RTT TECHNOLOGY TOPIC November 2003

Multi service multi media networks

In last month's Hot Topic (Multi-media Modelling) we argued the case for a balanced uplink and downlink with closely controlled end to end delay and **no** delay variability (network jitter).

In effect we were saying that a small but significant percentage of traffic (disproportionately significant in terms of margin contribution) would need to be real time.

Earlier Hot Topics had touched on the definition of 'real time'. According to the IEEE, a real time operating system is a system that responds to external asynchronous **events** in a predictable amount of time'. We reworked the definition to describe a real time network as 'A network that responds to external asynchronous **traffic** in a predictable amount of time'.

Note that asynchronous implies variable rate and highlights the need for a flexible layer one (radio layer) and a layer 2 that is responsive to changing traffic conditions. In addition, layers one and two need to work together to protect the higher layers of the protocol stack from the effects of a highly variable radio channel.

Asynchronous time sensitive and jitter sensitive traffic also implies a need for a new service class not presently defined within 3GPP.

We list below the four service classes for UMTS. There are two points to make- firstly there is an obvious need for a conversational **variable bit rate (VBR)** service rather than the constant rate (CBR) service presently specified. Secondly there is an apparent need for a much more rigorous definition of end to end QoS (quality of service).

- **Conversational Class:** minimum fixed delay, no buffering, symmetric traffic, guaranteed bit rate (CBR).
- **Streaming Class:** minimum variable delay, buffering allowed, asymmetric traffic, guaranteed bit rate (VBR).
- **Interactive Class:** moderate variable delay, buffering allowed, asymmetric traffic, no guaranteed bit rate (ABR).
- **Background Class:** big variable delay, buffering allowed, asymmetric traffic, no guaranteed bit rate (UBR).

Note: This is bearer QoS not end to end QoS!

Let us first consider the interrelationship of quality of service and cost of service. In previous Hot Topics we have said that it should be possible and desirable to build a tariff premium based on tangible quality of service metrics ie quality metrics that a user can directly experience. These include low blocked call rates, low dropped call rates, **consistent** good quality voice and **consistent** good quality video defined in terms of frame rate, colour depth, resolution and contrast ratio, and of course voice and video locked together in the time domain. Note the emphasis on consistency. Paradoxically a user may well perceive consistently poor quality as being better than inconsistently good quality (inconsistently good quality highlights the poor quality parts of the experience).

However we also know that **it is quite hard to put a value on good quality**- how much more will a user pay for 24 bit colour depth rather than 16 bit colour depth, for 25 frames a second rather than 15 frames a second, how much more will a user pay for VGA rather than CIF resolution.

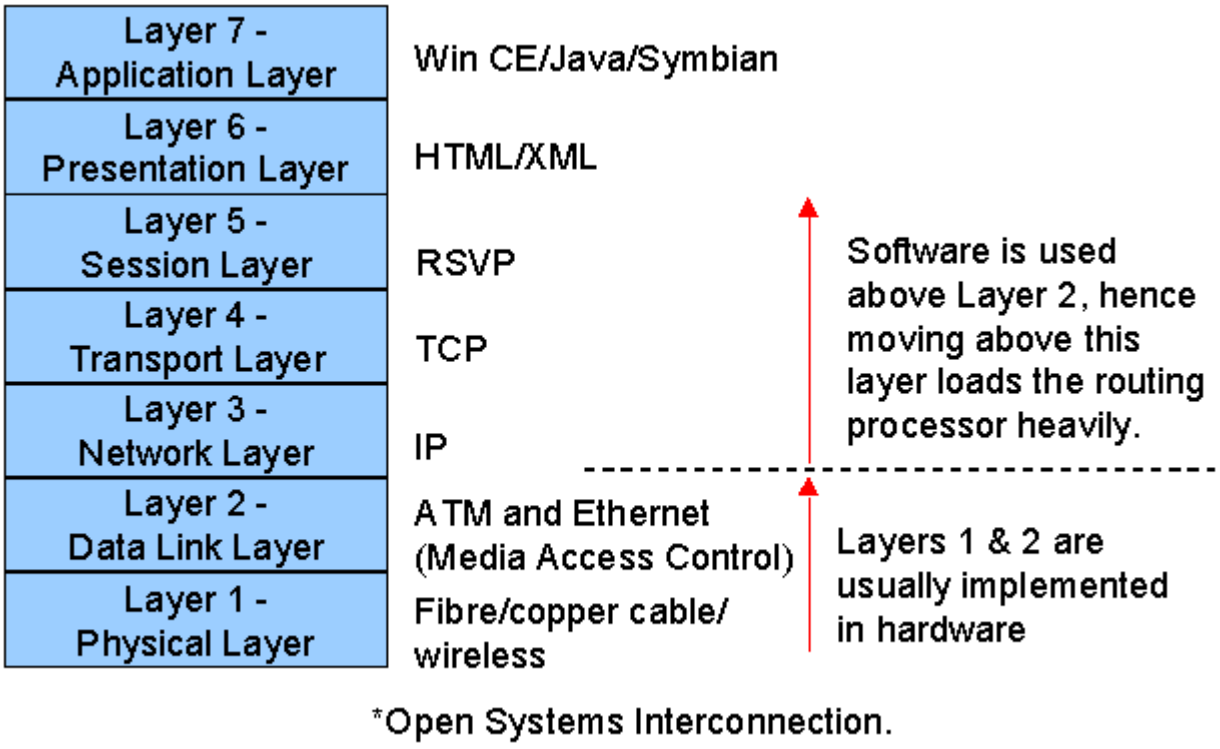

Figure 1 – Software Value – The OSI Reference Model

Figure 1 represents a slightly over simplified representation of the protocol stack in a wireless IP network. If this is a GPRS network, it is characterised by a relatively inflexible physical layer which was never intended to be suitable for multimedia traffic, an over complex MAC layer (layer 2) and a whole mix and match of intrinsically non deterministic traffic shaping protocols (RSVP, Diffserv, MPLS, SIP, SMIL and RTP). Even if these protocols are deterministic if used in isolation, they are certainly not deterministic when used together. Essentially there is flexibility in the higher layers of the protocol stack where it's not needed and inflexibility in the lower layers of the protocol stack which need flexibility. This combination more or less guarantees that guaranteed end to end QoS will never be achieved with a GPRS network, particularly a GPRS or E GPRS network dependent on IETF protocols for higher layer traffic

modulation.

What is needed is a flexible Layer One (W-CDMA is pretty good at this), a MAC layer that responds to changing traffic conditions (the ATM MAC layer in 3GPP1 is pretty good at this) and a physical layer and MAC layer that together protect the higher layers of the protocol stack, particularly the application layer, from the effects of a highly variable radio channel.

Note that this is a more hardware-dominant model better suited to delivering the determinism needed to manage end to end multimedia network performance ie consistent end to end delay and no delay variability. It is also a model that delivers flexibility where it's needed in the lower layers of the protocol stack.

In next month's Hot Topic we study determinism in the higher layers of the protocol stack- in particular the issue of whether to (and how to) deliver real time performance from the application layer.

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