Optical circuit switching for video content creation and broadcast

White Paper

HUBER+SUHNER

Serving a world of digital media

The global appetite for access to existing and new media content is one of the biggest drivers for technical innovation in the market today. The worldwide availability of ultra-high speed and reliable connectivity to the internet combined with storage and retrieval systems has created a growing need for flexibility in the creation, editing, distribution and broadcasting of content.

While traditional broadcast infrastructure was well suited for a limited and well-defined delivery system, today's users in a multi-media world expect instant availability across any network type and terminating on a wide variety of platforms. Consumption is no longer limited to television screens as consumers access content across mobile devices such as phones, tablets and laptops.

Meeting evolving standards

In parallel with the expansion of consumption has been the expansion of video formats – the progression from SD (Standard Definition) video formats to the 4K, 8K, HD, HDR, and 32K formats continues to drive the need for more bandwidth and the ability to broadcast in multiple formats simultaneously.

Serial Digital Interface (SDI) enables the transmission of uncompressed standard video, and more recently some HD formats, together with audio and metadata in a single stream over coaxial cable. However, SDI comes with limited bandwidth, which represents challenges for the higher definition standards, and is expensive to scale.

Today's broadcast infrastructure must support the need for real time production, playout and professional media applications with enhanced efficiency with the industry moving toward IP-based workflows, cloud-native operations, and virtualized environments.

Evolving standards

SMPTE ST2110

In response to these rapid changes in the broadcasting landscape the industry has been forced to develop new standards with a major transition under way from the well-established Serial Digital Interface (SDI) to the Internet Protocol (IP)-based SMPTE ST 2110, which first appeared in 2017.

Since traditional SDI over coaxial cable has limited bandwidth – making it harder to support higher-definition formats and costly to scale – many broadcasters are moving to IP-based workflows over fiber, avoiding the bandwidth constraints of coax.

The move towards broadcasting systems based on the SMPTE ST 2110 standard means that media and broadcast streams look more like IT platforms, creating the ability to have more flexible and scalable work flows.

Emergence of fiber optic connectivity

The fiber optic physical layer

In the area of the physical layer of the network, gone are the days of coax RF circuits. Today's content creation and delivery networks are all fiber optic-based to support the speed and bandwidth requirements needed to keep pace with the consumer's appetite for new data. Fiber optic also enables transmission over a much greater distance than coax with much lower cross talk and signal distortion.

Most notably, the content delivery and broadcast market has moved in the direction of more standard optical circuit types, using commercial off-the-shelf fiber optic transceivers, transport equipment and other network components. What used to be several different data streams – video, audio, meta-data – based on unique transport methods can now be treated in a uniform manner. This leads to optimization of network bandwidth and simplifies data and media management, which ultimately leads to operational savings and efficiencies.

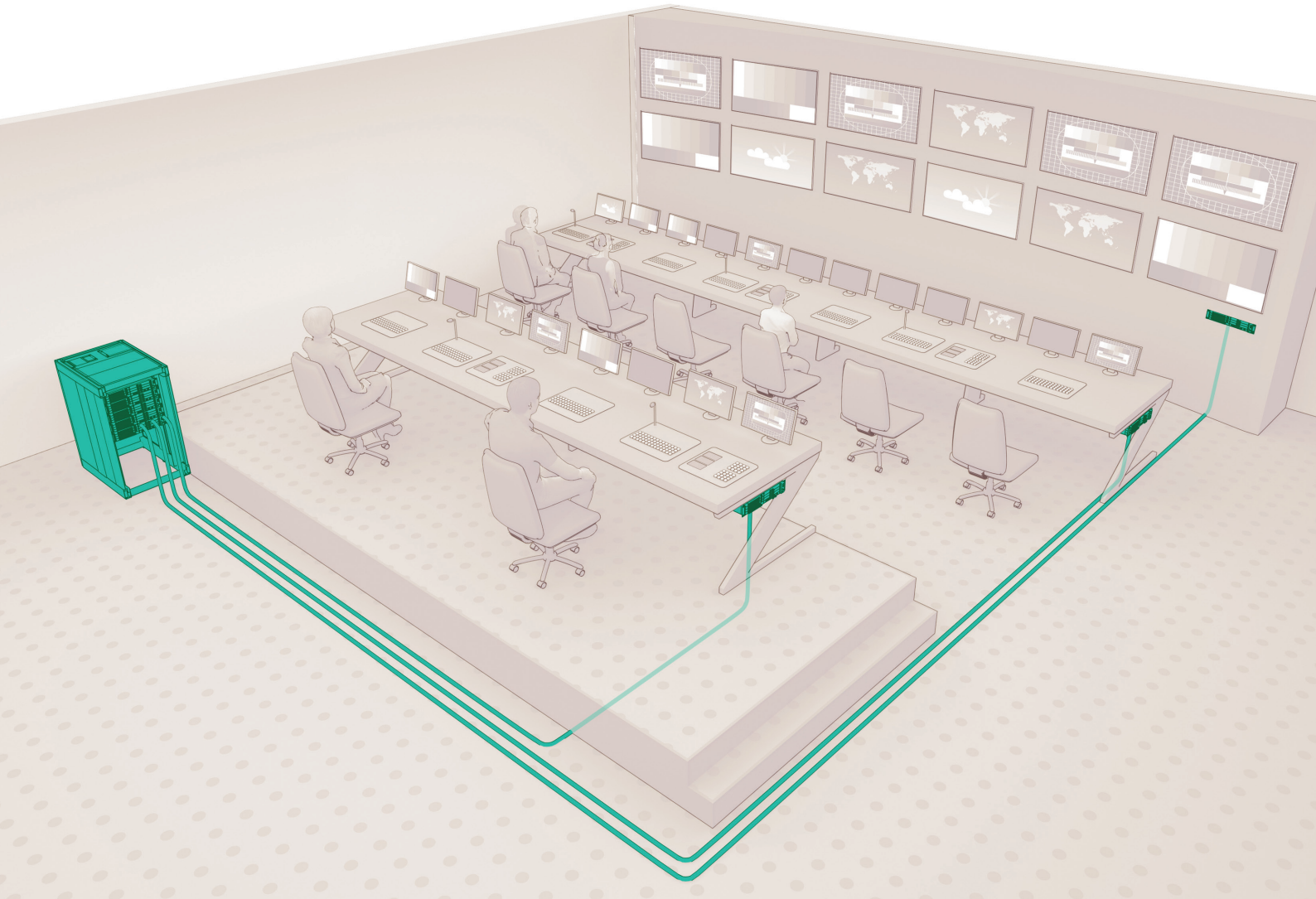
Benefits

Optical circuit switching

With the transformation to deploying standard optical transmission equipment, the use of agnostic, physical layer all-optical circuit switching allows the creation of an even more flexible and efficient architecture.

Eliminating manual patching from the network saves manpower, time and money, reduces the risk of human error and avoids impairment of the optical signal by repetitive connections. Optical circuit switches (OCS) are protocol and data rate agnostic so they are future-proofed against any new format changes.

The use of all-optical circuit switching allows producers to leverage and maximize the value of their production assets and cabling infrastructure. Content creators can now share equipment such as multi-format cameras, compression equipment, en/decoders and have access to transmission equipment as and when needed using optical circuit switching. A provider no longer has to maintain a one-to-one ratio of equipment to a particular broadcast event or content creator. Instead these resources can be managed more efficiently resulting in faster content creation, at a lower cost and in various formats, available across any viewing platform.



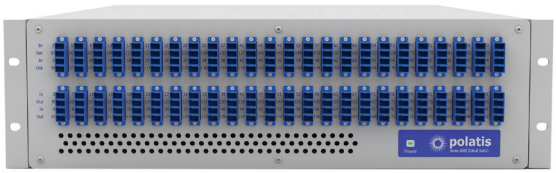
Benefits

Integration

POLATIS® OCS can be fully integrated in software-defined networks and are supplied with a number of application protocol interfaces, enabling them to be integrated with leading broadcast operating systems. A number of leading systems already have POLATIS driver support.

Optical circuit switching therefore allows for an efficient and cost effective way to manage the layer 1 physical fiber infrastructure.

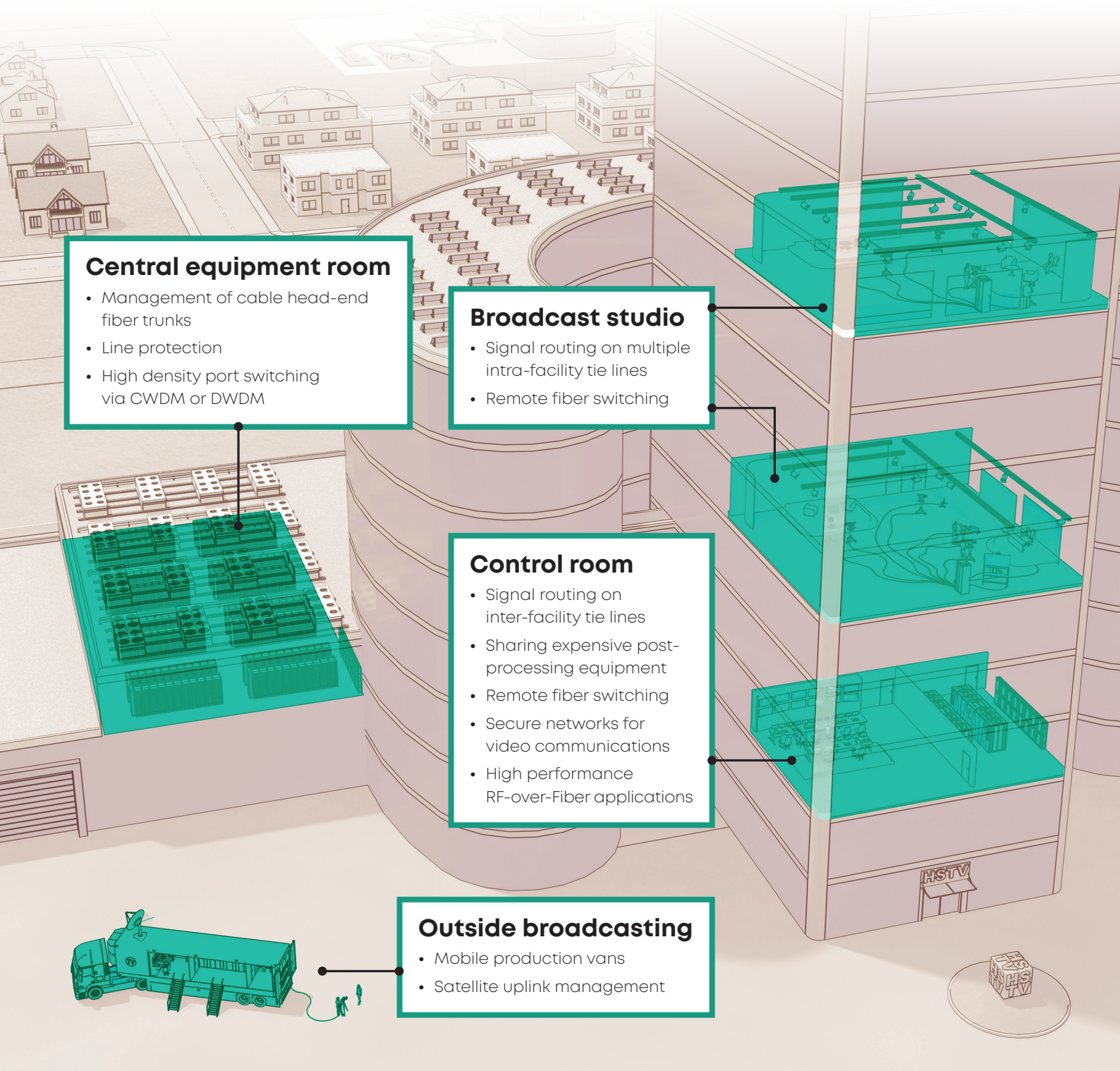
Integrated optical power meters (OPMs) can be used to provide real time signal monitoring to alert the user of any signal degradation or signal loss. From an operational perspective, troubleshooting time is greatly reduced since this fiber infrastructure is being monitored centrally out to the endpoints, thus leaving only one end point to worry about. All these advantages mean much less manpower is required to manage multi-venue locations or events, resulting in lower operational costs.



POLATIS® 96x96 Optical Circuit Switch

Overview

POLATIS® OCS support a wide variety of applications in the broadcast sector.



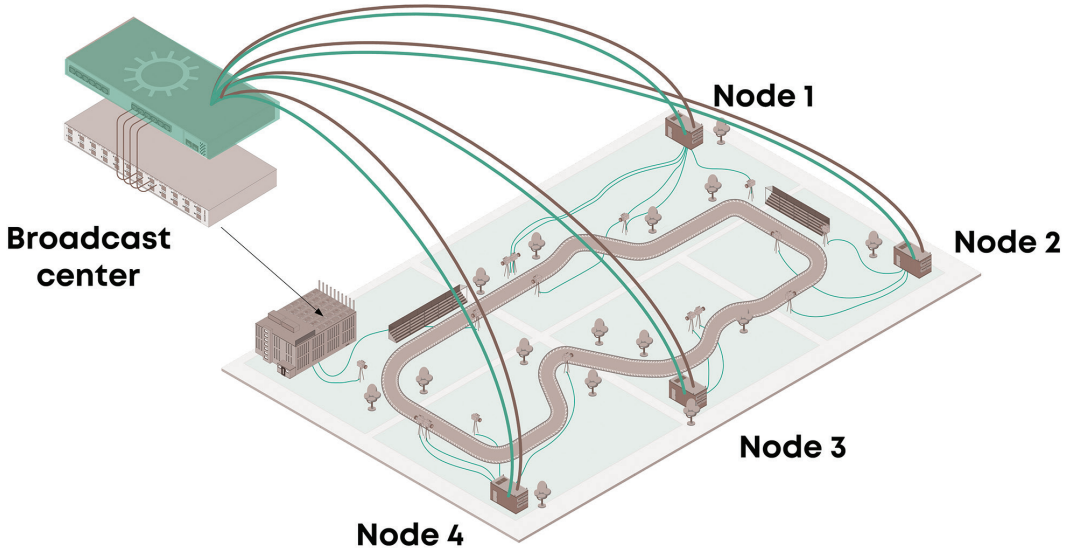
Live sports broadcasting

Broadcasting large-scale sports events such as motor racing and golf requires the installation of a redundant fiber backbone around the venue.

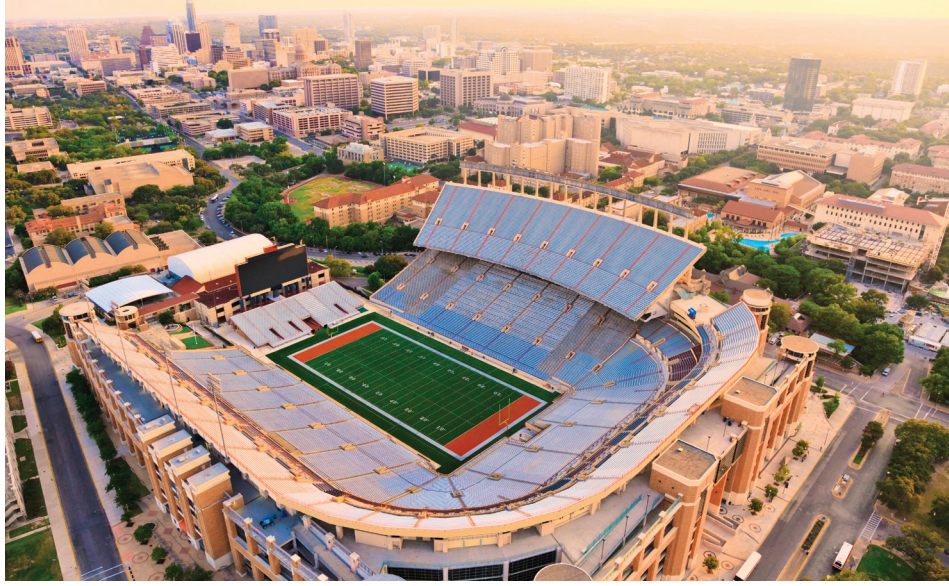
For motor racing it has to support complex live-timing obligations, on-board camera video, audio and data capture and multiple pieces of specialist equipment dotted around the circuit. This backbone has several connection points or nodes located around each part of the circuit, which collect all the video, audio and timing data from that sector and send it in both directions around the circuit, back to the broadcast center in the paddock.

Using traditional outside broadcasting (OB) trucks with cameras spurred from them using dedicated point-to-point optical or copper cables is not practical. Deploying optical circuit switching enables multiple inputs that are not all required simultaneously, to be aggregated and selected for broadcast according to the production need.

Optical circuit switching allows two diverse, protected fiber routes with automated provisioning for all of the critical systems, significantly reducing the complexity of managing this fiber infrastructure. Furthermore the use of optical power meters and variable optical attenuation through the switch allows the production team to equalize the signal strength coming from the remote devices into the broadcast production center.



Outside broadcasting: Redundant fiber paths from nodes to broadcast center managed by OCS.

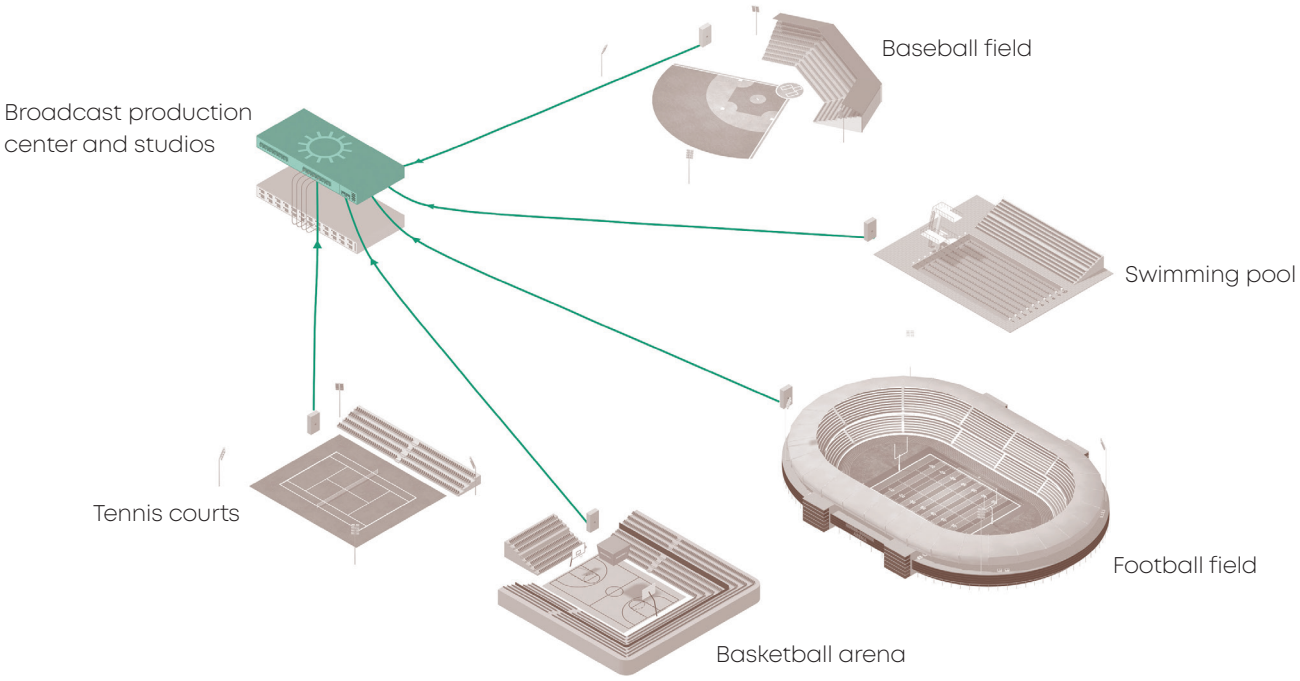


College sports broadcasting

The broadcasting of NCAA college sports in the USA is big business. Leading universities have invested millions of dollars to create a broadcasting infrastructure across their campuses, which may span entire cities, to capture the live action from the various sporting venues. The broadcast production process is also often used as a training ground for students studying media courses.

It would be prohibitively expensive to install full broadcast production capability at each venue and would incur a lot of underutilization of equipment as sports are not all broadcast simultaneously. Therefore, the universities are increasingly investing in systems built on the SMPTE ST-2110 standard, featuring central production facilities with a fiber rich network infrastructure out to the individual sporting locations to bring in the video, audio and data feeds, perhaps with a limited number of small remote equipment rooms in support. Useful additional functions include the transmission of replays to stadium screens and video playback support for coaches as part of a coaching system.

The same principles can also be applied to other multi-sport venues such as Olympic Parks where the production facilities can be centralized with a fully reconfigurable, software-controlled fiber layer featuring optical circuit switching, collecting and routing the feeds from the remote locations.



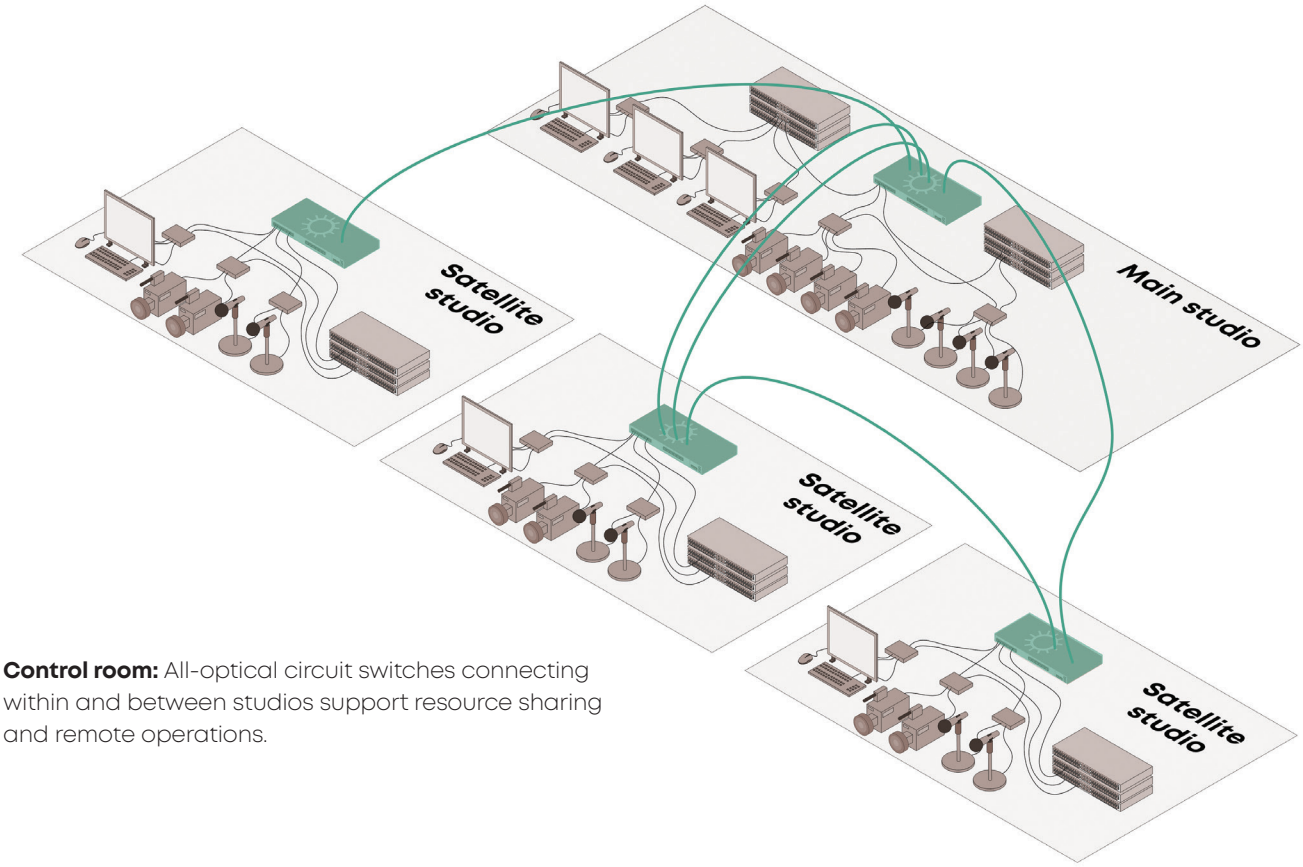
College sports broadcasting: OCS managing connections to sporting arenas and within studios.

Virtual extension of production studios

Many production facilities need to expand their capacity in order to meet growing customer demand for content. A lot of existing production studios are located in expensive cities such as New York, Los Angeles, Chicago, London and Tokyo where adding more space for expansion is cost prohibitive. Expanding the production facility using a satellite studio in a less expensive area, connected to the center with tie lines, is financially more viable. Some broadcasters also maintain permanent remote studios, for example at locations of national importance, so they can broadcast speeches and press conferences.

By front-ending the main production and satellite studios with OCS, operators can extend their production facilities at a lower cost. For the users, the satellite studios are just a virtual extension of the main studio.

One further added benefit of using OCS is the option to protect the tie line to the main studio with automated fiber protection switching so valuable production time and resources are not wasted while repairing a fiber break between sites.



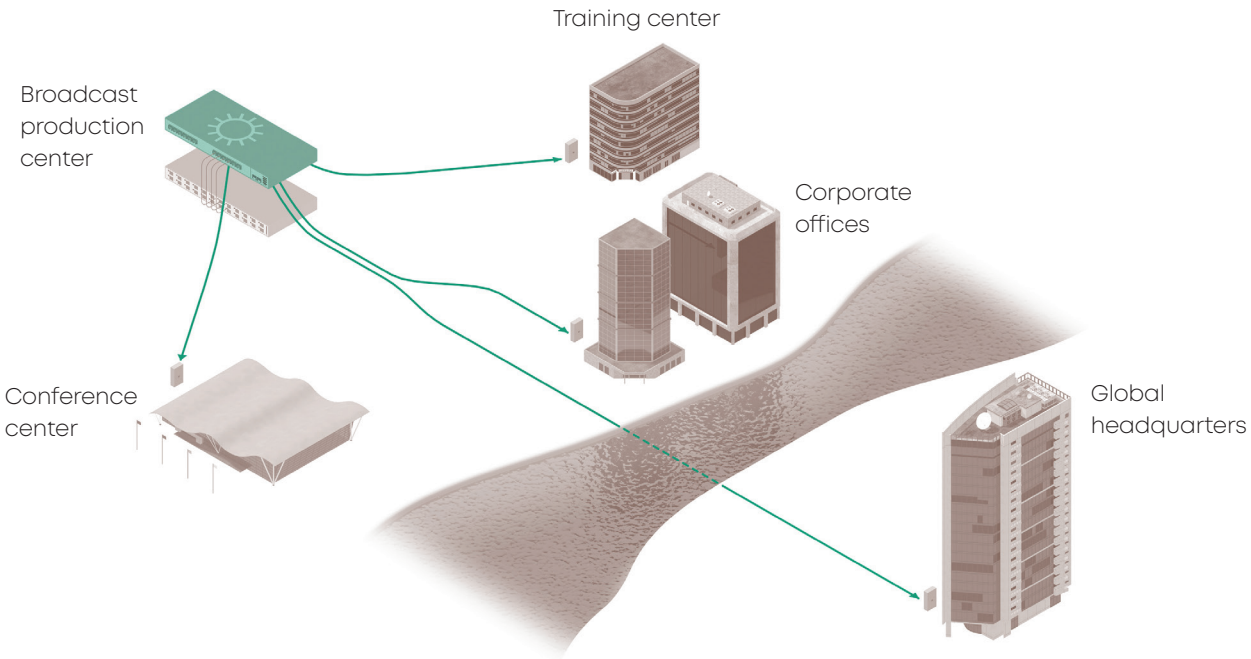
Control room: All-optical circuit switches connecting within and between studios support resource sharing and remote operations.

Corporate campus broadcasting

Many corporates have invested in an in-house broadcasting network to connect buildings across their campus, and indeed potentially across multiple campuses in different parts of the world. This enables them to do targeted broadcasts, for example, to an individual group in a satellite meeting room, or address all employees in a virtual Town Hall. Many have extended this capability beyond their internal needs to include broadcasting to customer events such as exhibitions and conferences.

Fiber has become the de facto standard for networking in multi-building campus environments. In most cases, bandwidth requirements for these applications already exceed the capabilities of copper/coax cabling so broadcast applications for corporate campus environments are being built following the SMPTE ST-2110 standards.

In these types of applications, low latency, flexibility and scalability without the need to add infrastructure, are all essential for the efficient management of infrastructure supporting these ever evolving broadcast applications. The infrastructure must utilize technology that facilitates remote production with centralized control and be available quickly on demand.



Campus broadcasting: International fiber optic network connecting business locations through OCS.

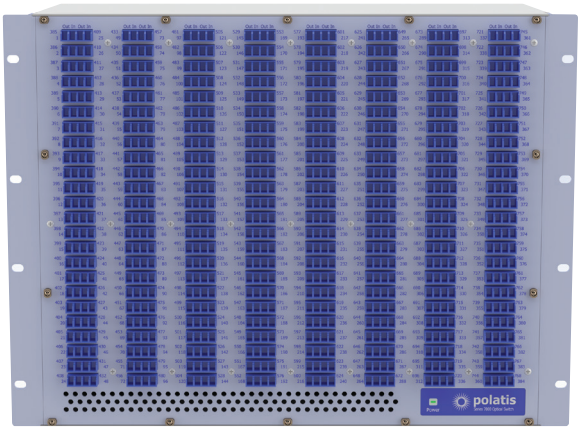
Advantages

Optical circuit switching

Layer 1 optical circuit switch

There are significant advantages to using POLATIS® optical circuit switching in the broadcast space:

- Protocol and data rate agnostic so future proofed against format changes.
- Supports all video and audio formats: AES signals, SMPTE ST 2110, SMPTE-276M, SMPTE-259M, 292M, ASI/DVB, NTSC, PAL, QAM.
- Supports single, mixed and multiwavelength formats – TDM, CWDM and DWDM.
- Ultra-low insertion loss and superior optical specifications.
- Near-zero signal latency – essential for live transmissions.
- Dark fiber switching allows setting up and holding of switch paths in advance of the transmission of optical traffic.
- Fully supports bi-directional optics.
- Software-controlled – seamless interface with today's broadcast infrastructure and production systems.
- Optional optical power meters offer real time signal monitoring to alert for degradation or loss of signal.
- Optional variable optical attenuation allows the signal coming out of the switch to be attenuated – receive levels into the studio or receiving devices are the same, irrespective of the source.
- Optional protection switching function for rapid deployment of redundant fiber backbone.
- Eco-friendly, low power consumption.
- Available in symmetric N×N and custom configurable NxCC port configurations.
- Matrix sizes from 16×16 to 384×384 ports.



POLATIS® 384x384 Optical Circuit Switch

POLATIS® 32x32 Optical Circuit Switch

The HUBER+SUHNER advantage

HUBER+SUHNER has pioneered the use of optical circuit switching in modern broadcast production systems. Our broadcast experts can provide advice and guidance on the best way to integrate optical circuit switches into broadcast production networks.

HUBER+SUHNER offers a broad range of products for broadcast applications, such as fiber cables, patch cords, fiber management, structured cabling solutions, POLATIS optical circuit switches, transceivers, WDM components, GNSS and Power-over-fiber and more.

Worldwide sales and support are available to make sure broadcast systems continue to operate day in and day out.

HUBER+SUHNER
POLATIS® optical circuit switches
Americas: +1 781 275 5080
EMEA/Rest of World: +44 (0)1223 424200
info.polatis@hubersuhner.com
polatis.com
hubersuhner.com

4014/4743/11.2025