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CDMA 2000 and IP QOS transparency

In Europe and Asia, there has been a substantial European focus on 'GPRS' and 'Edge' as an implementation option for GSM operators wishing to introduce packet routing and/or higher bandwidth access into existing 2G networks.

In practice, as the European and Asian focus shifts to IMT2000, it may become difficult to persuade network operators to invest in 2G network hardware and software up-grades, given the substantial investments implied in third generation network implementation. (See our March hot topic – the techno-politics of dual mode deployment).

The US does not have the distraction of the IMT2000 spectral allocation process – third generation deployment is therefore focussed on developing evolutionary routes for existing radio access technologies to make the access bandwidth IP QoS compliant. The US cellular and telecom standards making community is also notably closer (physically and psychologically!) to the Internet standards making process. In our view, this has resulted in cdma2000 being substantially further forward than W-CDMA in terms of practical IP QoS implementation.

Firstly, there is a well thought through implementation of high speed packet data, in effect a GPRS equivalent but using multiple Walsh codes (1 fundamental and 7 supplemental) on the downlink and multiple PN off-sets (1 fundamental and 7 supplemental) on the uplink. This gives a 115.2 kbps bearer (ie GPRS equivalent) or 76.8 kbps bearer (ie HSCSD equivalent). Higher rates can be delivered by multiplexing together RF channels (rather easier to implement on the downlink rather than the uplink). In practice, as with GSM GPRS, the tricky part is the uplink, partly because of the duty cycle and partly due to the RF power budget limitations implied in supporting higher uplink access rates. The soft handover architecture of IS95 however, provides an intriguing method for implementing the negotiation of bandwidth on demand **(FIG 1)**, with the supplemental Walsh codes/PN codes distributed across two base stations.

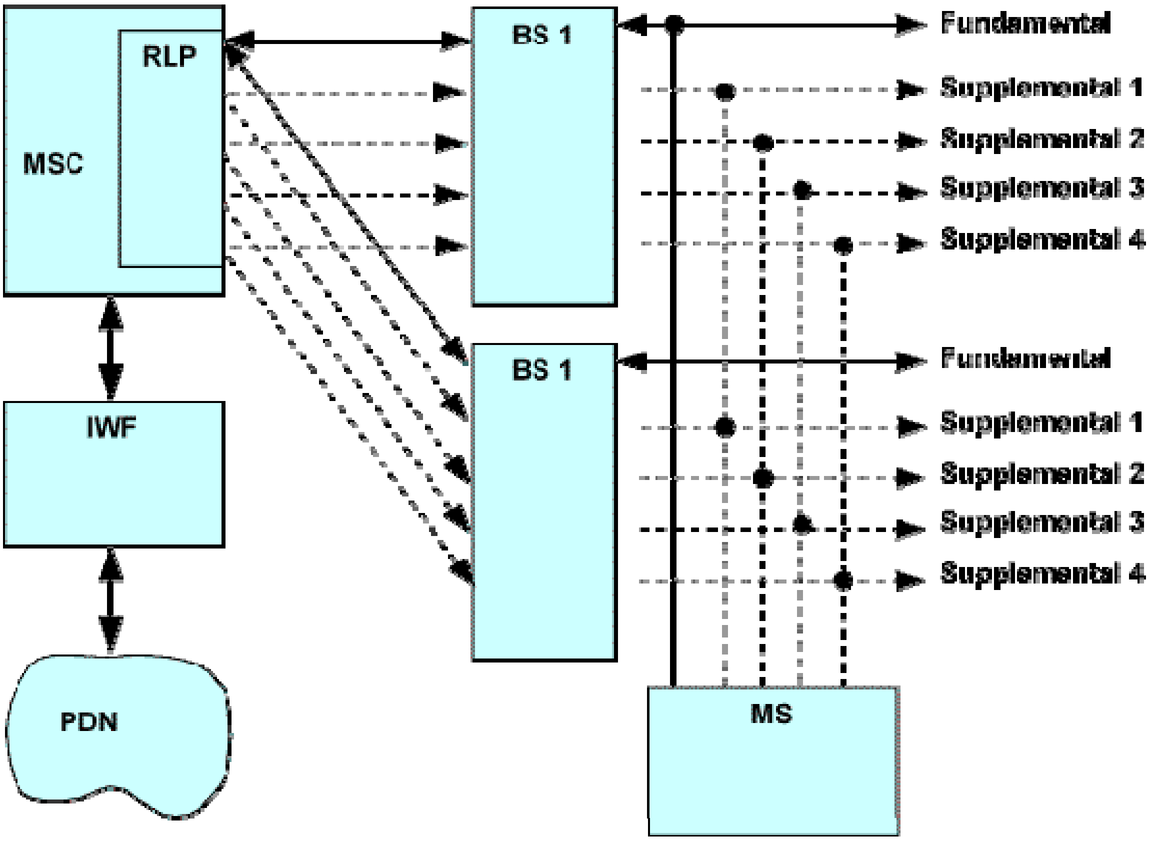

FIG 1

The OSI layer map **(FIG 2)** shows how IP QoS is supported, the point to point protocol can be set up in Layer 3 together with Resource Reservation Protocol (a form of virtual circuit switching), Layer 2 will support IP QoS control as and when IPV6 is implemented.

Note how in IPV6, the IP protocol stack takes over a substantial amount of the routing responsibility from the TCP stack. In my book, this makes cdma2000 substantially IP QoS compliant.

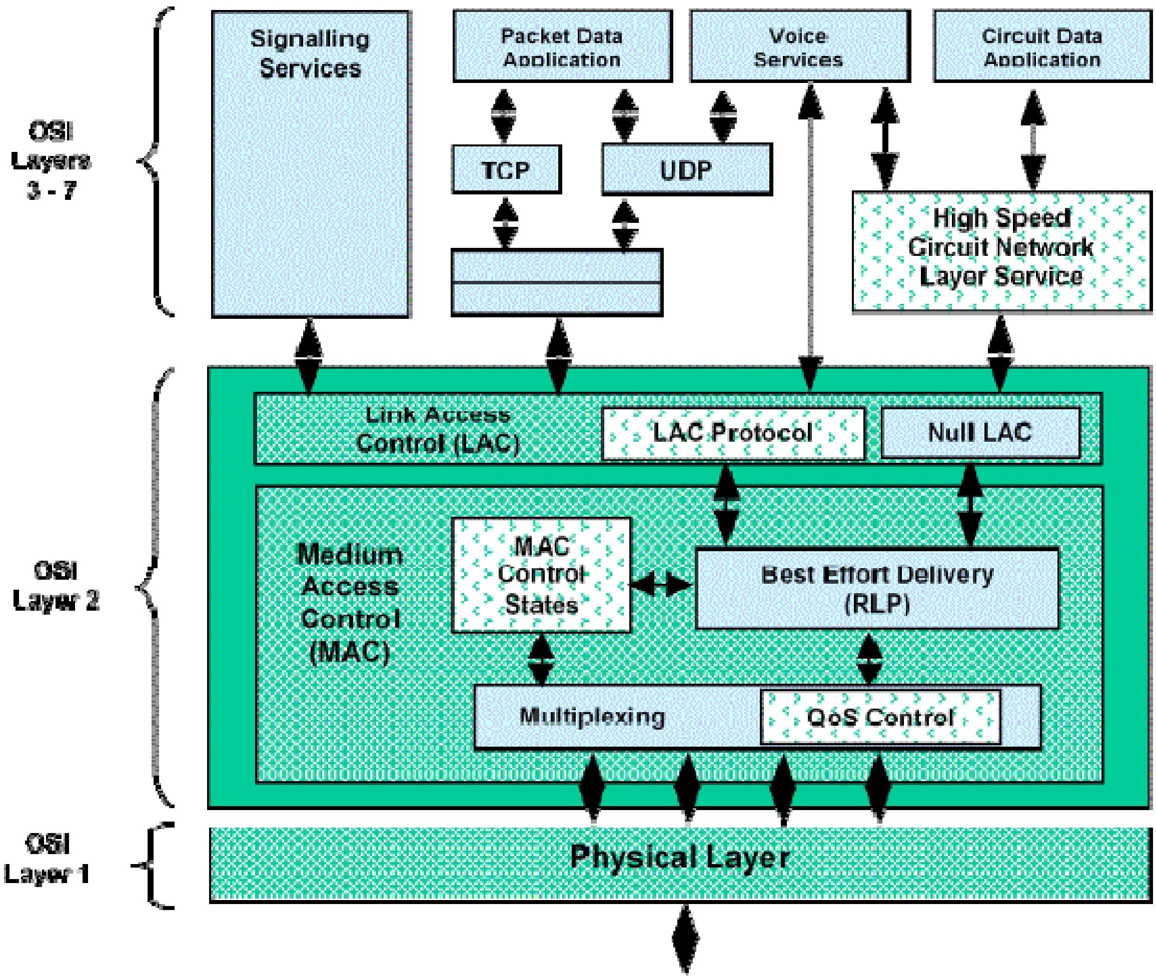

FIG 2

The issue of localised bandwidth on demand negotiation however still requires some further clarification.

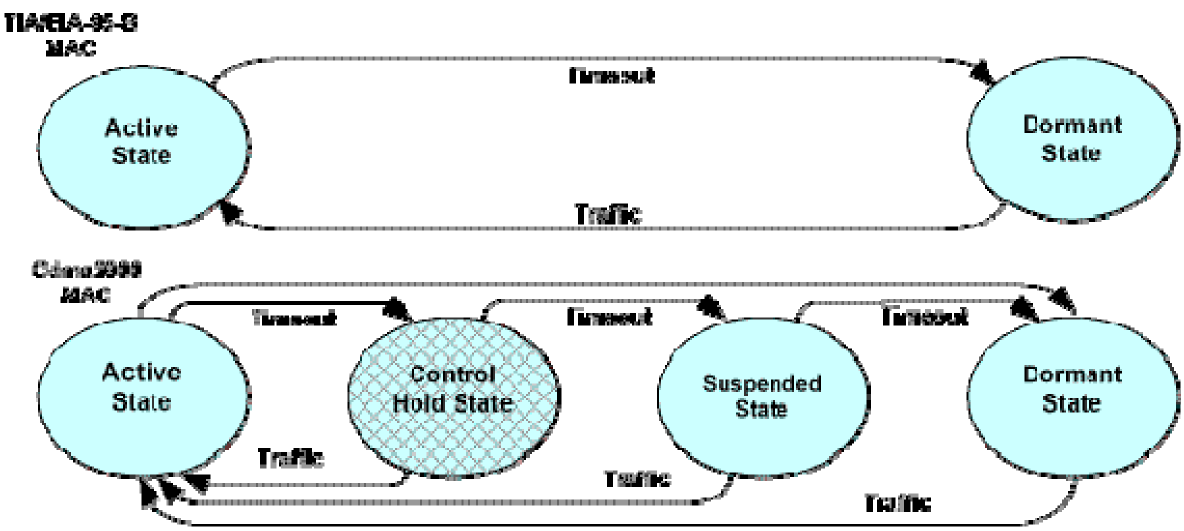

FIG 3

The diagram shows how, in cdma2000, 4 states of ‘preparedness’ are supported for information transactions – the active and dormant states presently supported in IS95B are supplemented with two extra states – control hold and suspended. Control hold maintains the power control, avoiding any delay due to power control stabilization, the suspended state keeps a ‘virtual active set’ of channels available.

The objective is to make the access air interface capable of transparently transporting IP QoS compliant sessions delivered from the application layer.

Our only reservation is that it is the distributed switch (shown in the diagram above as an MSC but in reality a distributed scheduling sub-system) which decides on bandwidth allocation on the basis of RF power and interference measurements supplied from the handset. This is a watered down implementation of the distributed computing model in which the application is made network aware (rather than the network being application aware). The distributed computing model implies the implementation of an Ethernet access and contention protocol (you see this today in DECT and related cordless access protocols). In Ethernets, the edge device is given the freedom to choose and acquire available bandwidth on the basis of locally measured interference. Our hunch is that the present cdma20000 implementation will be too over-centralized to support higher cell rates with adequate statistical multiplexing gain – keep an eye on Ethernet access and contention protocols – they will move inexorably towards wide area connectivity applications.

But in the meantime, plaudits for cdma2000 for being ahead in terms of practical wireless Internet implementation.

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