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The live coverage of news and sports events has traditionally been expensive and logistically cumbersome. Investing in specialist satellite trucks, or using satellite service providers, is beyond the reach of many media outlets. Even the live presentation of a single camera from field-to-studio typically requires an uplink to satellite, which necessitates booking costly transponder space. What's more, the steep cost and complex challenges of deploying satellite trucks or using fibre transmission can limit the way events are covered. While producers may want to get the audience as close to the action as possible, the need to site RF cameras within a certain radius of a receiving station restricts the editorial options. In addition, many personal stories surrounding global news events from war zones, urban areas or remote locations go untold because of the impracticality of access with conventional microwave trucks, or the sheer expense of BGAN operation. But there's an answer: widening cellular networks and new video uplink technology can now bridge the divide. Technology in this field has advanced to such an extent that broadcasters and online video professionals no longer have to rely on the expense or logistical headache of a satellite OB to achieve broadcast-quality video and audio. Ronen Artman, VP of marketing at LiveU, reports.

# Live cellular uplinking for TV and Web



The growing connectivity of terrestrial wireless networks including 3G, 4G LTE, WiMAX, and Wi-Fi can provide an increasingly resilient, comprehensive and cost-effective alternative to streaming SD and HD video via traditional satellite and fibre, provided users deploy the correct technology.

There are immediate advantages: uplink technology can be lightweight and therefore highly portable. Everything required for uplink-over-mobile in the field can be contained in a unit weighing around 5kg, including battery, and be packed into a single backpack with minimal time required for set-up and go. The latest mobile HD uplink technology for online applications can even offer

cellular video transmission in a handheld device weighing less than 700g. This can transmit video to a main hub, such as a studio or broadcast centre, or directly to an online video player for live streaming.

A second major advantage is cost. Since the infrastructure can be carried, trucks are not required. Satellite space is substituted by payment for mobile operators' data plans meaning robust high-definition video uplinks can be achieved at a fraction of the traditional cost.

## Wireless network challenges

But wireless technologies can be fickle. For voice the instability of cellular networks is a fact of life but

for video transmission the loss of even one packet means the consumer sees a dark screen - resilience needs to be guaranteed. Impaired connections are simply unacceptable in a live-to-air scenario.

The fundamental way LiveU circumnavigates the profound drawback of signal fluctuation in single mobile uplinks is to aggregate bandwidth over multiple carriers so that collectively they provide enough throughput and robustness to transmit up to 1080p HD signals using H.264 encoding.

This is achieved - and in the vast majority of our customer cases what we are talking about is HD video over 3G networks - by bonding modems together in a single unit combined with powerful RF technology that automatically senses all the wireless networks in its proximity, and splits the video stream among those channels simultaneously, as is the case with LiveU's LU60 product.

On the receive side, which can be on the other side of a country or the other side of the world, software installed on any Internet-connected PC receives those streams and reconstructs the HD video into its original frames. This technique effectively creates a robust 'virtual wide pipe' over narrowband channels for HD transmission and achieves it over what are unreliable networks.

In LiveU's case this is supported by sophisticated mathematical load-balancing that analyses and monitors the past performance of a given cellular channel in a particular location so that a signal can be dynamically switched between channels in advance of any dropout occurring.

Variable bit-rate (VBR) and constant bit-rate (CBR) technology is used to uplink live video in bandwidth conditions that can vary dramatically from second to second. Taking into consideration the continuous real-time measurements of the performance of every available link, the user's resolution and latency requirements, cellular channel behaviour and other parameters, VBR reduces or increases the H.264 video encoding rate. The result: a real-time video rate adaptation mechanism that optimises the encoding process on-the-fly.

Adaptive and predictive forward error correction (FEC), error concealment and error recovery mechanisms at the video application level complement each other and are employed as needed for each specific operation conditions.

Latency can start from below one second, depending on network conditions and the resolution selected. In general, latency is affected by the resolution selected, the bandwidth conditions in the field and the cellular modem internal delay. Once a certain latency mode is selected, that latency will stay consistent throughout the transmission (in other words, latency will not fluctuate mid-transmission).

In good conditions, multi-link cellular uplinking can transmit at over 3Mbps. Average conditions are in the 1-2Mbps range. However, LiveU technology can transmit effectively even below 300Kbps, depending on the selected resolution and settings.

The combination of bandwidth aggregation and use of a powerful antenna means that it's possible to effectively transmit from many dead spots and areas where a specific carrier may not have adequate coverage including in tunnels, crowded public spaces and underground stations. Its highly resilient profile enables live reporting from moving vehicles including helicopters.

## Data plans

While users can apply their own data plans to cellular uplink systems, we advise a service package that accommodates all the components needed for wireless transmission - from data plan to field units and round the clock 24/7/365 support - as this frees the customer from managing multiple data plans, eliminates the risk of unexpected roaming charges, and contains all the elements involved in wireless uplinking in one simple bill.

## New possibilities for live video

Cellular uplinking opens up new possibilities for broadcasters because of the inherent speed of deployment and mobility. This technology introduces a new era for live video to TV and Web.

The inherent portability allows users to extend their use of (or introduce) live sports and news content: deploy more units, gathering more content, in more places. Users of cellular technology can react instantly to news whenever it happens. If a news event turns out to be a non-event, which happens surprisingly often, a broadcaster who has assigned a truck loses money and staff time. That risk is negated with a cellular solution.



**LiveU's customers have deployed its technology all over the world including the Academy Awards, Grammy Awards, Super Bowl, Brazilian Carnival, World Cup in South Africa, 2008 Beijing Olympic Games, and president Obama's inaugural train ride from Philadelphia to DC. LiveU also just announced that NBC is expanding its use of LiveU LU60 technology to cover the US presidential race, using more units to offer non-stop coverage of the candidates' movements around the country.**



News portals previously prevented from providing unique live content because of the prohibitive cost of a satellite operation can now offer satellite quality video at cellular-based tariffs. Since units can be used to transmit on the move it offers superior mobility - something not possible with any other uplinking system.

In addition to serving as a key uplink resource at live events and breaking news stories, the technology affords news editors the freedom to cover a story from all angles. A single reporter or camera operator, outfitted with a video camera and portable cellular uplink unit, can be dispatched to perimeter areas of an unfolding story to interview eyewitnesses, cover other emerging sub-plots related to the event, or deliver reports from fast-moving vehicles.

Even if users don't require a live feed from the field in every instance, cellular uplink technology is ideal for preparing footage on the fly. Edit a take and add graphics in the field on a laptop and then uplink the finished file via FTP or upload large volumes of raw footage for studio editors to process.

For live sports, multi-link cellular uplinking is most applicable when used to augment rather than replace a standard satellite broadcast infrastructure. Camera operators can deliver on-the-spot video for quick updates, sideline and changing room interviews, roaming crowd shots and more. The signals are then typically streamed back to the studio for vision mixing.

Cellular uplinks can help significantly increase the amount of live content that local news channels can afford to use, helping to invigorate that market, right to the level of neighbourhood TV. This creates a new price point for live content.

Portable cellular uplinking frees web streaming from Ethernet dependency, and provides a substantially more stable and robust solution for streaming live video than using a single aircard or other wireless connection, making the future of live video from the field to the Web a reality today.

Regardless of any single network's sporadic performance, LiveU's solutions consistently sustain the satellite quality video and maximum resiliency, anywhere, anytime ushering in a new era in live video transmission.