THE BROADCAST BRIDGE

Super Bowl 15—A Technological Feat of Super Proportions

Brad Dick, Editor

What broadcast engineer, video or audio technician or camera person hasn't wanted to work the Super Bowl? Being part of the broadcast team for the most high-profile event in U.S. television is considered by many to be a career-crowning achievement. For those who do work the Super Bowl, it may be just another weekend football game—albeit one with an intensity that is off the chart!

However, what most of us don't fully understand is that these crew members collectively spend thousands of hours, long days and nights of hard work to install and connect the mountains of technology that is required to produce America's premiere sports broadcast. If that's not enough pressure, Super Bowl XLIX was also aired in 128 countries in 25 languages.

The Broadcast Bridge took on the challenge to pull back the curtain on this massive technology feat to provide some deserved visibility to a few of the dedicated people who help make the Super Bowl broadcasts possible. We also wanted to highlight some of the technology used to produce this international broadcast event.

What follows in this **Special Report** is an inside look at the dozens of trucks, a hundred channels of still-store and instant replay, remote editing and production systems, 4K cameras, 200 X 100, nine M/E production switchers, massive audio consoles, more than a hundred channels of intercom, and thousands of other pieces of gear— all needed to create this year's 110-million viewers sports extravaganza. Want to peak behind the Super Bowl technology curtain? Read on.

Brad Dick
Editor

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Behind the Scenes at Super Bowl XLIX

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Capturing The Big Game With The Latest Gear

By Michael Grotticelli

With preparations well under way and a week before the big game, a team of 70 NEP system engineers, tech managers and other specialists descend upon Phoenix, AZ to help create one super-television experience for more than 110 million viewers.

NEP Broadasting, the Pittsburgh, Penn.-based mobile production company, is handling coverage of the game, pregame, halftime, NFL world feed, NFL domestic news organizations and a number of shoulder programs originating in Phoenix that have already started this past Saturday. It's a herculean task, but one the company feels confident about, according to Glen Levine, co-president of NEP's US Mobile Unit group.

A Calrec Apollo console in NEP's ND1 will handle key audio duties for the game.

The main game coverage will be handled with two of NEP's latest 3 Gbps all-fiber HD production trucks, "ND1" and "ND4." ND1, one of the largest HD production trucks in the world, is NEP's newest 53-foot double-expandable production control room on wheels. Used this year for NBC's Sunday Night Football games, it typically caries 17 Sony 2500 HD cameras, a large (192 inputs and 96 outputs) Grass Valley Kayenne Elite (with nine M/Es) production switcher, numerous EVS XT3 servers and a Calrec Apollo digital audio mixing console. It also includes seating for more than 75 operating positions and a completely 1080p-capable infrastructure.

The second Game Truck, "ND4," is the company's "Double Eagle" truck, which has recently been upgraded with a full 3Gbps infrastructure and other new amenities. This truck is used primarily for NBC's golf coverage.

Another 23 trucks, set up in small "systems" outside University of Phoenix Stadium, will join these three large trucks. Basically there are 13 different systems on site for a variety of clients (NBC, Telemundo, ESPN International, etc.) that consist of three trucks— "A", "B" and "C"—to a system) within the large production compound. All are tied together with SMPTE hybrid fiber cabling, so that the three trucks of each system act as one. Six systems will be tied together for NBC and its many properties (e.g., Telemundo) alone.

NEP's Denali Group's "California" and Summit" trucks, will handle the halftime show (starring Katy Perry).

"This is by far our biggest event of the year in the U.S.," said Levine, who added that NEP Broadcast produces hundreds of live games each year for a variety of sports outlets, both national and regional. "The toughest challenge is logistics and making it all work in harmony."

Sony HD and 4K Cameras

In total, NEP will use 26 production units and some 60 cameras for the main game and its related events. The Sony HDC-2500 cameras will be complemented with five Sony F55 4K cameras (for slo-mo replays and to support "public viewing" areas around the stadium).

The Sony HDC-2500 system camera is the successor to the HDC-1500R Series (many of which will be used to cover activities outside of the big game, such as DirecTV's Beach Ball studio show and live game coverage). The HDC-2500 incorporates Sony's advanced technologies for studio cameras, such as a newly developed 2/3-inch CCD and new DSPs along with 16 bit A/D conversion that Sony said provides amazing picture quality with low noise and high dynamic range.

The HDC-2500 also provides the capability for transmitting directly from the camera via its side panel that can be easily replaced to fit HD Wireless (3rd Party) or Triax transmission systems. The camera is 3G compatible and has multi-format acquisition capability, from 1080/100i (double speed) to 1080/50P, as well as a wide range of other formats including 1080/50i, 1080/25P and 1080/24P.

"We love these cameras and what they bring to the production," Levine said. "This is a no-compromise show, so we're using the best cameras we can find."

"There will a lot more 4K cameras used this year," Levine said. "We'll also have several 4K Imovix Robo cameras mounted on the near side of the right and left end zones to give viewer a unique POV when goals are scored."

Interior of NEP's ND-1 truck, which relies on a 192 X 96, 9ME Grass Valley Kayenne production switcher.

This includes the five Sony F55 4K cameras—which will be used to shoot the action at a high frame rate and then slow it down for replay analysis—as well as the I-Movix "RoboCam" X10 ultra slow motion system (which is based on the Vision Research Phantom camera). At the Super Bowl, several high-speed X10 cameras will be controlled from a single X10 CCU inside ND1.

Game Creek Video

Of course NEP is not the only remote production services company involved this year. Hudson, N.H.-based Game Creek Video will send five of its newest trucks to work with ESPN."Victory" and "Justice" will be stationed in Scottsdale, AZ to produce a variety of Super Bowl-related events leading up to the game and "Freedom" will be located at the stadium. Between the five trucks, there will be a total of 21 Sony HDC-1500 HD cameras in use.

For the NFL Network, Game Creek is supplying its "Pride" truck for the NFL Pro Bowl draft, then media day and then the stadium, containing 15 Sony HDC-2500 HD cameras.

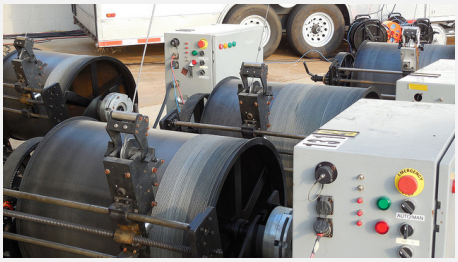
Game Creek's "Glory," "Patriot'" and "FOX" trucks will be parked outside the local convention center, complete with ten 2500 cameras and ten 1500s, to cover Super Bowl activities.

Other Camera Systems

Other camera systems used at the game include the "SkyCam" overhead camera system that is suspended above the action and provides viewers with a captivating view of all of the action.

The camera is suspended by two high-strength cables that create an x and y axis, which allows the camera to move anywhere across the field. A series of winches and pulleys loosens and tightens the cables, creating not only the movement around the field, but the camera height as well, giving the camera operator the option to zoom down onto the field for close-ups and other views.

Interestingly, the SkyCam camera operators are required by the National Football League to stay behind the action and at least 12 feet above ground level so as to not impede play.



Skycam control reels shown being used at Kyle Field for a Texas A&M versus Alabama football game. Image courtesy Flicker, Petersengl.

We're sure NBC has a few surprises to be revealed on Sunday, February 1st. Major sporting events like the Super Bowl have always been a good proving ground for production companies and their equipment alike. With so much at stake, it's not a place to test new gear, but that never stopped a TV network from trying something new each year. This year's contest between the New England Patriots and the Seattle Seahawks should be no different.

NEP Carries Super Bowl Responsibility Over The Line

By Adrian Pennington

There are select sports which attract an audience far beyond that of the immediate game or fan base. The Super Bowl is one such event. And all things being equal, it is on track to exceed last year's record 111.5 million viewers to become the most viewed telecast not only of 2015 but of all time in the US.

It's an event that dominates the US TV schedule and dwarfs rival events like the FIFA World Cup domestically. Super Bowl XLIX will also be aired in 128 countries in 25 languages, racking up further eyeballs, even if the event overseas does not rate on a par with a World Cup or Olympic Games. All in, it's a lot of responsibility for NBC and NEP, the host producer and host outside broadcaster respectively, of this year's pictures.

"The Super Bowl has become more of an event outside of what happens on the field because it's a time when family and friends get together," says Mike Werteen, co-president of NEP's US mobile division. "In the business, everybody compares their production to the scale of the Super Bowl because it is the most watched event in the US."

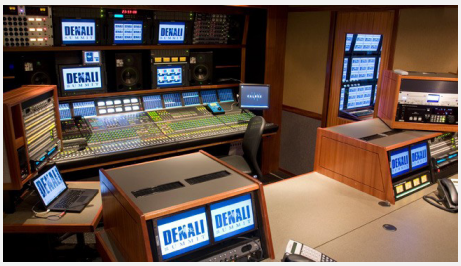
NEP may send more resources to other events but no event entails quite the amount of pressure as the Super Bowl.

It will have 27 trailers at the University of Phoenix Stadium in Glendale, Arizona by the end of next week, servicing domestic clients NBC, CBS (which hosts in 2016 with NEP as partner), DirecTV and ESPN as well providing the host feed direct for NFL Films which will transmit the pictures to international rights holders. NEP will have 70 engineers, drivers and specialist technical managers on-site.

All the domestic and world camera feeds for the pre-/ match and post-match will be fed into a central distribution hub (NEP's ESU truck) and made available for any broadcaster in the compound to access.

One key discussion is around slo-motion coverage. NBC, says Werteen, is seeking greater clarity in replays. "There are two ways that can be done; one is by increasing the frame rate and there are a significant number of HFR cameras at the game. The second is to use 4K UHD and integrate that into the 1080i feed.

Mike Werteen, co-president of NEP's US mobile division.



NEP has multiple trucks on site to support the Super Bowl, including the Denali: Summit. Shown here is the truck's audio suite with a Calrec Apollo mixer.

"Since every play is so important anything that enables the camera operator to stay wider so as to not miss any potential action, and then to have that available as a replay option, is important," he explains.

"The sheer technical requirement, the logistics, the number of credential led staff has grown significantly over the past decade. The domestic game coverage, the world feed and the half time show – each is an individual production and all have grown in size and scale."

NEP parked its first truck at the venue on January 12. It is providing a range of services for the shoulder programming for a number of content aggregators through the week leading up to the game weekend.

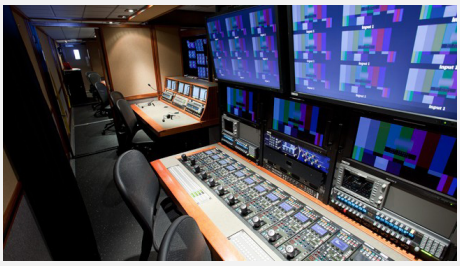
Planning has understandably been in the works for some time.

"It was not coincidental that we built NBC a new truck [ND1] for NBC's Sunday Night Football coverage in the year that they are in charge of the host feed for the Super Bowl," says Werteen. "We knew this was going to be an enormous year for them. Discussions about the level of Super Bowl coverage began two years ago."

NEP's new flagship ND1 was on the road last summer and is planned to take the lead in Super Bowl coverage for 2016 (CBS host) and 2017 (Fox host). It is actually designed as four interconnecting trailers which can be configured according to a client's requirement. Its HD infrastructure is connected to a Grass Valley Kayenne 9 ME mixer, Calrec Artemis and Apollo audio consoles and 100 channels of EVS recording on XT3s.

If anything says the event is not about pure sport it's the half-time extravaganza where coverage turns from sports to live pop concert. NEP is in charge of output for this too. Advertisers are expected to pay $4 million for a 30-second commercial in the slots leading up to the half-time break.

It's an exceptionally busy period for the company. This week it is in Aspen covering the Winter X Games for ESPN and it will send a further complement of trucks to Scottsdale Arizona for CBS coverage of the Phoenix Open PGA tournament, which runs simultaneously with the football game.



Camera control in NEP's Denali: California. The truck will assist with the half time show starring Katy Perry.

EVS Dominates Live Action Servers at the Super Bowl

By Frank Beacham

More than 90 percent of the world's TV mobile trucks use EVS technology for recording live action, quick replays and high-speed super motion camera coverage. This is true for the upcoming Super Bowl as well.

Both NBC and international broadcasters will use EVS XT3 six and eight-channel broadcast servers with associated EVS control and networking gear. Even EVS doesn't know how many of it servers will be at the Super Bowl in Phoenix this year, but the 2014 Super Bowl had more than 85 units in action, the company said.

Though Avid's MediaCentral Platform technology is dominating NBC's Super Bowl coverage this year for its radical new workflow concept, EVS said its technology is a major content contributor to the Avid network. "We use many of the different SDKs and APIs from Avid in our solutions," said James Stellpflug, EVS's vice president of sports. "We've been a significant partner of Avid's for many years in terms of how we integrate our components, facilitate content flow and metadata flow as well as the types of media sent over to them."

EVS, Stellpflug said, specializes in the fast recording of game content and repurposing it to the various NBC personnel via the Avid network. "In a nutshell, there are two broad workflows that take place at the Super Bowl," he continued. "One of them is the live game production. That's the very rapid turnaround record and playback functionality. EVS is the majority component of that live ecosystem.

"Then you have the editorial layer — the Avid editing — where some of that live content moves over for quick or longer term editing. Our speciality is the rapid production of the game itself and allowing NBC to use those assets in the editorial layer."

On game day in Phoenix, EVS's gear will manage all of the camera acquisition and move that footage, in XDcam format with metadata, quickly to the Avid backbone for use by others in editing suites throughout the production system.

James Stellpflug is EVS's Vice President of Product Marketing.

Two EVS XT3 servers will be on site to handle playing back fill and graphics, as well as live video.

"NBC is also using two of our XT3 servers as spot boxes," Spellpflug added. "The technical director will use those servers as a resource for playing back fill and key elements, graphics, sponsored elements and other video into the live show."

EVS's XT3 server is a non-stop networkable recording device that works from ingest to playout. It can be configured for eight channel SD/HD, six channel 3D/1080p or three channel 4K. It is used for live editing, slow motion replays, multi-channel playback, multimedia distribution integration and transfer to NBC's other systems such as craft editors, automation, archiving or storage. It can handle any format.

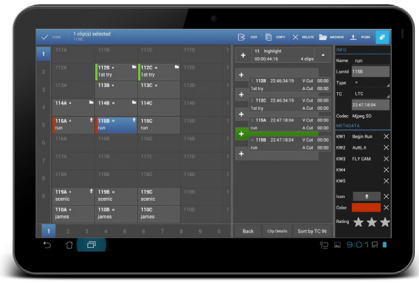
The server has 20TB of storage space and can record 381 hours of HD video. It has two 10Gb Ethernet connections and uses 3G-SDI networking. It records in HD and lo-res at the same time, so users can browse or prepare highlights in lo-res and download the finished package in HD. That requires the use of metadata.

"The ability to manage metadata and content requires that we have a user surface that allows operators to manage and tag the content and highlight pieces," Stellpflug said. "LSM Remote is the controller itself. LSM Connect is an adjacent panel that gives users more functionality. It will be used by 21 operators at the Super Bowl location."

LSM Connect is a tablet-based panel for clips and playlist management. Directly connected to LSM Remote and the server, LSM Connect gives the user instant access and control of all clips and playlists created during live production. It allows clip indexing, searching, dragging and dropping in a playlist.

Another key EVS technology being used at the Super Bowl is IPDirector, an integrated suite of video production management applications. It allows ingest control, metadata management, on-the-fly editing and playout scheduling — all managed from a single interface.

Running on a Windows-based workstation, IPDirector allows all network personnel to instantly share content, edits and metadata. The software suite integrates with Avid's system, allowing transfer of media to post-production tools or archiving.



The LSM Connect tablet-based solution for clips and playlist management. Directly connected to LSM remote and the XT Live production server, LSM Connect gives operators instant access and control of all clips and playlists created during a live broadcast.

"NBC is using the IPDirector core to manage the content around the entire venue," Stellpflug said. "IPDirector gives them visibility into those live assets, as well as how to organize them, how to tag them with metadata and ultimately how to expedite them into Avid's editing. They have IPDirector at both Stamford and at the stadium site.

"IPDirector allows NBC's editors to look at the broadcast trucks and grab live assets from the game or the lead up to the game. They can move the content around and gets their hands on the video."

Finally, another key EVS component is XFile3, which is the the archive and restore gateway for the live production workflow. From a single, connected workstation, XFile3 allows NBC's personnel to find and restore archived content — transcoding it if necessary. It automatically backs the video up to disk on-the-fly throughout the production. Operators can monitor and manage all file transfers from a single interface.

IPDirector provides users an integrated suite of production applications. NBC will use it to manage on-site content.

"Essentially, XFile3 allows NBC's staff to manage and archive all the live assets from the game to Stamford while the game is still going on," Stellpflug said. "They can archive all the material to transportable media as well as to gateway devices which allow them to share it as needed."

Game Creek trucks and EVS equipment will be working the 2015 Super Bowl.

In addition to NBC, EVS servers, control and networking technology is installed in all NEP and Game Creek Video trucks and other smaller units being used at the Super Bowl. Stellpflug said EVS dominates the sports market because "it offers a consistently reliable platform that works week in and week out and performs to the users expectations.

"We call our servers the engine that never dies — a thing that you just can't stop. It's reliable, it's fast and it allows the production people to perform their jobs anywhere at anytime."

Avid Everywhere to Get a Big Workout from NBC at the Super Bowl

By Frank Beacham

At the last Olympics, NBC Sports began experimenting with Avid's MediaCentral Platform. The concept allowed the network's personnel to collaborate on projects without having to be on site.

In an effort to boost performance and lower the cost of transporting large numbers of staff to remote sites for major broadcasts, NBC Sports began experimenting with Avid's MediaCentral Platform. The goal was to enable the network's personnel to collaborate in real-time on a single project from wherever in the world an event might be located.

NBC liked the way the new technology worked and is now poised to launch a far more refined version of it at the Super Bowl on February 1. This is a high-profile showcase event for Avid Everywhere — Avid's vision of the future of how media is to be made — and a big cost saver for NBC, who can move far fewer people and less equipment to the Super Bowl site and gain more than 30 percent greater efficiency with the gear they already own.

In essence, Avid Everywhere is a concept that allows people in different locations to collaborate on the same project in real-time. Everyone — whether they edit video or audio or produce video segments — is connected through the Internet and the content is shared through the cloud. Avid's MediaCentral Platform is the range of gear and software that carries out the vision in the real world.

Leverage the technology

For a network like NBC, a producer of major sporting events throughout the world, much of their hardware and people can stay at "home base" at NBC Sports' headquarters in Stamford, Connecticut and still get work done. This results in huge cost savings and a major reduction in complex logistics for major sporting events.

For the Super Bowl, NBC has set up two remote production facilities in the Phoenix, Arizona area. One is at the University of Phoenix Stadium in Glendale, Arizona, where Super Bowl XLIX will be played. The other is Block 23, the name of a specially constructed media center 20 miles away in downtown Phoenix that will host a variety of NBC Sports Group programming during the week of the game.

The Block 23 media center — built due to space constraints at the stadium itself — will be the site of pre- and post game shows, as well as several NBC talk shows during the days before the game.

Ray Gilmartin, Avid's senior director of product and segment marketing for broadcast and media.

All of NBC's other facilities — including the network's extensive multi-petabyte media archive that holds several decades of sports content — remain at home at Stamford, more than 2,500 miles away from the Super Bowl site. Everything is connected and instantly accessible through Avid's technology.

Multiple studios and locations--one familiar interface

NBC has more than two dozen Avid Media Composer video editing systems spread over the three locations. Avid's Interplay|Production manages and coordinates content creation, automates workflow and allows contributors in the production team to collaborate. Tasks such as media movement, transcoding and proxy generation occur in the background. Producers, editors and assistants can simultaneously find, arrange, edit, review and annotate media while working on the same or different stories. Everyone has instant access to NBC's archives in Stamford.

Avid's ISIS system, installed at all three locations, provides the shared nearline storage capacity needed for real-time workflows regardless of workgroup size. Avid Pro Tools audio editing systems handle audio tasks and sweetening at both home base in Stamford and at the stadium.

Avid's AirSpeed system is being used for ingesting content and Avid's Interplay production and management technologies enable NBC to automate ingest, production and distribution processes. The entire system is connected via WAN acceleration technology.

"Being able to centralize that production hub and to connect people in this workflow from wherever they are means they can work together seamlessly like they are all in the same facility," said Dana Ruzicka, Avid's vice president of segment strategy and planning.

"They can do their core content creation in Stamford and still have people on-site in Phoenix who are close to the action. They can connect each link in the Super Bowl production chain with one underlying technology platform. We've talked a lot about our strategy in the past, but now we are seeing NBC really put it into action in a high-profile way."

Dana Ruzicka, Avid's vice president of segment strategy and planning.

Replicate and reuse = cost savings

After the Super Bowl, NBC has plans to replicate the technology to other sporting events, with boxing the next sport slated to use it. Then comes NASCAR, the National Hockey League, Formula 1 racing, the English Premier League and the 2016 Olympics.

"With Avid Everywhere, large-scale remote productions like the Super Bowl become location-free," said Jim Miles, director of digital workflow systems at NBC Sports Group. "We can now do production in real time by tying together multiple locations and people all over the map."

Jim Miles, director of digital workflow systems at NBC Sports Group.

"Using the Avid MediaCentral Platform, we are able to produce an incredibly large amount of content," added Darryl Jefferson, vice president of post and digital workflow at NBC Sports. "By allowing everyone to access archived media wherever they are, we are significantly expanding the capacity of our production."

By the 2016 Olympics, Ruzicka said Avid expects to widen the availability of the platform to a far larger base of users, including Avid's own competitors. The company has established a Connectivity Partner Program that makes available a tool kit to adapt non-Avid built equipment into the Avid MediaCentral Platform. The goal, he said, is to have anyone with even the smallest facility of any kind to be able to connect with others.

Darryl Jefferson, vice president of post and digital workflow at NBC Sports.

The platform, Ruzicka said, benefits any media user, not just large networks like NBC. "We support anyone from the individual artist to the largest media enterprises," he said. "An artist with only ProTools can do cloud collaboration with other users. A guy in one place can play guitar and one in another place can do the drum tracks to create music. We want anyone doing any kind of media to be able to work with anyone else."

A Good Intercom is Vital to Any Broadcast

By Kevin Hilton

Producing football is tough enough, but broadcasting Super Bowl XLIX moves the requirement for a good intercom to a whole new level. The solution needs to connect the broadcast technical and production teams not only with each other but also to the crews handling the live half-time show.

The main focus of NBC's host coverage is the outside broadcast area at the University of Phoenix Stadium in Glendale. This is also working in conjunction and parallel with the broadcaster's headquarters in Stamford, Connecticut and facilities set up in the Block 23 development of Downtown Phoenix.

Each has its own dedicated intercom system but all are interconnected to allow the different installations to communicate with each other. John Pastore, director of broadcast communications for all NBC Sports productions, including the Olympics, explains this is made possible by the use of IP networking based on RTS's RVON voice over IP (VoIP) technology.

Comms feeds between the stadium and Block 23 and from both locations back and forth to Stamford employ RVON VoIP signals carried over fibre connections provided by Level 3 Communications. The IT infrastructure specialist is supplying IP networking capability to NBC for communications in addition to the main video production, with what Pastore describes as "multiple services" including the broadcaster's own VPN (virtual private network). "As well as the main network intercom Level 3 is also providing the basis for telephone intercom and communications and the NBC intranet," he says.

The OB compound at the stadium, with 14 mobile units supplied by NEP Broadcasting, is connected for communications using four RTS ADAM modular matrix intercoms. and, says Pastore, allow all the individual systems "to behave as if they were one gigantic intercom".

According to Pastore the ADAM frames "vary in age and level of technology" and offering a differing number of ports, from 736 as the largest to 256 the smallest. These also interface with the in-house communications installation at the stadium, which is based on Riedel products. "We've got audio back and forth from that over fibre or copper," Pastore comments. This enables the broadcast teams to talk to the entertainment and live sound personnel working for ATK Audiotek, which is providing equipment for the half-time show. There is also a link between the entertainment crews and the production staff for the pre-game programme, who are based Downtown.

An RTS Trunkmaster acts as the hub for multiple intercoms for Super Bowl coverage. They are networked together using IP.

Trunkmaster is the basis of RTS' 'Intelligent Trunking' offering, which it describes as a "private version of the long distance telephone system." It enables up to 255 individual matrix intercom systems to interface with each other seamlessly and instantly, maintaining the existing presets, scroll lists and tallies of the local matrixes. Pastore explains that the truck intercoms are interfaced using a mixture of RTS TriBus (triple bus) and Dual-bus expander cards designed for the ADAM frames.

"Those are fibre-based," Pastore observes, "but Trunkmaster runs over IP. So we take the intercom from the trucks and then convert the feeds to IP and put it on a closed communications network. The majority of this is wired but there are some wireless units to and from the trucks for operators who are moving around." All wireless comms at the stadium are supplied by RF specialist BSI. These include seven party line systems with two ISDs for the game and four party lines, eight ISDs on the pre-game.

VoIP is now an established part of intercom installations, both in the studio and for major outside broadcasts such as the Super Bowl. Although networks for broadcasting predate IP, the growth and spread of the technology has played a major role in the expansion of networking for TV production. "This is my fourth Super Bowl and with each one the network and IP presence gets larger," Pastore says. "We rely on IP-based intercom more now and that's been made easier by systems like Trunkmaster. I would say that the amount of IP being used grows at least 20 percent every year."

Other systems enabling the further networking of IP include RTS' own OMNEO. This is based on standard Ethernet running Audinate's Dante IP-based media routing technology as the transport medium and OCA (Open Control Architecture) for control and monitoring. Pastore says NBC has been "playing around with OMNEO" but points out that most OB trucks in the US are anywhere near using the system and continue to be copper-based. "We probably will use it in the future," he concludes, "but there are some speed bumps to get past. Maybe for the next NBC Super Bowl in three years time."

OMNEO's program transport component is the result of a partnership between Bosch Security Systems and Audinate Pty. OMNEO uses Audinate's Dante networking technology to provide standards-based, routable IP media transport.

Super Bowl Audio—World Class

By Kevin Hilton

The Super Bowl is as much about sound as it is the specular images generated by millions of dollars in video gear.

The Super Bowl is as much about sound - the roar of the fans, the chants of the cheerleaders, the fast and sometimes frenzied delivery of the commentators and pundits, the emotional or occasionally eccentric rendition of the National Anthem, the decisions of the referee and the glitz of the half-time show - as it is the images of the men in tight trousers, shoulder pads and helmets running about with a ball of dubious inflation.

This year's event was no different, with the interval performance by Katy Perry pushing all the "spectacular" buttons and getting as much media attention as the New England Patriots' 28-24 victory over the Seattle Seahawks.

Behind the host of sound mixes of the presentation, commentary, field effects and entertainment were a team of operators and engineers, five mixing consoles, 114 microphones and a number of inputs that main game mixer Wendel Stevens described as "too numerous to even guess".

Stevens was working at the 72 dual fader Calrec Audio Apollo digital desk with Bluefin 2 signal processing in NEP Broadcasting's ND1 production truck. Feeds for the National Anthem, belted out by Broadway star and unlikely heroine of little girls every where from her performance in Frozen, Idina Menzel, and America the Beautiful, sung by R&B singer John Legend, were also taken into Steven's console. The half-time show was mixed in another NEP mobile, Denali California, which is equipped with a 144 multi-layered fader Apollo.

Also working in ND1 was Ryan Outcalt, who prepared the game effects on the vehicle's 48-fader Artemis Beam sub-mix desk, which has connections to a Calrec Hydra distribution system and MADI circuits. The pre-game studio show was mixed by Mike DiCrescenzo on the 86 dual layer fader Alpha board in NEP SS24, while Lee Pfannerstill QCed "dozens" of feeds between the mobile truck area and both RF system supplier BSI and other locations in the University of Phoenix Stadium.

Calrec Apollo mixer was central to the 5.1 surround audio for the NBC audience.

Calrec Artemis Beam sub mixer relied on full MADI interconnections and the Calrec Hydra distribution network.

Stevens estimated there were probably "well over 100 inputs for each console", with a mixture of analogue, embedded and MADI signals being carried through the compound on "miles of cable". He added that "most of the distribution of shared compound feeds" was done over MADI generated by the consoles and Grass Valley Sonata Series analogue to MADI converters.

All NBC sports programmes are produced in 5.1 and the discrete surround sound format featured for the Super Bowl. "It's pretty much the same show I've done all year on Sunday Night Football," Stevens said. "The game sounds are up front, the announcers are in the centre and the crowds are in the rears."

To help create as accurate as possible a sound picture of the game, a wide range of microphones was used round the arena. This involved 12 manned parabolic microphones based on Sony ECM-77 miniature omni-directional lavalier units that could be directed to different areas and pick up specific sounds; 10 crowd microphones that were a mixture of Sennheiser ME64 shotguns and Audio Technica 8022 X/Y stereo mics; 24 mics mounted on cameras (Sennheiser 416 and Audio Technica BP4029 shotguns) and ECM-77s on each goal post."

Sennheiser ME 416 shotgun microphones were used on many of the field cameras.

There was a total of 50 mics for the talent working on the show, with 10 RF units supplied by BSI. On top of this there were six to eight player microphones, which were encrypted and controlled by the NFL. The mic feed for referee Bill Vinovich was taken directly from the stadium into the broadcast desks. Play-by-play announcer Al Michaels and 'colour commentator' Cris Collinsworth were fed through Studio Technologies Model 230 commentary consoles.

Social Media was alive with comments about the left shark marching to his own beat throughout the Katie Perry half-time performance. Image courtesy fanatix.com.

The audio, both for TV and in the stadium, seemed to be connecting and doing what it was meant to. It's just a pity that such a slick performance is now being somewhat forgotten on social media in favour of jokes about the dancer during Katy Perry's performance of Teenage Dream, the now infamous Left Shark, who ignored the beat in the sound mix and everything else around him.

AT&T Brings LTE Broadcast to Super Bowl Switching

By Philip Hunter

LTE Broadcast comes to the 2015 Super Bowl with AT&T broadcasting three live video channels.

Last year Verizon made a splash at Super Bowl with a demonstration of LTE Broadcast in a tent just outside the stadium to invited guests. Arch rival AT&T has picked up the baton for the upcoming Super Bowl 2015 and is taking it a stage further with an in-stadium demonstration of the technology. AT&T will broadcast three live channels comprising two streams of clips and replays from different camera angles, plus a continuous data stream of stats and information.

But this is still a demonstration confined just to 40 LTE Broadcast enabled Samsung Galaxy Note 3 Android smartphones. This alone highlights how slowly LTE Broadcast is rolling out, but also that the technology does actually work and can deliver high quality live video. AT&T has already had a practice run at the College Football Playoff Championship Game on January 12th, using a similar configuration.

AT&T worked with partners Ericsson for infrastructure, Qualcomm for the LTE Broadcast middleware, ESPN for broadcast transmission, MobiTV for the streaming app and Samsung for the handsets themselves.

The cellular industry is understandably cautious over the rate of LTE Broadcast roll out after the catalogue of past failures of attempting to transmit video to multiple mobile devices simultaneously, including Qualcomm's own MediaFLO. Those past attempts failed for various reasons, including lack of the more robust and higher capacity LTE/4G technology. But above all, the real reason no cellular broadcast service has been successful remains—there are few devices capable of receiving the LTE Broadcast signals and displaying HD video with sufficient quality.

The Super Bowl LTE Broadcast signal will be received on 40 Samsung Galaxy 3 phones.

AT&T's conducted its first LTE Broadcast test in Arlington, TX's AT&T stadium, site of the 2015 national championship game between the Oregon Ducks and the Ohio State Buckeyes. Photo Credit: Jerome Miron-USA TODAY Sports.

Inside LTE Broadcast Technology

The arrival of tablets and large smartphones coupled with rollout of 4G/LTE networks has revived interest from many familiar players, notably Qualcomm, that were involved in the past failures. The current LTE Broadcast, based on eMBMS (evolved Multimedia Broadcast Multicast Services) standards, is also known as LTE Multicast. Both names are correct depending on the stage of distribution. The data is multicast over the operator's backhaul network to the cell towers. This enables each individual cell the ability to receive an LTE Broadcast stream or not within the overall mobile service.

Inside each cell, the streams are broadcast within a reserved part of the radio spectrum, so that they are available to all devices within range. AT&T is reserving 5 MHz of its LTE spectrum within a cell for the Super Bowl demonstration. The advantage is that any number of people in the cell can receive the broadcast because the allocated spectrum is only a fraction of the total band available to all services. This overcomes the spectrum hog effect that a one-to-one cellular model requires.

Events like Super Bowl are one of the most appealing use cases for LTE Broadcast. That is because a large number of people inside a given cell are likely to be interested in watching live video content such as action replays at almost exactly the same time. The alternative would be to send the streams as separate unicasts to each user's device. But it would only take perhaps 50 or 100 doing so simultaneously, depending on the precise spectrum allocation and the total amount available for a given service, to block the whole cell.

With LTE Broadcast technology, there is always remains sufficient spectrum for people wanting to use their handsets to make phone calls, send email or surf the web at the same time. The technology also avoids congestion on the operator's fixed line backhaul network serving the cell towers. That is because the multicast of channels need be only sent once across each hop of the network, allowing a downstream cell to join the stream without requiring additional spectrum.

LTE Broadcast also improves the quality of experience to customers, according to AT&T. "Think of it this way," wrote AT&T's senior EVP of technology and network operations John Donovan in a recent blog. "Many customers attending a football game accessing venue-specific content, like live footage from a player's helmet cam, could experience lags because everyone else is trying to get that same content, at the same time, through individual data streams on their individual devices," Donovan wrote. "LTE Broadcast would make available one single data stream for the helmet cam footage, available to all compatible devices in the stadium which could minimize network congestion. This trial demonstration signifies the early stages of our foray into LTE Broadcast, but we see a promising future with this technology."

LTE Broadcast -- Take Two

Verizon can claim it opened the LTE door in 2014 with its demonstration of LTE Broadcast at Super Bowl XLIX. That demonstration involved a similar coalition of vendors, including Ericsson, Qualcomm, Samsung and MobiTV.

In May of that year, Verizon conducted a second LTE Broadcast at the Indianapolis 500 using the same Samsung phones being used at this year's AT&T Super Bowl test. The Indy 500 demonstration incorporated race video, in-car cameras and live video from cameras deployed around the track. Although Verizon has no plans for an LTE Broadcast at Super Bowl 2015, a spokesperson says it is continuing to work on different use cases for the technology.

AT&T tests of LTE Broadcast reserve 5 MHZ for multicast services.

LTE broadcast is not limited to sports. Other LTE applications could include simultaneous delivery of software updates to multiple devices, one-to-many commercial services of various kinds and live streaming at concerts or to mobile devices outside the venues.

While both Verizon and AT&T remain committed to launchinga commercial LTE Broadcast service, it is unlikely to happen before the technology is widely supported in devices such as smartphones and tablets. This lack of such support means that although AT&T will be transmitting LTE at the 2015 Super Bowl, only those 40 AT&T customers with a special Samsung Galaxy Note 3 Android smartphone will be able enjoy the service.

Verizon Wireless Spoils Comcast's Super Bowl Party

By Philip Hunter

Super Bowl 2015 year was set to be the biggest stage yet for Comcast's TV Everywhere strategy, but unfortunately two thirds of US mobile subscribers will be unable to view the streams on their smartphones. This is because the NFL (National Football League) sold the smartphone rights to Verizon Wireless, which has 34% of the US mobile service market, even though Comcast and its subsidiary NBCUniversal own remaining rights. This means that while anyone can watch the Super Bowl on laptops or tablets via NBC's live stream of the entire game and surrounding events, they will need a Verizon Wireless subscription to access the stream on their smartphones.

Comcast is still hoping to gain a lot of traction for TV Everywhere with the stream being available via NBCSports.com and the NBC Sports Live Extra app on iPads. This is at a time when US pay TV operators, after a slow start, are moving full steam into TV Everywhere as their next competitive frontier. This month Dish Network and DirecTV launched dedicated OTT offerings separate from the main package, and it is likely that others will follow during the year. The need to reach out for new pay TV subscribers and remain competitive with existing ones is now outweighing fears of "self-cord-cutting" in the business calculations of the operators.

Comcast's mission was to exploit its stranglehold over the nation's biggest and most iconic sporting event to attract a new generation to pay TV in general and its own package in particular, by offering the whole stream free. NBC now has rights not just to the game itself but also pre-game coverage and the halftime show, which according to Nielsen ratings was watched in 2014 by 115.3 million people, the most in its history. NBC also hoped to attract a big viewing total for an episode of "The Blacklist" following the big game. The free stream will run from noon February 1st until 10 PM ET that evening.

But the impact of the free streaming will be weakened by its unavailability on 66% of the nation's smartphones. Although anyone can view it on a tablet or PC, the smartphone has become the most popular device for accessing video outside the home despite the smaller screen, because it is quicker to set up and more convenient to hold, as well as usually being to hand. This is particularly the case for Comcast's primary target group for Super Bowl streaming, the so called Millennials, defined loosely as anyone aged between 10 and 35, 37% of whom do not currently have a pay TV sub in the US. Many of those without a sub also lack a tablet and even those that do own one tend to leave it at home when travelling, while having their smartphone with them.

The corollary is that Verizon Wireless will itself do well out of Super Bowl and gain enough new subscribers to make paying for the rights worthwhile. But for Comcast and to an extent pay TV in general there is a sense of an opportunity being lost. It was supposed to highlight how TV Everywhere allows you to access what you want wherever you are on whatever device you have to hand, but in the event it will show that is not quite the case.

Comcast meanwhile has been stepping gradually into OTT. It launched its Xfinity TV Go app for iOS and Android devices in November 2013, allowing subscribers remote access to 35 channels of live cable programming. This was a rebranded version of the operator's existing mobile software but for the first time enabled streaming of live TV from any Wi-Fi network and not just in the home. Then in September 2014 the app was opened up to cellular networks as well as Wi-Fi.