RTT TECHNOLOGY TOPIC
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Wireless IP

(See for background previous **HOT TOPICS** - **Mobile IP** - April 99, **Ad Hoc Networks** - May 99).

Wireless IP is used, generically, to describe the application of TCP/IP (transmission control protocol/Internet protocol) to wireless networks. Specifically, wireless IP encompasses IP based traffic management, IP based network management, IP based mobility management and IP based access management. This HOT TOPIC analyses each of these areas.

The IPV4 to IPV6 Transition

Moving from IPV4 to IPV6 increases IP address bandwidth from 32 to 128 bits. This allows a 4 bit flow label to be used which supports 16 access priority levels - ie the basis for traffic discrimination. The first 8 bytes of the 128 bit IP header tell routers how to direct a packet steam (i.e. routing trajectory management), and where and how the user is attached to the network (mobility management). IPV6 also includes digital signatures for authentication and encryption - the basis for access management.

IP Traffic Management

In 3G networks, we are assuming a proportionate increase in video and image streaming with or without simultaneous audio - the traffic mix shift. MP4 variable rate differentially encoded information is presented to the physical layer.

This traffic is by its nature highly asynchronous (in earlier HOT TOPICS we describe this as 'complex content'). In general, this asynchronous traffic will be multiplexed together, usually into an ATM cell switch fabric and then delivered on to SONET or frame relay transport. The packet stream can be either isochronous (packets arrive in the same order they were sent) or non-isochronous.

IP traffic management overlays a number of routing protocols each of which provides a measure of traffic shaping functionality, for example RSVP pre-reservation protocol. RSVP was originally intended as a way of pre-allocating an IP session resource for a pre-determined period - a kind of virtual circuit switching. The problem was that the protocol could handle only 2300 simultaneous flows - i.e. the protocol didn't scale well and was less than optimal for multipoint to multipoint streaming. RSVP is now evolving to become a per conversation/per session protocol defining QOS requirement from the device - for example RSVP embedded in Windows 2000.

This highlights an important philosophical point - most network designers assume that a network should be application and device aware. There will however be thousands of different application form factors with thousands of different QOS requirements and thousands of different device form factors with widely differing image capture, image processing and display capabilities. In practice, a high quality QOS can only be delivered when QOS requirements are application driven from the device - i.e. the application becomes network aware rather than the network being application aware. In RSVP, the highest level of service is application driven, i.e. the application is readily able to quantify it's resource requirements, the lower levels of service (medium quality, low quality or best effort) are network driven.

Having used RSVP in the application layer embedded in the device to define QOS, Multi-Protocol Label Switching (MPLS) is then used as a flow switching protocol. MPLS breaks packets into fixed length cells, i.e. an ATM look-alike structure optimised for a multimedia multiplex. The packets within an IP session are then grouped into a single flow and then tagged for expediting through the router hops (usually being mapped into an ATM or frame relay circuit). Finally, Diffserv is used to provide additional traffic shaping. Diffserv was originally proposed as a protocol for defining 4 levels of service at the network edge. It is now being proposed (and promoted in various IETF work groups) as a way of grouping traffic flows together that share similar QOS characteristics, ie QOS flow aggregation. It is then used as the basis for negotiating service level agreements between carriers (inter-network SLA peering).

IETF RTP - IETF real time protocol may be used to synchronise complementary traffic streams being moved into and through the network (for example time stamping parallel per user bit streams carrying audio and video streaming). The IETF SMIL protocol (synchronised multimedia integration language) may be used to perform a similar function at the application/presentation layer.

IP Based Network Management

All of the above requires new measurements to be made to provide an effective audit of network performance, for example, end to end delay, end to end delay variation, access latency, network latency and application latency (server bandwidth constraints). These become embodied into IP SS7 - an IP based upgrade of SS7 and/or an evolution of SNMP (simple network management protocol).

IP Based Mobility Management

As vendors begin to embed IP addresses into base stations and routers, IP based mobility management becomes an option, potentially home location and visitor location registries could be replaced by DHCP servers (dynamic host configuration protocol) tied into a Directory Enabled Network, ie an IT solution super imposed onto a telecom network structure.

IP Based Access Management

By access management, we need to clarify that we mean access to delivery bandwidth and to memory bandwidth. Note how encryption is used both to secure delivery bandwidth privacy and memory bandwidth privacy.

Ditto authentication - we authenticate to arbitrate on the right of access both to delivery and memory bandwidth, i.e. access to servers or virtual (network resident) storage - the storage area network proposition. IP Sec can be used to provide both delivery and memory bandwidth security including integration with X500 directory standards (X509 certificates) and Public Key Infrastructure (PKI) products. Note also how Triple A (the authentication, authorisation and accounting proposals from the IETF) also addresses the perceived need for unified billing platforms.

Summary

IP protocols based on IPV6 have the potential to impact most, if not all areas of 3G network topology. Given our assumption of six industries presently converging (computer, consumer, IT, wireless, wireline, TV), IP protocols provide a basis for future service integration.

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