The Optocore Option

By: Alan Hardiman

A major audio upgrade at General Motors Place rides on an Optocore fiber-optic digital network

The Vancouver Canucks of the National Hockey League recently completed a major renovation of the audio system in their arena, General Motors Place, just in time for the start of the 2008-09 NHL season. The entire system, input to output from the new Soundcraft Vi6 console to the L-Acoustics loudspeaker line arrays, is connected and managed via a dual redundant Optocore fiber optic digital audio network.

The Optocore installation in Vancouver comes hard on the heels of the spectacular deployment of a similar Optocore network in the Bird's Nest Stadium at the Beijing Olympics in August. In response to an increase in

business and the associated technical support demands, the company is ramping up its world-wide operations, and recently expanded its North American office in Toronto.

"Optocore is the key to everything we're trying to do here—it was a very important choice for us," says Fred Michael, president of Rocky Mountain Production Services (RMPS), who installed the new $1.7-million sound system, which features improvements to the main loudspeakers, intercom, and wireless and sound system infrastructures at General Motors Place.

The Optocore system is comprised of a number of individual rack-mount modules connected in a 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. The total run at GM Place is about 1,500'.

The L-Acoustics LA8 loudspeaker DSP controllers feature network remote control capability. An Optocore

Top left: The Soundcraft Vi6 console in one of its mixing positions. A portable, triple-wide rack was built for it and its ancillary racks to use in any of three locations. Left: Upgrades to the center-hung scoreboard include the addition of six L-Acoustics' ARCS loudspeakers to improve on-ice coverage.

DD6NE distribution switch, with six fast Ethernet ports (100/10 Mbps) integrated into the fiber-optic network, is used for that purpose. "So Optocore plays two key roles: It brings in all the inputs to the system via the digital fiber-optic network, and it enables all of our system control as well, because the DD6NE switch takes the 100m (328') limit of an Ethernet network and extends it to 1,500' in our case," Michael says.

Optocore modules are distributed in four areas throughout the building. The system handles audio inputs as well as conversion from analog to digital where necessary, then routes these signals to the Soundcraft Vi6 console connected to the network via an Optocore DD2FE optical MADI unit for processing. Optocore carries the console's digital outputs to the appropriate locations, and the audio gets reconverted back to analog before the power amplifiers.

The main performance sound system consists of six line arrays suspended over the ice, with 360° coverage from seats behind the glass to the Level 500 suites. The design allows an audio technician to vary sound levels according to the particular needs of the building. Geometrically centered between each line array are two separate subwoofer arrays, each consisting of eight SB28s. Upgrades to the center-hung scoreboard include the addition of six ARCS speakers to improve on-ice coverage. The entire system is driven by 23 LA8 amplifiers.

Via Optocore, all audio on the network is available everywhere in the facility. Canucks Sports & Entertainment's chief audio technician, John Riley, who designed the new sound system, elaborates: "The fiber ring goes about 200° around Level Zero, which is the bottom floor of the building. Then it goes up one of the telephone rooms' risers and

rings around the other side of the rink on the 500 Level, and then up to the 600 Level, where the clock and amplifiers are. It then comes back down and goes the other way in the tray on Level 500, comes down a different telephone room riser, and hooks back up to the beginning.

"So it goes through all of these areas, such as the telephone room on Level Zero, where I have audio for concourses, gates, offices, and emergency paging, and other rooms on other levels, and it also passes through the central patch bay, where the stage rack is for the Vi6 console. All of these areas have all the audio passing through them, so, theoretically, 512 channels of audio are available at every location where there is an Optocore interface box."

For example, AES/EBU digital audio for the concourse area loudspeakers is routed from Optocore DD32E interfaces directly into BSS Blu-16 loudspeaker DSPs, and then analog into the existing amplifiers. Similarly, Lectrosonics wireless mics up on the 600 Level feed into the network via Optocore X6P analog input interfaces.

No latency issues

From the beginning of the design phase in January 2008, Riley knew he wanted to implement a digital audio network, and considered CobraNet and EtherSound, together with the different infrastructures and various snakes that go along with them. An inherent limitation of non-dedicated digital audio networks that must be addressed, however, is latency, particularly in live performance situations. For example, one leading manufacturer's published specification for minimum latency on a non-dedicated network is 1.67ms, but it is typically longer than that.

"When we started talking about the distances we had to go, we were getting into milliseconds of latency. Then I went to InfoComm in June and saw Optocore, and the light went on for me, because not only did it do every-

Above: Optocore gear. Right: Optocore fitted into the console rack at GM Place. On the following page: The Optocore system device layout.

thing on fiber, on a single pair, but it offered us latency way down in the microseconds," Riley says.

Integration of Optocore fiber optic networks into live performance systems is assured by a very low overall latency of 41.6μs between any points in the synchronous network, regardless of complexity, allowing for use in stage and in-ear monitor applications. In fact, on opening night at GM Place on October 9, the singer-guitarist Tom Cochrane performed on the ice using in-ear monitors, with no discernable latency. "Latency through the system is completely non-existent," says Michael. "The issue doesn't come up."

"Now you're talking about a world that I prefer to live in. I'm an analog guy, but analog's time is over. I don't want to say that I'm pioneering any new technology here—we in North America are so far behind Europe in the digital realm of things, it's not funny. In North America nobody seems to want to grasp the fact that optical is the way to go, and digital rides in the passenger seat of that truck," Riley says.

Choice of mix positions

When there is no hockey on the ice, GM Place becomes an entertainment venue, hosting an average of 100 non-NHL events each year. Since opening in September 1995, it has attracted some of the biggest names in show business, and has welcomed more

than 17 million visitors through its doors. So it was important for the new audio system design to incorporate sufficient flexibility to accommodate a variety of functions.

A portable, triple-wide rack case was built for the Soundcraft Vi6 console and its ancillary racks to enable it to be used in any of three locations: the game location on the 300 Level, a floor location for concerts, and an office location on the Zero Level for work being done away from the events themselves, such as daytime programming.

"We accomplished that with the Optocore setup, and I think it's quite amazing," Michael recalls. Three fiber connection points are available for the console, one at each location. The console can be wheeled from the audio room, into the elevator, and up to the 300-Level wheelchair deck, where some 10' of space has been allocated for the console.

"Behind it is an interconnect bulkhead with optical jumper cables. The operator removes these and introduces his cables instead, and that puts him on the network. When it's time to move the console, the operator simply disconnects and re-attaches the jumpers, and the ring is closed again. There's a similar panel in the office, so when the console is wheeled back down, you simply hook it up there. In every location, the operator has Internet access as well as access

to all the equipment he needs in order to get the job done—the L-Acoustics control system for the amplifiers, the Optocore software, the Riedel intercom software, the software interface for the Lectrosonics wireless mics, and so on," he adds.

"So from the mix position, the operator can look at his Optocore network, he can look at the Vi6 console, his wireless microphones up on the 600 Level, and the Riedel intercom system software, and execute commands on that software via the Optocore network. This is a big, unique plus for the Optocore installation. And it's all off-the-shelf components—we did not have to build anything custom."

Although not included in the GM Place installation, Optocore also accommodates DMX and Ethernet lighting consoles as well as digital video equipment. It also handles MIDI and control data, such as RS422 and RS485. Other signals may be transmitted via Ethernet using converter boxes—for example, intercom, USB,

and RS232. This allows for total signal integration on one fiber, eliminating the requirement to run additional cabling.

Optocore components

An Optocore deployment consists of a PC running Optocore control software and a minimum of two network devices. Larger configurations may include multiple audio I/O devices, AD/DA converter boxes with or without integrated microphone preamplifiers and splitters, and repeater modules. Inclusion of a second redundant optical fiber ring in an installation assures fail-safe operation.

Like the Soundcraft Vi6 console, Studer, DiGiCo, and Yamaha digital consoles can be readily incorporated into Optocore networks. This gives GM Place the ability to add one of these to the network at the request of a visiting client, either as part of the sound reinforcement or outside broadcast system.

"In addition to the mainstay DD32E 32-port AES/EBU device (for transport

of 64 audio channels) and the DD4FE, Optocore offers the DD4ME electrical MADI device (for transport of 256 audio channels), so all the prime pro formats are addressed. A number of recent live broadcast events have featured Neumann's new Solution-D digital microphones connected directly into Optocore networks, allowing signal transport and remote control via the fiber over long distances with pristine quality," says Bill Coons, newly appointed director for Optocore North America.

"By the end of 2008, Optocore will release a firmware upgrade, increasing the number of pieces of Optocore equipment that can run on a single ring from eight to 24," he adds.

For GM Place, this means that "in a few months, we'll be integrating all the digital and Ethernet equipment onto one ring. Currently we're using two," Michael notes.

A complement of three converter modules is also available. The X6 line of 2RU devices encompasses the X6P-16IN, featuring 16 analog mic/line

inputs; the X6P-8/8 featuring eight analog inputs and eight analog outputs; and the X6-16OUT providing 16 analog outputs. "A unique and truly useful feature is that via the software's local settings any input in an X6-16IN or X6-8/8 can be switched to an output, resulting in expanded flexibility on the job when you need it—all you need are XLR gender changers," Coons notes.

Supported sample rates are 44.1, 48, 88.2, and 96 kHz with 24-bit resolution. "The preamp design was developed with a 'best-that-it-can-be' mindset, and recently created a clamor when it came first against the top industry icons in a blind listening test held by a broadcaster in France. Inputs are adjustable in the analog domain in true 1dB steps, unlike other digital preamps on the market. For complete system fault-tolerance, all six Optocore network devices feature two optical links and dual power supplies. They can switch over in a very fast two samples in the event of power failure or signal loss. Each unit also has word clock in and out; if word clock somehow gets lost, it will default to the next device in the network in two samples as well," Coons says.

"As an alternative to the DD32E/X6 configuration, Optocore offers a larger 'all-in-one-unit' LX4AP 48-in/16-out 6RU audio stage box that affords some savings due to its packaging, but it has all the same features and top-notch circuitry. Like the X boxes, all inputs are available as A and B post-preamp analog output splits on DB-25 connectors. To connect an analog console or other device on the network, the companion LX4B provides 48 analog output channels and 16 analog returns on 24-pin connectors," he explains.

All inputs and outputs are balanced. Maximum analog input/output level is +18 dBu. Note that this conforms to the European EBU standard, which specifies operating level (0VU) at -18 dbFS. So an analog audio input to the Optocore system at the North American SMPTE standard, which sets

0VU at -20 dBFS, is capable of clipping the system by up to 2dB. Users should take care to limit such analog signals accordingly.

Rounding out the Optocore product line are the single rack-space DD6NE Ethernet distribution switch, providing redundant high-speed data transport, and DD8RP repeater/single-multimode protocol-independent converter. The latter features four user-configurable optical I/O ports for linking, amplifying, or adapting single-mode to multimode fiber in Optocore and other manufacturers' networks.

Cooperation

"This is one of the first examples of a new regime where manufacturers can no longer drop responsibility for their equipment at the end of the connector. All the work we're doing these days—not just in this venue but in all our installations—involves cross-platform compatibility between different manufacturers' products, and they have to

nals from other manufacturers' equipment. I'm seeing more and more of that, because everybody knows it's a networked audio world these days, and you can't just say, 'I'm sorry, this doesn't work interfacing with that other piece of equipment, we don't make an interface, so you're on your own.' All the manufacturers on this job had to step up to the plate to make sure that RMPS and GM Place were well supported on hardware and software compatibility issues."

A case in point is the choice of console. The Digidesign Profile was initially in the running, but, says Michael. Digidesign "hadn't worked out anything in terms of compatibility with inputs coming from other sources. Theirs was a closed world at the time that we looked at it. They didn't have a fiber interface card or an AES3 interface to the Profile. I understand Digidesign is addressing that now, but they lost the opportunity because they didn't have what we needed to inter-

> **"Optocore plays two key roles: It brings in all the inputs to the system via the digital fiber-optic network, and it enables all of our system control as well, because the DD6NE switch takes the 100m (328') limit of an Ethernet network and extends it to 1,500' in our case."**

take responsibility for it. There's nobody else to do that. This job was really interesting in that regard," Michael says.

"In dealing with the Soundcraft console interface to the Optocore MADI card, we had to get people from Optocore talking to people from Soundcraft at a very high level about compatibility issues," he adds. "We also had similar issue with BSS Blu-16 DSPs interfaced with Optocore; the manufacturers had to work together to ensure compatibility between all these signals moving around the system. Soundcraft and Yamaha are two very good examples where they're making cards that allow them to bring in sig-

face with Optocore."

Adds Riley, "There was an amazing amount of cooperation and dedication by all of the parties involved—the outside electricians, RMPS, John Morrison from Westnet Communications who installed the fiber and terminated it for us within the spec required by Optocore, and our own engineering department—in pulling it off at a speed you don't normally see in an installation of this complexity. I hadn't even seen Optocore before the middle of June, but by September 23, the whole installation was about 95 percent completed, which is just amazing. And it sounds amazing, too." ▨