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Tech Virtuosity Drives Push Into Multi-Device Programming

Olympics Portends Future of IP-Based TV

By Fred Dawson

Live Web and on-demand distribution of this summer's Olympics content represented a sea change in entertainment viewing experiences that offered a dramatic glimpse into the likely future of IP-based multi-device TV programming.

The technology platforms amassed by NBC Universal supported an unprecedented volume of content, range of outlets and richness of functionalities, demonstrating what's now doable with sufficient commitment on the part of content programmers. For NBC that commitment paid off in the near term with ad revenues topping $1 billion at press time, which put the games in the black a few days into the two-week event. And it was paying off for the long term, as well, with the online viewing trend line pointing to an opportunity to redefine ratings-based ad rates for future Olympics.

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The 2008 Olympics, with 157 million prime time viewers recorded after four days, was on pace to eclipse the record of 209 million viewers recorded for the 1996 Olympics in Atlanta. The amount of programming distributed this year to various NBC TV outlets, totaling about 3,600 hours, 75 percent of it live, was three times the previous record volume offered with the 2004 Olympics in Athens. About 10 percent of the audience watched events both on TV and online, while only 0.2 percent watched online exclusively, according to The Wall Street Journal.

"NBC Universal's coverage of this year's Summer Games is setting a new precedent for how audiences will expect live events to be streamed in the future," said Brick Eksten, president of Digital Rapids, which had the daunting task of supporting live streaming of 2,200 hours worth of Olympics content across the Web. In a reflection of how fast the Internet video space has evolved, NBC said it streamed just two hours of live content from the 2006 Winter Olympics in Torino, Italy.

"Everything about this effort – from the sheer volume of live streams and on-demand content to the quality of the end-user experience – will change how people will look at live event coverage from this point forward," Eksten said. "Never before have viewers had this much control over what they watch and how they watch it, and we're ecstatic to be part of this phenomenal project."

Gary Zenkel, president of NBC Olympics, made a similar point. "Over the past 20 years, we have continually expanded our coverage of the Olympics to new platforms as they have become available, and the Beijing Games will mark another milestone," Zenkel said. "With the Beijing Games, the Olympic viewer will be able to define his or her own Olympic experience like never before, watching every sport throughout the games, be it at home on TV, in the office on their computer or on the go on their mobile phones."

The uniqueness of the experience extends to the on-demand arena, where distribution via the platform supplied by Anystream to 16 outlets, including cable and telco TV, Web and mobile, aggregated to 3,000 hours and more than 10,000 discrete titles, with most of it in the pipeline within an hour of live recording. Acknowledging there's been "a lot of hype and broken promises in our industry," Anystream CEO Fred Singer asserted that "NBCU's ambitious vision for coverage of the 2008 Olympic Games will prove to be a watershed moment that shapes expectations for on-demand coverage going forward."

Indeed, as excessive as these claims might sound, it was easy to run the hype test by signing up and logging into the NBCOlympics.com site for supply of video coverage through the Microsoft Silverlight player. Viewers could choose to access

Brick Eksten, president, Digital Rapids

whatever events were streaming live at any given moment, usually numbering about 20, via a cleverly designed guide that provided a broad overview of choices with minimal scrolling. More dramatic still, users could populate not only the main viewing window but three other smaller windows with four simultaneous streams, allowing them to bring whatever they wanted into the main viewing screen depending on what drew their attention across the four chosen events.

"It's the ultimate picture-in-picture experience," said Mike Nann, director of marketing and communications at Digital Rapids. "The program was developed by Schematic to run on Silverlight. The platform allows a really rich interactive experience around video."

NBC's coverage, with $100 million allocated to production on top of $894 million paid for broadcast rights, began with video and audio capture at 39 venues in Beijing, all of which was fed into the small space allocated for production at the International Broadcasting Center.

The multi-window live streaming experi-

ence, complementing a wide range of on-demand and other information-rich options on NBCOlympics.com, represents an extraordinary degree of technology advancement, some of it achieved to meet stringent performance requirements for the Olympics and some of it honed over several years of development in the Web video arena.

Digital Rapids amassed processing equipment sufficient to output 300 streams from the broadcast center, which included a significant amount of redundant backup capacity. The equipment included about 50 Digital Rapids DRC-Stream systems, which combine video input and pre-processing hardware with software-based compression. Each system can receive two input video signals and pre-process them in hardware. Using the Microsoft-developed VC-1 encoding standard, DRC-Stream's software then compressed and formatted each input stream into three outputs for different user requirements.

The output streams were transmitted over a dedicated fiber link that connected across the Pacific to a content distribution network supplied by Limelight, which served the main NBCOlympics site and 227 NBC affiliated websites that participated in NBC's 2008 Olympic Zone offering. The Olympic Zone represented still another expansion in the use of the Web medium by allowing local affiliate sites to feature content of special interest to their audiences, such as interviews or performance clips featuring local athletes.

Digital Rapids, which has a longstanding relationship with NBC as supplier of streaming services for its Web sites, won the competition for the Olympic contract at the beginning of the year but actually began preparations earlier in anticipation that it would need all the lead time it could get should it win the bidding. Then, once it won the contract, the company learned just how daunting the challenge would be.

"At first our assumption was that the streaming would be done the same way as before, where our systems would be based in the U.S. and would process and stream a pre-selected feed sent to us by NBC from Beijing," Nann said. "We quickly learned this wasn't what NBC had in mind and so began preparing for a much more complex on-site operation. But it wasn't until later that we also learned about the challenges we faced as a result of the restrictions placed on each broadcaster at the International Broadcasting Center."

These included limits on the amount of space, how much power could be consumed and even how much heat could be generated by each broadcasting entity from all the participating nations. "NBC required that all these stipulations be met with no sacrifice in the quality standards they'd set," Nann said.

Fortunately, the preprocessing of video before the compression phase within the DRC is done in hardware, avoiding the use of CPU processing power that would otherwise be required to perform these functions on the DRC's core HP computer. This helped the partners meet the stringent power and heat limitations, Nann noted.

A hallmark of this preprocessing step is the extent to which it contributes to maximizing the quality of the video experience for any given level of compression and resolution in the output streams. "We perform de-interlacing [of the TV broadcast signals for progressive scan displays used in computers] and noise reduction on the video," Nann said, noting that eliminating spurious noise from cameras and other sources reduces the amount of information that has to be compressed.

"Unlike a lot of codecs that look at the whole frame, we evaluate each pixel to isolate content from spurious noise," he added. Preprocessing also sends the audio into a multichannel EQ (equalizer), which allows compression to done dynamically across multiple audio frequencies.

The Digital Rapids system, utilizing compression components from Microsoft, also uses software to perform motion estimation to set up the parameters for the encoding process. For example, if the video frame content is an interview where only the head of a speaker is moving, this step ensures that the encoding process will focus on the bits that carry that information.

"Olympic sports are one of the hardest sports to process efficiently," Nann said. "Cycling is a good example. You can have all the motion of the moving cyclists, including the spinning wheels, captured by cameras operated from motorcycles, and then you can have a very static sequence where a cyclist has stopped for some reason. It's hard to optimize the encoding parameters."

Given the limitations on the amount of equipment that could be used, this process was made even more difficult, because there was no way to provide all the extra processing power that would be needed to output

Russell Zack, VP, product management, Anystream

all the streams under maximum load conditions. A new advance in technology supplied by Microsoft for VC-1 compression helped solve this problem, Nann said.

"Microsoft has added what it calls Dynamic Complexity to its software developer kit, which allows you to balance out the load on each CPU so that if one has exhausted its capacity others can take over," he explained. "Normally this would be dangerous, because you could produce an overload situation elsewhere. But the Microsoft technology keeps it all under control."

To exploit these new capabilities required Digital Rapids to re-architect its platform to some extent, with the result that the system now has these capabilities available for use in other situations. "Normally we would treat each stream independently," Nann said. "We had to re-aggregate the process so that with six streams on the same box there's a self awareness as to what's going on across all six streams."

Preparations for the event also included integration of some of the metadata used in the Silverlight system to communicate with the client software on users' computers. This helped support the wide range of functionalities enabled by the Schematic/Silverlight application, providing for a richer experience than would otherwise be possible, Nann said.

All of these adjustments serve to move the ball forward when it comes to future application environments. "Every project will have unique requirements," Nann said. "But having gone through this effort and, to some extent, pain, we will be able

to apply these new capabilities in other situations as well."

Like Digital Rapids, Anystream has had a long relationship with NBC but had to compete for the on-demand Olympics contract. "The evaluation was based in part on who could handle the scale, variability of outlets and integration requirements," said Russell Zack, vice president of product management at Anystream. "This has been nearly a year in the making."

Anystream's equipment was stationed in New York where it tapped into the NBC distribution infrastructure to capture content designated for on-demand distribution. There it performed all the processing to accommodate on-demand access over cable, telco, Web and mobile networks.

One of the big challenges associated with the on-demand component of the NBC agenda was to create a scenario that would allow the production crews to test the system in advance of the games, which required a set-up that would generate content from 39 different venues, Zack noted. "NBC was working around the clock for weeks and weeks to have people send out content from 39 locations to simulate the real-world situation," he said. "This included testing what happens if various systems fail."

From a technology standpoint, the range of complexity and challenges was "like the Olympics itself," he added. "There were many more video-capable devices to be formatted for than is typically the case. For every feed [to on-demand venues] there are different distribution formats and different rules associated with different types of metadata – for example, which content is available immediately, which is not."

Anystream supplied on-demand content for cable VOD in accord with formatting and metadata requirements set by the Comcast Media Center and TVN and for telco VOD as dictated by operational requirements of Verizon's FiOS TV and AT&T's U-verse platforms. Content had to be formatted for terrestrial IP and satellite distribution to all these outlets and to the Web and mobile outlets as well, each with their own device formatting and metadata requirements.

Mobile was an especially cutting-edge aspect of what's going on with these Olympics, representing what NBC said was the "most ambitious major sporting event coverage ever delivered on mobile." Content included breaking news alerts, live mobile TV broadcasts and a mobile Web site for access to mobile-optimized content. The NBC Olympics Mobile Web site included live news, results tabulations, highlight clips, featured video, Team USA profiles, slideshow galleries, voting polls, customizable TV and online listings and much else. Most of this video was provided through the Anystream on-demand distribution platform.

While Anystream came to the Olympics already prepared with Anystream Lifecycle Platform modules that were designed to allow content suppliers to plug in and meet all the distribution, formatting and metadata requirements for these various outlets, there were unusual steps that had to be taken to accommodate the volume and scale of content, Zack noted. And there were new points of integration, including the consumer-facing side where the Silverlight platform had to be assimilated into the modules, and on the upstream side to achieve indexing of the massive amounts of stored content on the storage servers supplied by Omneon.

Executing all the availability restrictions based on time zones, where broadcast had to precede on-demand availability in one place even as on-demand was already available elsewhere, as well as embargo rules based on types of outlets and deals between NBC and distributors was a big challenge, Zack said. "This is a breakthrough event that will give large companies comfort to stage future major events with this kind of coordination between broadcast and on-demand," he said. ■