

Optocore at Viva ELVIS

By: Alan Hardiman

A fiber-optic network designed for a complex Cirque du Soleil spectacle

The 1,840-seat theatre for *Viva ELVIS* is the seventh permanent venue in Las Vegas for Cirque du Soleil. The new structure, integrated within the ARIA Resort and Casino was specifically designed to accommodate the design and production requirements by Cirque du Soleil for the production of *Viva ELVIS*, which opened in February. (See *LSA*, May 2010, for a look at the show's production design.)

The performance sound system in the *Viva Elvis* Theatre was designed from the ground up to meet the creative demands of the show by Cirque's sound designer, Jonathan Deans, who elected to build the show on an Optocore fiber-optic digital network, rather than on a traditional copper infrastructure, "partly because everything is so spread out—the backstage area alone is 200' wide," says assistant head of audio Aaron Beck, who originally signed on to the show as project manager in August 2008, and trades off front-of-house mixing duties with head of audio Kevin Owens.

Optocore is a system comprised of a number of individual rack-mount modules connected in a fiber-optic synchronous ring network capable of transporting audio, video, word clock, and computer data over distances typically up to 2,300' between each individual Optocore device using multi-mode fiber, and optionally up to 68 miles with single-mode fiber.

Impressed with the sound and features of Optocore, Deans decided to give it a try, even though he had never used it before. Following a number of exploratory conversations with

Optocore's developer and president, Marc Brunke, in which Deans laid out some of the unique requirements for *Viva ELVIS*, Optocore accelerated development of the system to provide for multiple clients in a server-based topology. Matt Ezold represented consultants Auerbach Pollock Friedlander, and Bob Barbagallo and Mario St. Onge served as project managers for Solotech, the system installer.

"We're the first to use client-servers," says Beck. "Up until now, Optocore was run from a single computer. We wanted multiple clients to be able to control any part of the network—we have two clients in the monitor room, one client at FOH, one client in the equipment room, and another in the RF area. We've taken it to the max of what we needed. Before our show, they had only ever had eight device IDs on the ring. Optocore wrote special software for us to take it up to 24 IDs." With 21 network devices currently on the ring, the current software still allows for some expansion.

And take it to the max they did: *Viva Elvis* uses the largest Optocore dual redundant single ring network ever installed: The 21 network devices handle 504 audio inputs and 776 outputs, converted to 48kHz AES digital audio and through twin Meyer LCS LX-300 mix engines for front-of-house and monitor mixing.

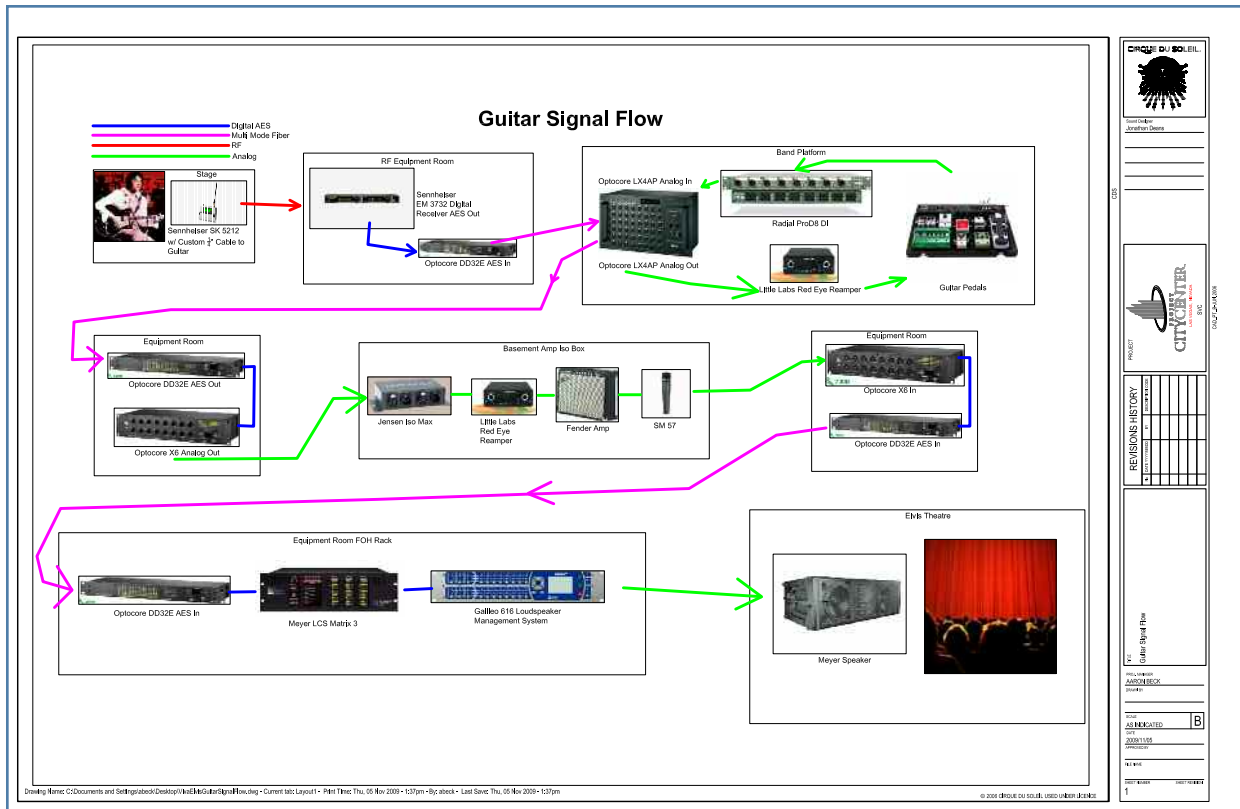
Because guitars are such an important part of the show, a sub-system was required to incorporate three on-stage guitarists, a vault of vintage guitars, a basement full of

amplifiers, and a forest of foot pedals that have to be switched on the fly while the guitarists are busy with their choreography or riding up the 50' set. This was accomplished primarily using MIDI triggers with a chain of 18 different Optocore network devices, Optocore A/D converters, mics, and direct inputs (DIs), all interconnected with no buzz or hum. (Please refer to the accompanying guitar signal-flow diagram.)

Two Optocore LX4AP XLR-input modules, each with 48 mic preamps, are located backstage for all the band inputs. Additional Optocore X6P-16IN input modules in the equipment room handle 24 mic inputs, mostly from the guitar amplifiers located in the basement, and an off-stage clarinet. The system also includes other miscellaneous inputs around the stage, primarily all band-related. Elvis Presley's voice, additional band tracks, click track and SMPTE time code are replayed from dual redundant Ableton Live 8 playback systems running on Mac Pro computers equipped with RME MADI cards feeding a pair of independent Optocore DD2FE MADI I/O modules via fiber.

Integration of Optocore fiber optic networks into live performance systems is assured by a very low overall latency of 41.6 microseconds between any points in the synchronous network, regardless of complexity, allowing for use in stage and in-ear monitor applications. Latency through other components is a much more significant factor, being many times greater than this.

"Optocore has the lowest latency via straight AES or even the analog converters of any component in our system, hands down," Beck concedes.



Above: This chart lays out the guitar signal flow at *Viva Elvis*.

Macros

Optocore offers the ability to create 24 keystroke macros per client, and this facility is heavily used in *Viva Elvis*. One macro was written to switch the Ableton playback outputs from the first DD2FE interface to the second, effectively becoming the redundant-switcher. The macro can also be triggered via MIDI, if desired.

"We're using macros a lot in our backup scenarios," Beck says. "Next to our LCS monitor console, we have a Yamaha O2R mixer that receives stem mixes from the FOH mixer. If the LCS monitor console were to crash, we can reroute the in-ear monitor signals to come from the O2R with a press of a macro. All band members would continue to get in-ear monitoring while we re-booted the monitor console."

In the RF area, RF technician Whitney Day has programmed 24

macros on his Optocore client to route wireless mics singly or in various combinations to one or more of four Optocore outputs that he can monitor right at his station.

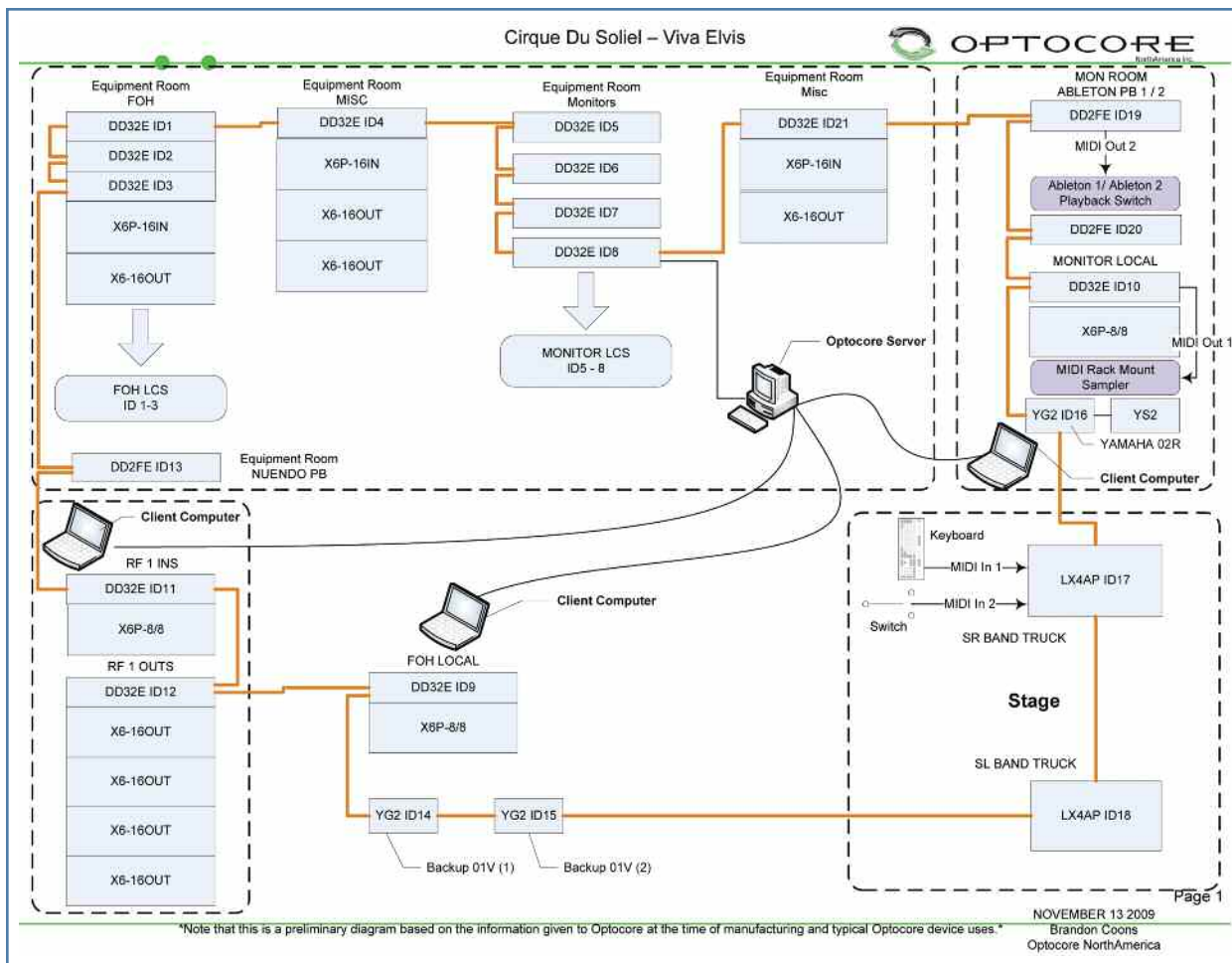
Yet another macro enables one or more of 16 pre-recorded band tracks to be substituted for its corresponding live input. "If a horn player were to call in sick, for example, we'd just fire a macro that would play his recorded track in place of his mic input. The show's staging really doesn't allow for understudy musicians or subs. The players are not in a band room or a pit; they're an integral part of the show, with their own choreography, riding lifts that move constantly on and off the stage, so it really isn't feasible to have subs for them. If someone's absent, we just fire a macro and have his identical, recorded track show up on the same input that his microphone would be on, at exactly the same level,

because with Optocore it's truly zero in, zero out," Beck explains.

The crew has found the macros to be so useful that they have programmed more than 100 of them for use at various points during and between shows.

Virtual sound check

A 128-channel Nuendo recording system is connected via an Optocore DD2FE single rack-space module, accommodating 128 MADI channels on two input and two output BNCs. The show can be recorded to Nuendo when required, and played back through the mix system simply by calling up a file that maps Optocore inputs to Nuendo, assigning the 128 recorded tracks in place of the live inputs from the stage boxes and RF inputs that would normally feed the front-of-house and/or monitor consoles.



Above: The overall Optocore layout at *Viva Elvis*.

“If we’re teaching a new person the mix, or we just want to just listen to something, we open that second Optocore file and do a virtual sound check with 128 tracks of audio, just like we’re sitting there mixing the live show. The ability to do all that and not move a single wire to reroute the audio is pretty remarkable,” Beck says.

Reduced complexity, lower cost

Like every Cirque show, *Viva Elvis* continues to develop during its run. Beck says he can easily reroute thousands of patch points in software into or out of any of the show’s five main and backup consoles without

moving a single wire. The YS2 and YG2 expansion cards, made by Optocore for Yamaha digital consoles, allow for simple fiber connection of 32 I/O into a Yamaha 02R, and 16 I/O into each of two Yamaha 01V boards.

“I wouldn’t want to do a show without Optocore now. Thinking back over previous Cirque shows using the same playback system, for example, I would have had to convert the playback to MADI, then convert it to analog for input into our Solotech analog switcher, and from there convert analog to AES digital audio to get into the LCS mixing console. And that’s just for playback,” Beck says, taking a breath

while considering the magnitude of the signal transport for the many hundreds of inputs and outputs in the entire show.

“Regarding overall audio transport cost, I’d say we’ve saved maybe 50 percent, based mostly on the cost of labor in terminations per copper connection. Consider the RF room alone, where we handle the inputs from the mics and the outputs for the in-ear monitors. Forty Sennheiser 3732 receivers feed the wireless mic signals via AES digital audio directly into a single rack space Optocore DD32E,” Beck explains.

A second DD32E outputs the 30 stereo in-ear monitor mixes via four Optocore X6-16OUT analog output

modules to the RF room transmitters and a few hardwire locations.

“So what would have totaled in excess of 100 copper lines is reduced to four pieces of fiber. When you replace the job of terminating more than 100 copper lines—that would have taken a couple of guys several days to complete—with four fiber terminations that one technician can do in less than an hour, you see the real saving.

“On top of that, Optocore is flawless in performance. During the entire production process, I never had to troubleshoot a single ground problem,” Beck recalls. “From Day One, the system has been completely silent. The first time the monitor mixer turned his speakers up, it was


so quiet he didn’t even think they were on!”

Optocore equipment list

The Optocore system installed for Viva Elvis comprises the following modules: 13 DD32E 32-port AES/EBU modules, each accommodating 64 audio channels; three DD2FE dual MADI/video/data network modules, each accommodating 128 I/O channels; two L4XAP stage modules, each accommodating 48 XLR analog mic inputs, with remote-controllable mic preamps; three YG2 16 I/O modules for Yamaha mini-YGDAI slots.

These first 21 modules are fiber network devices, each bearing an individual ID on the Optocore ring

network. The following converter modules provide analog-to-digital and digital-to-analog conversion via D-sub 25 ports on the DD32E modules.

Also in the system are three X6P-16IN input modules, each accommodating 16 analog input channels with mic preamps and up to 96kHz/24-bit analog-to-digital conversion; eight X6-16OUT output modules, each accommodating 16 output channels with up to 96kHz/24-bit digital to analog conversion; three X6P-8/8 I/O modules, each accommodating eight analog input channels with mic preamps and eight analog output channels with up to 96kHz/24-bit A/D and D/A conversion; and YS2 16 I/O module for Yamaha mini-YGDAI slots. 

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