel mapped lighting that adds heightened realism to the virtual set. Subtle nuances in light texture, movement, and spectral characteristics create dramatic effect, elevating the storytelling potential of virtual production.

IBL is paving the way for a new level of creativity and excitement in visual storytelling, but not without some challenges that we solve with Quasar Science solutions.

RAINBOW 2

The premier linear LED for motion picture and content creation. High quality tunable white light and the highest RGB color saturation with multiple pixels to maintain super smooth, flicker free dimming, the R2 will be your workhorse. This linear LED light offers incredible data connectivity whether wired or wireless and can be powered anywhere via AC and DC power inputs. Integrated Ossium Mounting System (OMS) allows for rigging in ways previously unobtainable.

Available in: 2’ 4’ 8’



DOUBLE RAINBOW

The Double Rainbow (RR) Linear LED, with its two rows of high fidelity RGBX pixels, creates realistic lighting with vibrant saturated colors and intense white light. A unique shape provides a powerful light source using little space. Wireless and wired data connections mean no data boxes, receivers or transmitters. Built in network switch for simple native connectivity. Integrated Ossium Mounting System (OMS)rigging adapts to everything. AC/DC inputs for continuous power whenever and wherever.

Available in: 2’ 4’

OSSIUM FRAMES

Combine Rainbow tubes into stacked arrays to create a wall of light. Both Rainbow 2 and Double Rainbow bolt on using the integrated Ossium Rail, supported by the solid Ossium Frame. Power up with the included multibank adaptor, and add data for dynamic control of your lighting array. Direct Connect of every industry standard wired and wireless control option from DMX and Bluetooth through to sACN. Simple to set up, with the power to be complex in all the right ways.

Available in: 2’ 4’

Arrays for up to six Double Rainbows or twelve Rainbow 2’s. Please enquire for bespoke 8’ installations.

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