The Challenges of Building a 350 Megapixel Augmented Environment at Radio City Music Hall

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In 2017, Radio City Music Hall completed an expansion of their entertainment technology to include 36 4k projectors mapped onto the ceiling, arches, and walls of the auditorium and the largest permanently installed 8k display in the world. The on stage display had physical dimensions of 90ft x 40ft and consisted of several hundred emissive display cabinets based on a pixel pitch of 3.4mm. Finally, two smaller displays on each stage wing also used an input resolution of 3840px x 2160px.

Driving more than 40 4k displays in perfect synchronization provides the first obvious source difficulty, but almost everything from content production to electrical design raises complex problems to be solved in such a large immersive environment.

In this talk, based on first hand experience working on the project, the presenter would like to cover the demand and audience reaction to the immersive installation at RCMH, the technologies used, and some of the complex engineering requirements.

I. PROJECT BACKGROUND AND CREATIVE GOALS

In 2017 Madison Square Gardens, the owners and operators of RCMH, completed a video installation comprising of more than 40 video surfaces controlled by 3080px x 2160px inputs. The arrangement of the displays was such that, for the audience, one large seamless display was formed on the walls, columns, arches, and ceiling around them. For the creative team on the production, this gave them the power to expand the show beyond the frame of the proscenium and into the rest of the theatre, completely surrounding the patrons.

For the 2017 production of the Radio City Rockets Christmas Special the artists employed a design that involved snowfall, and stars, and Santa flying across the sky, which was projected above the audience, to create a unique and truly immersive experience. Reactions were extremely favorable. Having the creative power to control elements outside of the traditional proscenium frame gave the artists the power to bring the audience into the story, and in the words of creative director Travis Threlkel, bring the audience one step closer to “living the story”

II. THE TECHNOLOGIES USED

To accomplish their vision, 18 projection positions equipped with two Christie Boxer 4K30™ 30,000 lumen projectors created a video surface along the ceiling, walls, columns, and arches of radio city music hall.

For the on stage display a different display technology was selected. ROE Visual Black Onyx 3™ emissive led display panels were selected. Each panel was connected to one of 4 led Revolution Display M8™ 4k display processors.

The input signals for each processor were provided via collaboration with 7th Sense Design media servers. Beyond this basic list of equipment, several providers each contributed synchronization, distribution, networking, power controls, and more.

III. PROJECT ENGINEERING

Throughout the development and installation of the project many engineering challenges were overcome. One of the most obvious and most difficult comes from content production for a dome environment. Following content production, how do you split the 350 megapixels of video content down into normalized 4k rasters for processing and distribution.

Timing synchronization is a source of many headaches and complications. Not only to several media servers need to be synchronized, but 44 projectors and video processors and hundreds of LED panels need to subscribe to the same tight timing requirements.

Finally, because of the complex visual environment, color calibration (color volume) has to be matched between the projectors and LED emissive display technology in order to create a more seamless visual environment. Each technology has very different base components, mercury lamp + filters + 3DLP chips and short bandwidth directly viewed LEDs. Finally, calibration complexity was further increased by using the projectors on a non uniform projection surface, the yellowish ceiling of Radio City Music Hall.