August 17, 2004

From: Michael Beach
Chair, Video Standards Work Group

To: NITC Technical Panel

Subject: Public Comment on the Proposed Synchronous Video & Audio Standard

The following are all the submissions I received from the offices of the NITC as comments on the proposed standard. As chair of the committee I have attempted to comment and clarify concerns and questions raised. These are all good comments and well thought out. I applaud those who submitted comments. I am hopeful their comments and my clarifications help the Technical Panel and the NITC in its decision process.

It is recommended to the Technical Panel that this document be inserted into the committee recommendation as section 10.0.

Submission 1

Comment:

- Report >> Page 5 of 64 >> paragraph 3.4 MPEG-2

A test showed that MPEG-2 quality is not acceptable to distance education users below 2Mbps. While this statement is true, many people will be questioning why would you test MPEG-2 at a data rate as low as 2Mbps. MPEG-2 was never designed to be used for distance learning at that low of a bit rate. The two MPEG-2 consortiums in the State of Nebraska are running at either 4Mbps or 5Mbps.

Clarification:

The testing referred to was a part of the last standards effort a few years ago. This time all that was tested was latency since processing speeds have increased. The latency testing was to show how newer processors effect throughput. The MPEG-2 CODECs in use have decreased from three processors to one. It is agreed by the committee that the quality of MPEG-2 above 2Mbps is acceptable to users and that MPEG-2 is not designed for use below that data rate. The document is not questioning the quality of the MPEG-2. However, the committee felt that with the transport providers promising future access to bandwidth currently not available to users and the flexibility of IP-based networks, we should examine protocols that allow lower bandwidth use per video stream. This was to be tempered by whether or not the users felt the quality of the lower bandwidth video was acceptable. The subjective test results as documented in the report on pages 46 through 49 clearly show that H.263 and H.264 at 768Kbps or higher is viewed as high quality by the participants in the test. It also shows that a significant percent of those tested felt that at 384Kbps the video could be considered better than minimum quality. If the viewers had said that this was not good enough quality, the outcome of the recommendation would likely have included MPEG-2.

Continued Comment:

Testing MPEG-2 at 2Mbps totally misrepresented MPEG-2 as a viable option for higher quality distance learning in Nebraska. And at only a minimal higher cost than the lower rates, being recommended for the standard, our students could have continued with the quality that they have become accustom to in their learning environment.

Clarification:

There was no misrepresentation. MPEG-2 quality is a known quantity in the state. Despite the comment, there is a great deal of debate as to costs associated with bandwidth and specific potentially selected CODECs. Until some sort of formal proposal is submitted for any given bid which may be published, it is not known if the network cost differences will be "minimal." It is also not known what the author meant by "minimal." Likewise the comment makes it sound as if H.263 and H.264 are of lower quality than MPEG-2. This is a subjective assessment. The committee went to great lengths to not decide the quality issue, but to allow the users to define quality. Those who participated in the viewing exercise clearly felt the quality of H.263 and H.264 at 768Kbps and higher was high quality.

Continued Comment:

The transportation cost outside of their own geographic area would be the same with MPEG-2 as with the recommended standard contrary to what is stated in this paragraph. And MPEG-2 would not have limited the interconnection over a wider geographic area contrary to what is stated in this paragraph.

Clarification:

The committee disagrees with this assertion relative to bandwidth. There is no reason given by the author as to why this statement is correct. From the view of the committee, increased bandwidth equates to increased cost. Whether that bandwidth is purchased for use within an existing LAN/WAN or whether that bandwidth is purchased between consortia to pass across the Network Nebraska backbone there is a cost associated with the connectivity. One other benefit to lower bandwidth use is that even if the same amount of bandwidth is purchased for the same amount of dollars, the decreased bandwidth required to pass any one video stream could allow for an increased number of streams. This means that the education community could increase the amount of distance learning teleconferences without increasing annual costs. Finally, with IP-based systems and access to all the bandwidth paid for, other distance learning applications can be increased in the network. Many of these future applications may not even have been thought of before now because the current network topology doesn't allow for them.

Continued Comment:

The only somewhat valid reason for eliminating MPEG-2 is that there apparently was a decision made to not have any MPEG-2 to H.264 Gateways in the network. These gateways that the vendors were willing to furnish at no cost is obviously what would have allowed the wider area connectivity and would have made the transport cost the same as for the chosen standard to interconnect all parts of the state. MPEG-2 would have been on an IP Network and thus no routing or scheduling system complications.

Clarification:

There was no pre-decision about any of the standard. However, the author brings up an important consideration. Gateways are by their nature restrictive. If the system is IP-based and all the system CODECs are able to interact directly, the only restriction to the number of streams will be the amount of bandwidth purchased by the contracting consortium. If a gateway is required a pair of CODECs of the two interfaced protocols are connected to each other back-to-back. Each pair can only pass one video and one audio each way. So if six CODECs are used at a gateway for the standard K-12 setup of one send and three receives, the gateway is limited to one class at a time.

Also, the CODEC pair uses analog as the interface between them. This means that as video passes from one CODEC to the other is decoded and re-encoded. This adds latency and the potential for increase packet errors.

Transcoding is a software version of a gateway. Unfortunately, the committee was unsuccessful at finding any product that can transcode between MPEG-2 and any H.2xx family standard. Even if there were such a product it would have added latency as well. As stated above, if the users would have considered the quality of H.263 and H.264 not good enough for their use the recommendation would likely have been different.

Continued Comment:

I suggest that for the accuracy of an otherwise outstanding document, that a simple statement be made that MPEG-2 was not included because a decision was made not to have any MPEG-2 to H.264 Gateways in the Network. Of course it would be appropriate to mention the characteristic of MPEG-2 Network.

Clarification:

If such a decision had been made before hand that statement would have been included. The previous standard was for MPEG-2 and H.263. The assumption at that time was there would be a need for gateways. Since the committee was willing to adopt that standard then, this seems to suggest that there was a willingness to weigh the possibility of gateways if the quality issue required it. That was exactly the balancing that took place then and now. All the factors listed in the document needed to be considered. The recommendation is a result of balancing all the information and selecting the best solution as perceived by the committee.

Continued Comment:

= Report >> Page 5 of 64 >> paragraph 3.6 MPEG-2 Transition

However, every effort is being made to supplement the H.264 upgrade with alternative funding so that these MPEG-2 sites will be able to interconnect with hundreds of other schools.

The Crossroads Distance Learning Consortium MPEG-2 schools and other sites are currently interconnected with five other distance-learning consortiums that include a total of about 90 distance-learning sites outside of the Crossroads Consortium. In about two weeks the number of distance learning consortiums that they can connect to will increase from 5 to 7. And the number of sites they can interconnect to will increase from about 90 to about 110. The Sandhills Technology Education Project (Consortium) was to be interconnected to all of these

sites but declined the opportunity, at the time, due to not seeing any great value. There would have been some incremental added costs, but not a major cost per school

I suggest that the statement simply be changed to say, so they can continue current possibly interconnections and add interconnections without the use of Gateways.

Clarification:

Good suggestion. The committee recommends the Technical Panel amend the report to reflect that the connectivity suggested is without the need for a gateway.

Continued Comment:

- Report >> Page 19 of 64 >> Costs >> Paragraph ©).

If the current connectivity provider would permit purchase of bandwidth on a flexible use basis ..... A point in passing the educational purchasers do not want to purchase in increments of bandwidth as they are relying on one-time up-front grant type funding.

Clarification:

As stated before, less bandwidth means less annual cost or more traffic passed for the same cost. The funding for hardware lease is up-front grant type funding as stated, but the annual cost is shared between federal E-rate dollars and local match. Also, despite the up-front funding, providers have expressed a need to amortize capital expenses over the life of the contract. This suggests that the up-front funding does not cover the full cost of capital investment. If the up-front funding does cover the full cost of the capital investment, then there is a reason for a lower annual cost in the future since the current contracts would have covered the cost of the initial fiber installation.

Continued Comment:

- Report >> Page 20 of 64 >> Bandwidth (a.)

Below 2 Mbps the quality drops off quickly. This is an irrelevant discussion and should be omitted because, as mentioned before, it was never intended by anyone to operate MPEG-2 below 3 Mbps and most likely at 4 Mbps.

Clarification:

This issue is addressed above.

Continued Comment:

- Report >> Page 20 of 64 >> Compatibility (a.)

Upgrade to MPEG-4 Part 10 (H.264) is really a complete replacement. Please review this statement in light of the new information being released by Ahead Communications.

Clarification:

Ahead Communications is the manufacturer that supplied the currently installed MPEG-2 CODECs in Nebraska. We have consulted with Ahead. They plan on providing an H.264 card for their equipment at some point in the near future. It is agreed that in the case of JPEG equipment the upgrade to H.263/H.264 is really a replacement. The same was true in the upgrade from JPEG to MPEG-2 that took place at the STEP pod. It was also true when the SNDLC and Tri-Valley moved from analog cable to IP. In the case of the Ahead product, it will be a card replacement. The statement referenced in the document was discussing upgrade from MPEG-2 to MPEG 4 (Part 2). The document recommends H.264 or MPEG-4 (Part 10). These are different protocols. The only reason Part 2 was brought up was that it was the next MPEG protocol introduced. But since it never really took off and the MPEG organization moved on to Part 10 (H.264) there was no reason to consider cost of upgrade from MPEG-2 to MPEG-4 (Part 2).

Submission 2

As I read the document, I do not get a sense or feeling of encouragement or support for emerging technology. The standard seems to be written to be restrictive instead of promotive. Compression technology will continue to evolve and improve in all aspects of communication, allowing for increased speed and decreased bandwidth.

Clarification:

All standards are restrictive by nature. If a protocol was not specific there would be no interoperability. H.263 and H.264 are the latest nationally and internationally adopted standards. There are many other protocols. Many of them were considered. However, there is no incentive to adopt a protocol that is proprietary in nature, or that has not been actually implemented on a large scale. Doing so risks increased cost and decreased availability of hardware and software.

It is agreed that the technology will continue to evolve. This in itself encourages us to select a standard. If we wait for the "final" version of compression technology we will never be able to settle on an agreed upon protocol because there will never be a final compression technology.

There is provision for experimentation and future looking. Specifically, the applicability statement exempts the University in its role of research. This allows the state to continue to experiment with future compression technologies. However, it would be unwise for the NITC to adopt a protocol that has not been adopted by recognized national and international standards organizations such as IEEE, SMPTE, ITU, etc.

Continued Comment:

Desktop video conferencing is growing rapidly. Unless something artificially restrictive gets in the way, classrooms and individuals will be able to communicate with each other without the need for specialized distance learning classrooms. Current capabilities are to the point where individuals or classrooms can connect with each other over traditional Internet 1 lines with acceptable clarity and ease; and without any significant outlay of funds. As Internet2 gains in use, this capability will only increase. I am excited about the possibilities.

Clarification:

The standard does not preclude desktop applications. In fact the SNDLC is actively using desktop technology. In the world of Internet teleconferencing H.263 and H.264 are increasingly the norm. This fact was one of those considered and weighed in favor of these protocols. The writer states that desktop clarity over Internet 1 is acceptable. This topic of acceptability is in the eye of the beholder and the issues around the decision process have already been described. Whether the video is passed over Internet 1 or 2 or over a private network has a great deal to do with the quality of the video in that to the degree there is control over bandwidth, there is control over video and audio quality.

Submission 3

Section 1.1 – The use of H.264 will provide superior video quality both above and below 384 Kbps. This section should identify H.264 as the preferred video codec at all data rates. It may be better to state that H.264 is required at data rates below 384 Kbps and that H.263 is considered acceptable at data rates above 384 Kbps.

Clarification:

There were several reasons for the split. In the subjective testing in which viewers rated video quality, there was no appreciable difference noted between H.263 and H.264 at the higher data rates. However, the processing required for H.264 either required a faster processor or latency was increased. A faster processor in CODECs equates to higher cost. Also, many of the tested CODECs automatically made the switch for the previously stated reason and did not allow manual over ride. For this reason the standard also states that the devices should be allowed to auto-negotiate the protocol and rate. If both have fast enough processors and permit H.264 at the higher data rates, it is expected that the devices will chose to run in that configuration. The proposed standard does not preclude that. However, in testing, interoperability between CODECs by different manufacturers showed the lowest common denominator to be what is specified in the standard. It is the intent to not set a standard that will unduly narrow the products an end user can purchase.

Continued Comment:

It appears that the NITC standard does not address Session Initiation Protocol (SIP) compliant devices as opposed to H.32x compliant devices. Products such as Marconi's ViPr integrates voice, video, and data over an architecture based on Session Initiation Protocol (SIP) standards, leveraging the Quality of Service (QoS) of a modern network and enabling geographically dispersed locations to communicate virtually, transparently, and naturally.

Developed in the 1990s by the Internet Engineering Task Force (IETF), SIP is a standard text-based signaling protocol for interactive, multimedia communication sessions, including conferencing, telephony, and presence, between users. SIP makes it possible for users to initiate and receive communications and services from any location and for networks to identify the users wherever they are.

The NITC standard should consider SIP based video devices as acceptable devices to be evaluated to meet the present and future needs of their Distance Learning application. Service Providers worldwide are investing in SIP based Voice over IP (VoIP) infrastructure to deliver multimedia applications. Installing a SIP based system would allow NITC to leverage the investments being made by the US based Service Providers.

Clarification:

The only communications protocol addressed in the document is that a network be IP-based. This is because that was adopted as the communications standard some time ago by the NITC. So long as a network can pass IP packets and the video and audio are as specified, the system will be compliant with the recommended standard. SIP technology may be discussed at some time in the future, but it is the understanding of the committee that such topology would not preclude the use of H.263 or H.264. Also, if the systems in place are to be upgraded, they must be compatible with the networks they currently ride on. This is a contractual issue. Users must work together with the network providers they are contracted with in order to make the upgrade successful. Otherwise they will have to wait until the end of their current contract and go out to a bid for a possibly new network provider. In some cases contracts will not come up for renewal until 2012. The NITC should not encourage a process that will cause such a long transition.

Continued Comment:

There is significant value in the concept of ad-hoc conferencing that is discussed in the referenced 64-page report but not called out in NITC standard itself. More consideration should be given to this aspect which allows for a system which can be more flexible in its use and applicability.

Clarification:

The standard is based on the larger recommendation document. Both are official documents of the NITC. The standard adoption document does not preclude ad hoc events. The standard chosen does not specifically address scheduling issues. If a network is IP-based it will by its nature have the option of ad hoc events. The Statewide Synchronous Video Work Group has specifically been tasked with working out scheduling and coordination issues. The hope is that future action will result from their efforts in this area.