NEP UK selects Arista as foundation for SMPTE ST 2110 modular OB trucks to deliver UHD content from world's largest events

Highlights

Challenge

To deliver outside broadcasting capabilities including UHD for the largest events, NEP UK turned to Arista as the foundational network technology for a new generation of modular IP capable OB trucks.

Arista Solutions

- Arista 7500 Series Switches on OB vehicles
- Arista 7280 Series Switches within Wimbledon Broadcast centre
- Arista EOS®

Results

- Scalable bandwidth able to support up to 2000 UHD streams
- Offering a maximum latency of 3.5usec and efficient 25W per 100GbE port
- IP 'block/truck linking' delivers enhanced resiliency between each element
- Fast and responsive technical support with a credible long-term product roadmap

NEP UK are an innovator in the world of broadcast services with expertise in managing large scale events. With increased demand for UHD content, NEP UK turned to Arista for the performance and latency critical networking layer for its state of the art 'Venus' and 'Ceres' IP-capable outside broadcast trucks that made their successful debut at this years' Wimbledon Tennis finals.

Project Background

Broadcasters are under pressure to deliver high value content in UHD, particularly large-scale live events. The use of traditional SDI based workflows inflicts technical limitation which has led many to seek more flexible IP-based approaches.

NEP UK, one of the world's largest outsourced technical production partners, has been at the forefront of this progression. From being host broadcaster for The Royal Wedding in 2011 to providing HD fly-packs in Kazakhstan for the Asian Games, NEP UK engineering experts and technical crew are a regular fixture at high profile events including its fleet of 17 cutting-edge OBs and flypack systems dispatched from operations in 21 countries around the globe.

Challenge

For NEP UK, it is often the case that no two events are the same and the move to IP delivers the scalability and flexibility needed to deliver the largest projects. For its latest addition to its fleet, NEP UK decided to create two new IP-capable outside broadcast trucks, Venus and Ceres that will be used at major events, sports fixtures and other large-scale productions.

Venus and Ceres are two 38-ton, 16.5-meter, double extender trucks with the capability to deliver simultaneous feeds from 32 UHD cameras and space for 35 on-board production staff. The use of an IP backbone in OB vehicles for signal interconnectivity and routing is not new. But using the interoperability enabled by the newly ratified suite of standards for SMPTE ST 2110 (-20, -30, -40) is unique and make Venus and Ceres truly state of the art trucks. The design also marks a ground-breaking step change in their underlying technology.

NEP UK has pioneered the 'building-block' approach to OB events. In the past, production capabilities were essentially limited to the size of a single truck and its original design capacity. With IP offered, NEP UK could more easily link equipment silos such as trucks, flyaways and local broadcast centers and make them effectively one homogenous system .

The first challenge for NEP UK was to create a system with enough bandwidth to accommodate multiple uncompressed UHD channels with available expansion (including multiple truck linking) to easily cover the largest conceivable event. The only logical way to achieve this is with an IP backbone based on SMPTE ST 2110. Only an IP infrastructure can potentially provide total visibility of all signals between all equipment silos.

The second challenge was to devise a modular hardware platform where each module could be easily configured to perform an alternative task. The final challenge was to implement a control and monitoring system that recognised such system changes with respect to network addressing and module function for simpler re-configuration of operator interfaces.

Solution

At the core of the new OB truck design is the need for huge amounts of bandwidth. As NEP UK director of engineering and technology Rob Newton explains, "We looked at a number of possible solutions and Arista offered us the only completely lossless architecture which delivered the best performance, lowest latency with deep support for multicast which is vital for this project."

The Arista 7500 Series selected for project is a store-and-forward switch that utilizes a virtual output queue architecture, which provides deterministic low latency with no head of line blocking. Latency is predictable as packet sizes increase from a low of 3.5usec (port to port) for 64 bytes to under 9usec for jumbo frames.

This lossless and deterministic capability is vital for video and is delivered through a store and forward architecture that reduced the serialization delay between forwarding engines and fabrics by utilizing a cell-based switch fabric where packets/frames are sliced into cells and are transmitted in parallel across multiple fabric modules simultaneously.

The huge data bandwidth provided by the Arista Commercial-off-the-shelf (COTS) network switches with fibre I/O meant the concept of 'anything to anywhere' in terms of signal connectivity was now possible. The switching in each truck has a data throughput of up to 28.8Tbps – equivalent to well over 2000 UHD streams with all associated audio and data. In practice such interconnections are limited to what is necessary but embedding this hardware capability ensured unparalleled flexibility and scalability. Production capabilities are no longer restricted or centred around the resources of a single truck.

At the heart of the IP switching infrastructure in each truck is an Arista 7504R, 7RU chassis with capacity for up to four 36 x 100G = 7.2Tbps linecards to form a high density, low power non-blocking Ethernet switch. Fully configured, it delivers up to 28.8Tbps switching capacity with a flexible arrangement of 25/40/100GbE interfaces. Offering a maximum latency of 3.5usec and efficient 25W per 100GbE port, the Arista switches provide ample data throughput and data linking capacity to realise NEP UK's 'single virtual truck concept'.

The Arista powered IP network is also the perfect foundation for NEP UK to extend this building block or 'modular' concept to the individual equipment components. NEP UK has deployed multiple IQUCPs (Unified Computer Processors) from Grass Valley. These devices can be re-configured/software programmed to perform alternative tasks. Equally important for NEP UK's concept was system device control and configuration. The Grass Valley IP routing control system works by communicating with and instructing 'edge devices' to call or cast data (video, audio or data) via the IP switch(es) to other devices on the system. Just like the internet, system devices and processors perceive no boundaries with respect to the switch locations working solely on set/configured source and/or destination IP addresses. In short, increasing truck and/or flyaway count is analogous to adding server capacity on an internet network.

Arista IP switches coupled with Grass Valley's redundant (autonomous) IP system routing controllers can be set to provide main and back-up data trunks on an as required basis. In Venus and Ceres not only has the redundancy hardware overhead been reduced by using duplicate line cards in their modular switch frames but NEP UK's IP 'block/truck linking' approach provides the potential to support and/or spread redundancy schemes across multiple trucks. It's worth noting

that a duplicated IP line card provides redundancy for all data types, video, audio, and data (including control data) further reducing and standardizing hardware components compared to traditional topologies. The data redundancy mechanism employed for audio and video data is as per SMPTE ST 2022-7.

Gloucestershire County Cricket Club in Bristol

Conclusion

Both trucks have been put through their respective paces at several high-profile events. The inaugural deployment for Venus was at a high-profile Wedding in Windsor in May. However, July 2018 witnessed the first combined deployment with both trucks linked via the IP flyaway system to form the world's largest SMPTE 2110 OB installation in support of broadcasters at the Wimbledon Tennis Championships.

NEP UK is contracted to handle the technical facilities within the Broadcast Centre for Wimbledon Broadcast Services (WBS), the in-house production company. NEP UK installed a distributed routing system, connected by main and back-up MTP fibre optic cable, to serve on and off-site domestic and international broadcasters.

The WBS set-up within the Broadcast Centre is run from a huge Master Control Room (MCR) operation based around two core 7508 Arista switches and additional Arista 7280 switches. "The Arista switches in the OB trucks, the flyaway and MCR form the largest IP system that we have ever built for an OB," says Newton. "Although, we're not completely IP yet as the mixers are IP in and out, the multi-viewers are too so we probably could do it all in IP but we are using existing kit that needs to be used elsewhere."

Venus and Ceres mark a new direction for OB vehicles with NEP UK helping to define a new methodology from which others across the industry will benefit. "Arista has been a fundamental element in helping to successfully deliver the vision of our 'building block' approach based on IP that has the potential to eventually allow trucks from different suppliers to work seamlessly together for the benefit of event organisers and broadcasters," says Newton.

Santa Clara—Corporate Headquarters
5453 Great America Parkway,
Santa Clara, CA 95054

Phone: +1-408-547-5500
Fax: +1-408-538-8920
Email: info@arista.com

Ireland—International Headquarters
3130 Atlantic Avenue
Westpark Business Campus
Shannon, Co. Clare
Ireland

Vancouver—R&D Office
9200 Glenlyon Pkwy, Unit 300
Burnaby, British Columbia
Canada V5J 5J8

San Francisco—R&D and Sales Office 1390
Market Street, Suite 800
San Francisco, CA 94102

India—R&D Office
Global Tech Park, Tower A & B, 11th Floor
Marathahalli Outer Ring Road
Devarabeesanahalli Village, Varthur Hobli
Bangalore, India 560103

Singapore—APAC Administrative Office
9 Temasek Boulevard
#29-01, Suntec Tower Two
Singapore 038989

Nashua—R&D Office
10 Tara Boulevard
Nashua, NH 03062