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There's a lot more than picture quality at stake

We've got to clean up our act in high-definition

By David Felland

Few viewers of the PBS high-definition channel realize that it doesn't exclusively air HD programming—or that most of it, in fact, is standard-definition video that's been upconverted to HD.

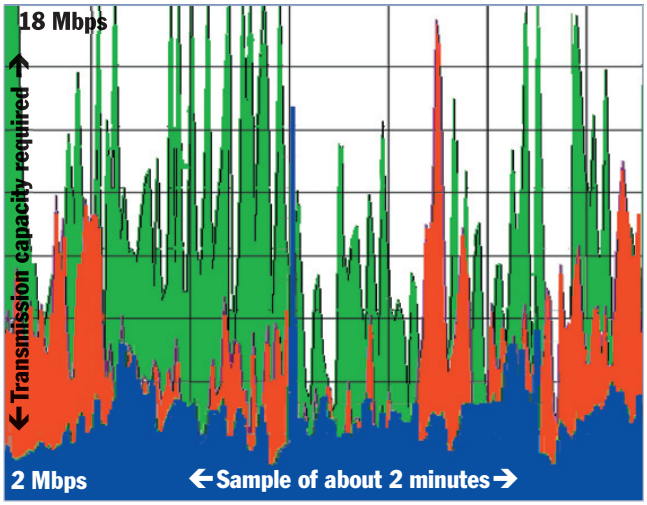
This cost-saving measure may have seemed advisable when very few viewers had screens that could show the difference, but it increasingly will become an embarrassment.

Moreover, upconverting reverses the expected relationship between picture quality and the digital bitrate needed to transmit it. Noisy upconverted standard-definition video turns out to gobble up more DTV bitstream than true, clean HD does, wasting transmission capacity while delivering mediocre pictures.

Our competitors look better than we do. Public television should clean up its act in high-definition and move expeditiously to real HD service. And while we're at it, we should reduce the degree of compression in the PBS feed to local stations, which is also undercutting our HD quality.

Look at our supposed HD channel and you'll see what I've noticed. Pictures originally captured in HD live up to their billing, but then an upconverted program comes along. The synthetic HD picture doesn't have the actual detail of HD, but it's been processed to have 1,080 lines anyway. When a scene comes along with complexity or fast movement, or both, the picture breaks down. Imagine what happens when the camera pans across an evergreen forest with millions of leaves, or a waterfall with lifelike details that would be lovely in HD. Instead, we see the picture dissolving into blockiness or stuttering motion or even a brief total freeze.

Earlier this winter, in my work as director of engineering and operations at Milwaukee Public Television, I was trying to determine why we had such disappointing HD in the national feed that we broadcast on the digital channel of WMVS. As I investigated, it became apparent that our video encoders were working overtime to handle exceptionally noisy source video. It turns out that DTV technology isn't good at handling noisy video, such as highly processed upconverted video.



How fat the bitstream? A sample of synthetic upconverted HD often fills much of the 18 Mbps video capacity of a DTV channel, while a true HD travel show uses less and a locally produced HD program even less. (Source: Milwaukee PTV measurement using TSReader Professional software. Color alignment is approximate. See original data at Current.org.)

In Milwaukee we've been looking at digital signals for a long time. In 1992, MPTV conducted the first long-distance DTV broadcast demonstrations for the FCC and industry insiders. For five years we've produced all our local content in HD, and it looks good, like HD should.

When we encoded original HD video for broadcast, we found, the encoder put out a digital stream of approximately half as many bits as required for noisy, upconverted standard-definition (SD) widescreen programs.

There is a lesson here: With a complex system like DTV, use it the way it was designed to be used. We're not doing that now.

A quick look at the program listings website TitanTV.com revealed that PBS has very little true HD available for stations to broadcast in prime time. The supply of true HD programming is limited; it's repeated over and over. Some nights there is none. Meanwhile, the digital channels of our free-to-air commercial competitors present little except new HD programs every night. Something seems wrong with this picture.

Lagging behind

Going slow with HD was a reasonable strategy while the market was ramping up. But prices for high-quality displays have fallen, and people are buying them faster than ever. PBS has serious competition from numerous content providers whose beautiful HD shows appeal to traditional public TV audiences. Like black-and-white broadcasters in the 1950s, we risk losing our viewers to channels that deliver eye-popping visual quality. Content may be king, but quality is an important factor that we discount at our own peril.

More than viewership is at stake. Public TV prides itself for the high regard and trust it has earned with the public. It takes a long time to develop credibility and very little time to lose it.

Viewers in the Milwaukee area don't know why certain channels look better than others. They see the problems in our HD channel and ask why most of our "PBS HD" programs look so bad. We have to tell them that the PBS HD Channel really isn't HD most of the time. At that point the callers say: "What do you mean? You call it the PBS HD Channel!"

We need to stop marketing the PBS HD Channel falsely. If they can't trust us to brand our services honestly when we face

inconvenient problems of technical cost, how can they trust us to be scrupulous when we face inconvenient problems of editorial quality or journalistic honesty?

Raising standards for producers

In my opinion, PBS could provide an excellent "digital gift" to all of public TV and its viewers by requiring producers to deliver higher-quality video starting as soon as possible. Our national source video needs to have less noise than what PBS currently accepts.

I suggest updating the PBS Technical Operating Specifications (TOS), strongly encouraging producers to meet professional HD submission standards. We need a broad conversation within the production and engineering communities about the levels of quality needed for productions that are shared nationally. (The range of HD equipment has expanded greatly. *Current*'s Feb. 12 article was a good introduction to the economical end of that range.) Producers need to know the best practices for working with the HD production tools now available.

HD equipment once cost so much that we had little choice but to go slow in the quality transition, but it's now very affordable. Though we would face some costs by accelerating our purchase of new production equipment, we should compare that to the loss of valuable transmission capacity when hundreds of public television digital transmitters are unnecessarily chewing up our bitstream. We might be surprised by the business case favoring higher technical standards.

Freeing up transmitter capacity

PBS can give the stations and viewers a second digital gift—increasing the efficiency of DTV—by reducing the stress on encoders at the local stations. The result will be increased bit capacity that stations could use for other purposes. Not only will their pictures look better, but they'll also have newfound megabits to add multicast channels and service-providing, revenue-generating datacasting options. This technical change comes as close to a win/win deal as one could hope. We need better quality as well as more bitstream opportunities.

In the DTV age, when local broadcasters can excel through careful bit management, high-quality source HD will give stations new service options. I'd guess that freeing up an additional megabit-per-second by moving to "cleaner" true HD programs would be worth substantial new revenue.

In Milwaukee, we have two digital stations on the air, allowing us to allocate bitstreams totalling about 40 megabits per second among 10 full-time SD and HD services, delivering 87,600 hours of programming to our market in a year. Most licensees have just one channel, or 19.39 Mbps.

Even with twice that capacity, we'll face difficult choices if we want to add a new multicast channel, such as V-me or World.

And unless public TV frees up some additional bits, we won't be able to even consider using new modulation techniques such as Advanced Vestigial Side Band (AVSB), which would let us broadcast to mobile and portable devices. It would be a shame if public TV can't serve the emerging transient market simply because we failed to clean up our bit management.

Satellite feeds we can work with

While we're cleaning up our technical act, public TV and its viewers would benefit if PBS also minimized compression of its satellite feeds to stations.

When PBS first began distributing its HD channel, many stations lacked DTV encoders and wanted to "pass through" the feed directly to their transmitters. As a result, PBS now sends us a ready-to-broadcast feed at the maximum broadcast stream rate of 19.39 Mbps. However, that bitrate is not ideal for contribution-quality feeds—content that's expected to be further processed and integrated into a broadcast. The feed quality is severely compromised if stations do any of the routine post-production tasks required to assemble a broadcast day, such as inserting tune-in promos, station IDs and underwriting credits. And by now all but about 30 PBS-member licensees have acquired DTV encoders and the capability of inserting material into the HD feed.

Increasing the satellite distribution bitrate from 19.39 Mbps to 45 Mbps (with a Dolby audio rate of 448 kbps) would improve video and audio quality while enabling stations to do postproduction without impairing quality. So that we can all make this upgrade, the system should subsidize encoders for the handful of stations that still lack them.

These issues aren't news to many of my engineering colleagues around the country. When we discuss resolving the problems, they reply, "Why are you telling me about this? I can't fix it! Only the general managers can make something happen, and they don't get it."

They may understand one of these days, but I hope they'll begin cleaning up public TV's HD act before more viewers buy HD displays, notice the problems and begin to demand it. ■

David Felland, director of engineering and operations at Milwaukee Public Television, previously worked at Minnesota Public Radio (winning two Peabody Awards for technical direction), at Twin Cities Public Television and at the Wisconsin Educational Communications Board, where he planned the expansion of Wisconsin Public Radio Network facilities. He has worked with DTV from its experimental days, serving as a field test engineer for early tests in North Carolina. He also has been active in the PBS Engineering Committee and the International Electrotechnical Commission. E-mail: dcf@mptv.org.