RTT TECHNOLOGY TOPIC
May 2001

Image, video, radio and network quality

In previous HOT TOPICS we have explored the relationship of source coding, channel coding and radio bandwidth/network bandwidth quality (3G content - March 2001).

In this month's HOT TOPIC, we analyse how source coding is continuing to evolve and the related impact on radio and network bandwidth quality of service (QoS) performance expectations.

CMOS image capture platforms (digital cameras) are providing new opportunities for image capture, image storage, image retrieval (image searching) and image delivery.

Companies like e-vue.com (www.e-vue.com) (- a spin off of the Sarnoff Corporation) and Nixvue (www.nixvue.com) are facilitating income streams based on the processing, archiving and distribution of digital images delivered **from** corporate and personal subscribers.

Integrating archiving with digital rights management and image indexing, search and retrieval (www.neocore.com / www.virage.com) facilitates image ownership revenue.

Ownership revenue is however dependent on the preservation of image quality.

Images are compressed in order to improve storage **and** delivery efficiency. Compression can either be lossless (the original image is perfectly preserved) or lossy (some of the original image is lost). Lossy compression delivers higher compression ratios, typically 40:1 compared to 4:1 for lossless compression. Lossy compression economises on storage and delivery bandwidth, lossless compression preserves image quality.

A J-PEG image captured in fine camera mode (a 'Q' factor of 90 - see March HOT TOPIC) creates a 170 kbyte file (storage bandwidth) which takes 41 seconds to send across an (uncoded) 33.6 kbit channel. The same image with a Q factor of 5 occupies 12 kbytes of storage and takes 3 seconds to send (www.Jpegwizard.com case study).

As you would expect, video streaming exhibits similar quality/storage bandwidth/delivery bandwidth trade offs. Companies like Vast Video (www.vastvideo.com) are facilitating income streams based on the processing, capturing, storage and re-distribution of video clips **from** corporate, specialist and personal subscribers. Integrating archiving with digital rights management and image search engines ensures video content ownership can be translated into ownership revenue.

An MP4 encoded video stream (www.emblaze.com, www.packetvideo.com) can be delivered over remarkably narrow band channels - a 9.6 kbit cellular channel for example. The trade off is quality - frame rate, colour depth, resolution, 'Q' and consistency.

The constraint is not bandwidth quantity but bandwidth quality. The radio channel at present is a constant rate variable quality channel (the impact of slow and fast fading). Video quality is the 'variable' introduced both by the varying quality of the channel (bit error rate) and dynamic range of the information being presented to the encoder.

Most compression schemes are implemented using 'differencing' (also known as differential encoding). Image macro-blocks are compared against each other - difference factors are sent rather than the actual data (block to block differences in image coding, frame to frame differences in streaming).

Frame to frame differencing works well in networks delivering **consistent** quality of service, not so well in networks delivering inconsistent QoS. QoS **consistency** is therefore an important measure of bandwidth quality.

In a 3G radio access network, the radio bandwidth moves from being a constant rate, variable quality channel to **a variable rate constant quality channel** (if properly implemented, the power control loop corrects for slow **and** fast fading). Admission control (if properly implemented) matches offered traffic to available delivery and memory bandwidth (buffer bandwidth) constraints.

The benefit should be a more **consistent** user experience.

However, video quality also depends on network bandwidth quality (**consistent** QoS).

In a packet network, congestion induces packet loss, delay and delay variability (re-routing and re-transmission of packets). IP networks do not presently deliver sufficient control of end to end QoS to guarantee a satisfactory 'rich media' end user experience (the quality/consistency metric).

Until radio bandwidth and network bandwidth **quality** issues are addressed (including a better integration of radio and network bandwidth planning and management/control), video transmission will continue to be a (highly) variable user experience.

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We aim to introduce new terminology and new ideas to clarify present and future technology and business issues.

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Contact RTT

RTT, the Shosteck Group and The Mobile World are presently working on a number of research and forecasting projects in the cellular, two way radio, satellite and broadcasting industry.

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