Case Study
NEP Australia’s Andrews Hubs

CONTINENT-WIDE IP REMOTE PRODUCTION
Lawo Case Study: Continent-Wide IP Remote Production NEP Australia's Andrews Hubs

In early 2018, NEP Australia ushered in a new era for live sports broadcasting when its all-new IP-based remote production setup came online. NEP's new Andrews Hubs in Sydney and Melbourne—the first of their kind in Australia and the most technically advanced facilities on this scale in the world—enable multiple concurrent outside broadcasts via IP.

Driving Forces

The consumption model of broadcast is changing. People want everything anywhere, all the time. To keep pace with this trend and allow Fox Sports Australia and other stations to produce ever more high-quality content with their most talented people, NEP Australia suggested breaking away from the limitations of siloed operations. “Take Perth: you fly there one day, you work one day, you catch the red-eye home—you’re out for three days,” explains Todd Procter, Head of Innovations and OB Special Events, Fox Sports Australia.

Australia has a mass the size of America, with most people living on the East and West Coasts. After analyzing how and why...

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Lawo Material involved in this Project:

**IP Core Infrastructure**
- 44x V__matrix systems for CI, streaming and MVs
- Over 180x C100 processing blades
- “UEFA AV Stagebox concept”: A__mic 8/A__digital 8 (12 units in all)
- 12x V__remote 4 for AV sync measurement

**Control**
- 6x new VSM systems
- 7x upgrades

**Audio**
- 6x mc96 consoles
- 4x mc56 consoles
- 7x mc56 console upgrades
- 4x crystal broadcast consoles (backup mixers)

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NEP is Australia’s largest and most experienced outside broadcast and studio facilities company. It provides broadcast infrastructure for major sport and studio productions both across the country and internationally. NEP facilitates more than 2,000 hours of Australian broadcast television each year, including live sport (NRL, AFL, Cricket, MotoGP, Australian Formula 1 Grand Prix), popular series and drama (My Kitchen Rules, The Voice, Family Feud, The Chase, Australian Ninja Warrior) as well as live entertainment and event programs (Dancing with the Stars, The Footy Show and the annual Logie awards).

—Marc Segar, NEP Australia’s Director of Technology

“...we were looking for a flexible and virtualized environment based on IP that would be agile enough for all our sporting codes, scalable for any size project, and integrate well with audio and communications.”

40 signals take a mere 27ms to travel from an iOB in Perth to NEP Australia’s Sydney Hub (the two locations are more than 4000km apart).

IP Remote Productions Across Australia and Beyond

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In addition to a Network Operation Center (NOC), four control and audio rooms, the Andrews Hub in Sydney features a number of multi-function rooms, including two small studio spaces for commentary applications in the future (at the moment, commentary is still contributed on-site). There are plans to use augmented reality to turn some spaces into a virtual arena for in-house commentary. To this effect, two 30m² rooms are equipped with a lighting grid, DMX, etc.

The other four multi-function rooms (two each for seven or four persons) can be allocated to CCU, overflow EVS, graphics, or other functions as needed.

where NEP Australia used its freelancers, the company proposed a novel approach. The “Anyone, Anywhere” philosophy of the new Andrews Hub facilities in Sydney and Melbourne means that while the traditional outside broadcast workflow involving commentators, camera operators and everything viewers see out in the field still takes place on location, the production team works out of a facility several hundred or even several thousand kilometers away from the venue.

This is the future of TV production. There is absolutely no reason why any broadcast cannot be covered like this from now on. It’s easy for everyone, the broadcast is not compromised and it is a lot more efficient.”

—Aaron Brownlow, OB Director, Fox Sports Australia

Two Hubs, One Giant System

In a mere 14 months, NEP Australia built and equipped two hubs, in Sydney and Melbourne, four “iOB” trucks and seven hybrid setups. Telstra Broadcast Services rolled out fiber-optic network connections to the 29 venues selected by NEP Australia. Some of these venues are connected at 50Gbps (gigabit per second) and operate without compression, while others rely on 10Gbps and VC-2 compression.

Telstra’s Distributed Production Network (DPN) enters the Andrews Hub CAR via a 320Gbps connection. There are also connections to NEP’s dark fibre network and Optus, allowing access to other venues outside the DPN.

Thanks to the distributed IP production flow, production teams (like the EVS team) can now consist of operators scattered over several cities and work together like they were in the same room.

Philipp Lawo, CEO of Lawo in Germany, commented: “IP is capable of delivering this distributed workflow. Bringing the Andrews Hub project to life was a groundbreaking change for all parties involved and the industry at large.”

Marc Segar of NEP Australia concurs: “When we started this project, the IP technology we decided to use was not ratified, was not real and was not available on the market. This project has encouraged the broadcast industry to try and beat the status quo and move forward.”

“Building At the Speed of Light
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NEP Australia’s Andrews Hubs

**VSM Studio and vsmSOUl — Unified orchestration, control and monitoring system**

**VENUE**

**Production Galleries 1-3**

**Audio Mixer**

**Audio Processing**

**iO8**

**Total: 29 venues nationwide**

**Network Red**

**Network Blue**

**TELCO WAN**

Redundant

**30x 1080i (SMPTE 2110)**

**16x 1080i (SMPTE 2110)**

Bandwidth:
- Metro venues @ 50Gbps (uncompressed)
- Regional venues @ 10Gbps (VC-2)
- Hub interlink @ 10Gbps permanent, scalable up to 300Gbps when needed

**De-Encapsulation**

**WAN Gateway**

**Compression**

**ID + SDI multiviewer**

**Routing**

**Audio shuffling**

**Network analytics**

**Network Red**

**Network Blue**

**30x 1080i (SMPTE 2110)**

**16x 1080i (SMPTE 2110)**

**AV Delay Measurement**

**Audio Stageboxes**

**Backup Audio Mixer**

**V__remote 4**

**A__mic 8**

**A__digital 8**

**V__matrix**

**mc 256 MkII**

**Nova 73**

**CAR Resource Pool**

**VSM Studio and vsmSOUl — Unified orchestration, control and monitoring system**

**AV delay management**

**Total: 29 venues nationwide**

**PRODUCTION HUBS**

SYDNEY + MELBOURNE
User Experience

Special attention was devoted to providing a uniform, familiar user experience for all operators involved. With uncompressed SMPTE ST 2110 data, some operators reckon, the HD picture quality is even better than before the switch to IP. In addition, the network is fully redundant, fully resilient and fully monitored for guaranteed uptime.

The first trial event at ANZ Stadium in Sydney on October 21st, 2017, managed to conjure up that familiar live feel: "Commentary, talkback, EVS—all worked as if we were at the OB," commented Angus Millar, Head of Production at NEP Australia even though the production team was at the Sydney Andrews hub...

OB Trucks

While broadcasters and OB facilities in other parts of the world are switching to compact IP-equipped vans where possible, NEP Australia decided to use slightly downsized OB trucks. Sprinter vans were deemed too compact for the "Anyone, Anywhere" approach, which dictates a maximum amount of flexibility.

The new “iOB” trucks (intelligent and IP) are 13m long and no longer expand like the previous generation, because there is no need for that. They are equipped with totally different gear than previous OB trucks. Optical cables are used to send video around the venue, and the six main optical lines coming in from Telstra deliver all of the video, audio and control data between a venue and the hubs. Plus, the hubs basically have complete remote control of the trucks no matter where they are stationed.

Conferencing in Perfect Harmony

To ensure that all crew members are on the same page, NEP Australia has developed a proprietary video-conferencing system and installed video cameras all around the hubs and in all trucks. The camera operators at the venues stay in the loop as well and can follow video conferences on their return screens. A “Meeting” key has been configured to "put the director’s camera on basically every screen", ensuring that all hands in every location can be part of the meeting.

Audio Control and Monitoring

While all audio streams are transported from the venue back to a hub for mixing and processing, the signals that the commentators hear are generated directly at the venue to avoid even the slightest time lag.

The Lawo mc² 96 console in the OB truck can be remotely controlled from the location that acts as audio MCR, even if it is several thousand kilometers away. A screen next to the audio MCR console furthermore shows the positions of the faders in the OB truck on location.

Conversely, when the audio engineer at the hub moves a fader on his mc² 96 console in Sydney, the faders on the console in the OB truck also move.

The Road Ahead

What will be NEP Australia’s next move? In early March 2018, following the successful launch of the Andrews Hub project, Marc Segar already had an idea: “We would like to run trials from Los Angeles and Tokyo, and Asia Pacific as a general region makes sense. If we can start sharing our resources and people internationally... Wow, think of what could be achieved!”

In late April 2018, NEP Australia and Telstra Broadcast Services announced that they had delivered the world’s first remote production across the Pacific. It involved 30 HD camera feeds in Los Angeles that were linked via diverse and hitless 10Gbps circuits on the Telstra Distributed Production Network (DPN), with the production taking place in Sydney.

An Award of Excellence that was much appreciated by the entire Lawo team.
Let’s Talk Features

Given the project’s scope, the Lawo team designed a system around its V__matrix software-defined IP-routing & processing platform. V__matrix frames are rack units that can be loaded with C100 FPGA-based processing blades, which are then populated with the required virtual modules (software). All blades were fitted with the requested inputs and outputs, plus options for embedding/de-embedding.

Thanks to Lawo’s innovative licensing model, virtual modules can be either assigned to a fixed core processing blade or stored in an on-site license server on a repurpose-as-you-go basis for unprecedented flexibility.

MADI to Ravenna/AES67 conversion is handled by 8x $A_{\text{madi4}}$ stageboxes for up to 32 MADI streams.

Other devices used in this setup are Sony XVS8000 production switchers, EVS replay systems and an Arista leaf-spine switching infrastructure.

Lawo’s VSM broadcast control and monitoring system serves as an overarching orchestration and control solution providing a common, streamlined user interface for all operators. The multiviewer configuration is supplied by “theWALL” multi-viewer control systems for easy drag & drop mosaic configuration using tablet computers.

The stagebox approach used at the 29 venues in Australia was inspired by Lawo’s successful deployment at the European Soccer Championship in France (UEFA 2016) where the international broadcast center (IBC) in Paris was able to monitor and receive the signals from all stadiums via IP, and to control every detail of the production remotely.

Lawo further decided to keep using its existing primary production devices, so appropriate conversion units were needed. Lawo suggested a mix of appropriately configured C100 processing blades inside V__matrix frames (SDI to IP, plus audio de-embedding) and $A_{\text{mic8}}$ as well as $A_{\text{digital8}}$ stageboxes (both audio) at the venues, and V__matrix frames plus C100 blades at the hubs in Melbourne and Sydney.

NEP uses Lawo mc²96 audio consoles in six control rooms, and mc²56 audio consoles in the IP-based OB trucks.

• Connected, centralized production centers in Sydney and Melbourne
• 29 connected venues
• 7 centralized production control rooms
• 4 new connected IP OB intelligent production outside broadcast vehicles
• 4 new fully-equipped grip trucks
• 7 upgraded trucks with hybrid IP layer
• 50 gigabit-per-second fully redundant network
• 100% IP

“We now have a consistent crew, because we don’t travel people as much. Sure, it’s great to have the cost savings and the benefits that come with that, but it’s even better to have a more efficient environment.”

—Marc Segar, NEP Australia’s Director of Technology
Here are a few of the features requested by NEP Australia for the Andrews Hub project:

- Supported formats: SMPTE ST-2110 supporting VSF-TR03704 uncompressed with separate essences for video, AES67 audio, metadata and time code;
- All system interfaces supporting TR-03/SCTE-2110 allow for free audio/video re-mapping of any audio input signal to any video stream—in any combination;
- Ability to operate with various compressed formats: Lawo proposed the J2K and SMPTE2042 VC-2 contribution-quality encoding solutions developed in-house;
- Ability to combine the systems in such a way that 1x large, 4x small, 2x medium or 1x large + 1x small system(s) can be configured and operated independently.

- Operation as a single large system at 720p, 1080i, 1080p, at 24, 25, 50 and 60 fps, and integer derivatives, with a capacity equivalent to 1024 inputs and 2560 outputs at 3Gbps;
- Possibility to break the overall system up into 4 fully functional, free-standing systems with the equivalent of 256 inputs (192 of which supporting c6-embedding) and 640 outputs (512 of which support embedded audio, 10 multiviewer ports, 32 PIPs per port), plus ability to input and output 8 MADI streams independent of video;
- At least four broadcast router control systems in a redundant configuration, with the possibility to split them up into smaller systems and redundant operation for automatic fail-over, support of tallys and tally dependencies. A total of six VSM systems were installed, and seven existing ones were upgraded;
- All components proposed in the solution must be capable of handling 16 audio channels. Audio is streamed as RavensbusAES67, true to the TR-03 recommended practice.