RTT TECHNOLOGY TOPIC
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Packet shaping / traffic shaping protocols Part 2

In our last Hot Topic (July - Packet Shaping/Traffic Shaping Protocols (Part 1)), we highlighted the need for traffic shaping protocols to deliver equivalent 'dynamic range' to existing circuit switched networks - ie while 350 millisecond delay budgets could be tolerated for non-real time traffic, 35 millisecond end to end delay needed to be accommodated for real time (differentially encoded) rich media.

We were defining end to end performance - performance delivered through a complex network - the product of radio bandwidth/access bandwidth and network bandwidth delay and delay variability.

We identified the issue of traffic becoming increasingly asynchronous - i.e. more bursty over time, how bursty traffic intrinsically puts radio and network sub-components (power amplifiers on the radio side, buffer bandwidth on the network side) into compression.

Radio bandwidth compression generates intermodulation and adjacent channel performance degradation. Network bandwidth compression generates packet loss (and with TCP/IP, delay variability).

End to end performance is typically measured in **milliseconds (1 in 10 to the three)** - 100 milliseconds end to end delay with 10% delay variability would be an (ambitious) Internet service level agreement.

Over the **radio path**, path delays are typically measured in **microseconds (1 in 10 to the six)**, - 20 ms in a rural environment, 1 - 2 ms in a urban environment, 0.28 ms in a picocell (a 78 metre path at the speed of light - 300 million metres per second).

Further into the network, as aggregated bit rates increase, time dependency increases.

Packet processing in the optical/electronic layer is measured in **nanoseconds (1 in 10 to the nine)**. Packet processing in OC48 at 2.5 gbps needs to be accomplished within 65 nanoseconds, packet processing in OC192 at 10 gbps needs to be accomplished in 16 nanoseconds, packet processing at 40 gbps needs to be accomplished in 4 nanoseconds.

As we move towards **terabit processing** speeds we move towards **pico second processing (1 in 10 to the twelve)**. In practice we have to parallel process to meet time domain constraints.

An incidental issue that arises is power budget and heat dissipation. Banks of Intel 60 watt processors produce a substantial amount of heat - low power budget processors

(Transmeta for example) are needed in the network core to minimise equipment size and cost.

These are all symptoms of the practical problems of trying to make a network topology (the IP network) do something it was never designed to do - support critically time dependent rich media into and through a high performance network. Many telcos are presently congratulating themselves on the prescient preservation of their legacy circuit switched networks.

About RTT Technology Topics

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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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