

Discussion

Satish Menon

Q: Will service providers charge extra for a service such as EOD?

A: There are two models of charging: per-view or subscription-based. Most likely, a service such as EOD may use subscription-based service, which charges a flat-rate for on-demand access to content.

Q: What is the advantage of using IP in these network architectures?

A: There are several. First, IP is mainstream technology today and standard components used in mainstream computing can be used in a video network to lower the cost of equipment. Second, IP is switched technology allowing content from many locations to be made available to users easily.

Q: What are the problems in using IP?

A: The main problem is the ability to offer Quality of Service (QoS) that dedicates resources (network bandwidth) to users for the duration of an event. Lixia will talk about QoS in her talk next.

Q: What are the considerations for deploying streaming media technology for home theater use vs. cell phone use?

A: One of scale – home theater usage would probably imply HD-quality movies in the future, which require significant amounts of bandwidth per user. However, the number of users is likely to be far less, compared to cell phone users who typically require much less bandwidth due to the small size of the screen.

Kohtaro Asai

Q: I hear that MP3 utilizes the nature of human psychoacoustics. Does MPEG use such characteristics for video compression?

A: Certainly MP3 uses such characteristics for audio compression. There were similar approaches in the field of video compression; however, I do not know any clear visual natures explicitly utilized in compression algorithms, at least in standardized schemes. That is a future issue.

Q: You said 3-D would be a future direction. Do you have anything more to say about 3-D?

A: Compression of stereoscopic images has already been studied, but compression of 3-D space or light fields is a future issue. 3-D space compression will enable us to obtain images from any viewpoint we want. This type of data format should be defined at first

and then compression should be considered. In the future we expect that we will be able to see performing arts from any angle.

Q: What is the next breakthrough to obtain even higher compression?

A: This is a very tough question. Most of the recent progress in the video compression field is rather minor. Some techniques are good for this type of picture but not so great for general pictures. The next breakthrough would be a source-adaptive approach, that is, the algorithm itself could be reconfigured depending on the input signal. Maybe the encoder will be complex.

Q: Does the latest standard AVC/H.264 take network transmission into account?

A: AVC/H.264 has segmented the network related factors as NAL (Network Adaptation Layer). The remaining part, the compression layer, does not take care of the network layer even concerning synchronization. In that sense, AVC/H.264 could be considered to take care of the network by NAL, or it could be considered a not-thinking network layer at the stage of compression.

Q: Can AVC/H.264 be used for remote operation?

A: Yes. Since applications like remote operation require very short delay, it should be in real time. Since AVC/H.264 is a complex scheme, we should be careful to use it.

Q: I hear there are many specifications for video compression. Is MPEG the most common?

A: Yes. Certainly people use Windows Media or Real Player for streaming. These players can play MPEG-4. And before that, MPEG-2 has been adopted and used for digital broadcasting in many countries. DVD video is now growing worldwide in terms of market. I am sure that MPEG is the most used standard.

Q: Isn't it important to consider audio compression when we think of communication?

A: Yes. The combination of audio and video coding is studied for recognition or indexing purposes rather than for compression purposes. When we think of soccer games, we can guess that loud voices are related to exciting things happening in the game. A more intelligent approach may enable media conversion, even audio to video or video to audio. It can be a future topic.

Naoki Wakamiya

Q: In the case of TV broadcasting, sponsors pay for the air time. How do you manage viewers and air time?

A: When our scheme is applied to a streaming "service," there must be a server for 3A control. A user first communicates to the server prior to receiving a video stream. If segments are encrypted, a user has to ask the server to provide a key.

Q: Can you protect the system from abuse or DoS attacks?

A: One possible solution is to use a server's address to distinguish illegal packets. However, it is difficult to completely avoid the problem.

Q: The P2P architecture seems inefficient in bandwidth usage.

A: The P2P architecture wastes some portions of bandwidth in exchanging signaling messages. Thus, it decreases the efficiency. But, what is important is that higher scalability can be attained by the P2P architecture.

Q: Can you utilize game machines widely deployed at home?

A: As long as they are connected to the Internet, our scheme can be adapted to those machines.

Q: To make such P2P applications widely used, there should be a standard protocol.

A: When the industry thinks that they can make money from P2P applications, they will begin to make a standard P2P communications protocol.

Q: How do you manage the right control?

A: The problem can be solved to some extent by dividing a stream into segments and prohibiting a user to have the whole stream.

Q: Is there a possibility of a combination of a server-based and a distributed architecture?

A: Since peers are selfish, unpopular streams will disappear from a P2P network. When we want to provide a video streaming "service" on P2P architecture, a service provider must prepare a server that always has all video streams. The load concentration on the server would not occur, since it is used only when a video stream is not available in a P2P network.

Lixia Zhang

Q: I am a civil engineer. Since you mentioned civil engineering as an example: civil engineering has hundreds of years of history. What makes you believe that network engineering would also be long lasting?

A: Civil engineering will always be needed because human beings need houses to live in and bridges to cross rivers. Networking engineering will also be needed indefinitely for a similar reason: we need communication as much as we need to breathe. 100 years from now the Internet or its successor will still exist to meet those communication needs.

Q: Did the Internet open the door for lots of attacks?

A: Internet did not enable attacks but computer technology did. There were numerous attacks to telephone networks. However in those old days one probably had to build special analog circuits for the attack, a skill possessed by a small number of people. Today, the universal availability of computers, the ease of use, and connectedness have empowered individuals to do things that were unthinkable 20 years ago. We have created such powerful technologies that can be abused. My top priority research project is about enhancing the Internet with resiliency against attacks.