



NASCAR Overhauls Race Replay System with Telestream

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– Robin Pemberton, NASCAR Vice President of Competition

The Background

Celebrating 64 years in 2012, The National Association for Stock Car Auto Racing, Inc. (NASCAR), is the number-one spectator sport in the U.S., holding 17 of the top-20 highest attended sporting events, and the second-highest-rated regular season sport on network TV with broadcasts in 150 countries and in more than 30 languages.

NASCAR is also one of the most technologically savvy major sports. Broadcast coverage on Fox Sports, ESPN, TNT, SPEED and ABC is supported by NASCAR-installed trackside cameras as well as a bevy of in-car and onboard cameras to capture perspectives of both the trackside fans as well as the drivers.

Video is also a key component in controlling the NASCAR races themselves, which see 43 cars hurtling around the track at speeds up to 200 mph. NASCAR employs 18 high-definition cameras surrounding the track which feed a server-based replay system. A replay system, first developed eight years ago, was used by NASCAR race officials to watch and review on-track incidents such as crashes, pit violations and most important, to determine car positions when a yellow caution flag temporarily put a race on hold.

The Challenge

While serviceable, NASCAR's original replay system was MPEG-1-based and built using PCs and capture cards. The video was of low quality compared to today's high-definition broadcast-quality feeds. Moreover, the ability to search through a timeline for pertinent incidents was rather limited

and time consuming, requiring a highly-skilled operator to be able to keep up with all the video feeds.

NASCAR decided it needed a new, high-definition video capture and replay system with better browsing capability and enough storage to record an entire weekend of NASCAR action, including up to three races at a single venue: the NASCAR Sprint Cup Series, NASCAR Nationwide Series and the NASCAR Camping World Truck Series. The system had to be compact and rugged enough to fit into a small section of one of NASCAR's mobile production trucks that travel to each venue. It also had to have multi-user IP connectivity so that in addition to the race control suite NASCAR officials could concurrently access the system from various locations. Another requirement was the ability for the footage to be easily transferred to portable media devices for other applications, including review by race teams or repurposing by NASCAR Media Group at its file-based production facility in Charlotte, N.C.

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The Solution

NASCAR was already a customer of video transcoding specialist Telestream, using a number of its Episode and Vantage software-based transcoding systems at NASCAR Media Group headquarters. So, it asked Telestream if it could create a new replay system to replace its homegrown solution. Telestream took up the challenge, developing a new race control replay system based on its Pipeline HD hardware-based encoder and a new high-performance multi-clip player application.

Pipeline captures HD-SDI video from live or tape sources and encodes it in real time to leading mezzanine compression formats. Pipeline also sits on a network, making it highly scalable and easy for anyone to access.



Pipeline Replay application

By moving to Telestream's hardware-based encoders and its new high-performance multi-clip Replay application, NASCAR has taken a major step up in image quality and ease of use. Nine Pipeline HD Dual encoders, each capable of ingesting two HD-SDI channels in a one-rack-unit device, compress the incoming 720p/60 HD/SDI video into Apple's ProRes 422 mezzanine format. ProRes 422, which NASCAR already employs as its internal house format at its Charlotte, N.C. headquarters, is wrapped into 'Open' QuickTime which allows users to access the file while it's still being captured. That is essential for real-time replays of race action which is less than a second behind real-time.

NASCAR's goal with the Pipeline Replay system was to be able to record an entire weekend of racing into online SAN storage. It has been using about 10 TB of storage for a race weekend (roughly 24 hours of video). The 24 TB storage system is split into two partitions consisting of solid-state (SDD) for online storage and traditional spinning disks for near-line storage. The SAN uses hardware from Promise Technology and a StorNext shared disk file system from Quantum Corporation.

While the encoding power, bandwidth and storage afforded by the Pipeline Replay system is impressive, the hardware piece of the overall system was pretty straightforward, using standard Telestream and third-party gear. The real challenge for Telestream was creating the general-purpose Replay multi-clip player customized to meet the needs of NASCAR race control officials as well as timing and scoring personnel.

The Result

The result was an application that allows NASCAR officials to seamlessly review an entire event's timeline from any combination of camera angles. The system was been in continuous use at every Sprint Cup weekend since the Daytona 500 in February.

"The instant replay system that Telestream has provided NASCAR this season has enabled our officials to perform their jobs in an even more efficient and time-sensitive manner," said Robin Pemberton, NASCAR Vice President of Competition. "Having instant access to that many camera angles featuring such high-quality video has been a terrific addition to our race weekends."

The most difficult part of the Replay application's development was synchronizing 18 simultaneous HD camera feeds so that race officials could pick any point in time during a race weekend and get an accurate picture of what was happening on each section of the track. While each camera feed delivered frame-accurate information to the Pipeline encoder, the challenge was building a player that guaranteed that each frame was 100% synchronous to the other. Every frame is stamped with timecode when it comes out of the Pipeline system, but Telestream had to make sure that each frame from each camera angle was synchronously displayed to the user.

Pipeline Replay breaks a day of NASCAR action into segments, recording multiple files from each of the 18 cameras angles over the period of a race. Each camera angle is broken up into smaller, more manageable files spanning the entire event. The system allows the user to scrub in sync over the entire event timeline, creating a seamless multi-clip playback experience. The result is the same nice tactile scrubbing across all angles as you would get from one large continuous file.

Replay also allows the user to select track status metadata tags for instant access to particular action. Track metadata is captured from a NASCAR IP stream. The time-stamped data inside each IP packet is extracted and placed on the timeline with a descriptive name. All track flag status, leader laps, and pit data are then available to review the action.

A customized plug-in connects to the NASCAR IP data feed, interprets the metadata, and generates the markers along the timeline. Oval icons at the bottom of the NASCAR dashboard show race leaders after each lap, with different colors associated with particular cars. The oval icons change color when a new leader emerges, so the operator can easily navigate to a leader change. Replay also allows for custom metadata logging during an event or after the fact.

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Additionally, if officials have incidents that need further analysis, they can copy the required camera angles and the Replay timeline file onto a laptop for review at a later time.

Shifting Gears

Telestream's Pipeline Replay system has initially been used by two groups within NASCAR, race control and timing/scoring. With the media files residing on shared SAN storage it could theoretically support additional simultaneous access.

Pipeline Replay is also used to support NASCAR's archiving. With 100,000 hours of footage in its library, NASCAR still manually keys in metadata tags. With the new system NASCAR aims to take the Replay metadata, the scoring data and GPS data and sync it

up with all the other video it takes during a race weekend. That includes reams of ENG video such as interviews, etc. that it shoots with 20 ENG cameras at each venue.

While Telestream's Pipeline Replay system was initially created as a custom build for NASCAR, Telestream now offers the system to other sports leagues, officials and broadcasters.

The player can easily be customized to ingest time-stamped metadata from multiple sources making it applicable for all types of live, multi-camera events. It can also be used for other types of sports, reality TV production, or applications where review and logging of multiple camera angles is required.

To Learn More

To find more information or see a video, visit www.telestream.net/replay or call 1-530-470-1300.

