QUALITY IS KING

Raymond Wu looks at Quality of Service over WCDMA and GPRS

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While GPRS networks have reached a stable/mature state, the WCDMA networks are now coming on line. Mobile network operators will soon have the choice of delivering services to subscribers via one or both of these technologies. This choice brings with it different questions: are both networks suitable for all services? If not, what are the differences in service delivery? And therefore, who actually needs WCDMA networks and why?

Starting with the technical capabilities, the WCDMA network has more sophisticated mechanisms for delivering different Quality of Service (QoS) to subscribers. While the QoS parameters in GPRS (throughput, precedence etc.) exist, most services today are delivered on a "best effort" basis, i.e. there is very little active control over QoS in GPRS networks. In fact, it is not easy to see how the GPRS networks, for example in the air interface, can implement QoS to such an extent that different QoS levels can be guaranteed to the subscribers. The same can also be said for most core networks with IP version 4 - not to mention the public Internet.

WCDMA, in the air interface at least, would have more tools available for managing QoS. These include transport formats/traffic class in the higher layers, and power control and soft handover in the radio path. While these tools will enable the node B and UE to work closer together to manage QoS over the air, the same Situation as in GPRS exist for the core network/public Internet. Hence, while the WCDMA air interface part is an improvement over GPRS, it is still difficult today to visualise an end-to-end QoS guarantee over WCDMA.

Putting theory to one side, one can have a look at the actual performance of the two types of networks and see how they differ.

GPRS networks, with say four timeslot handsets, would typically deliver somewhere in the region of 30 or 40 Kbps throughput on the subscriber application level (running handshake protocols like FTP). The packet round trip time, between the air and Gi interfaces, would be slightly less than one second. These two parameters would have a significant impact on the transmission speed and reaction times, as seen by the subscriber.

The corresponding numbers for a WCDMA network with little load, can be 100 Kbps and 400 mS. In theory, therefore, WCDMA networks would have an edge over GPRS for subscriber services which require high transmission speed and/or fast reaction time.

Turning now to the actual services being offered today, they can roughly be divided into several groups: access to pre-packaged information, live communication between persons and access to private/public information which is not pre-configured.

Taking the first group, WAP has been used over GSM/GPRS to access pre-defined information like finance, news, sports results etc. Sometimes it can be combined with location-based services to add more value. The first WCDMA networks also offer something similar. Generally speaking, this type of information does not involve transferring a large amount of data. Hence GPRS or WCDMA would serve equally well - the exception being, for example, multimedia news/sports. If a streaming video clip were included, then the higher speed of WCDMA would be more suitable.

For information that is not pre-defined (for instance, reading an e-mail or surfing the web), the difference again rests on speed of transmission. Theoretically, accessing data via WCDMA would make a faster download. However, It is interesting to note that the first WCDMA network does not allow the user to go outside the network operator's portal - for instance, to read e-mail from a corporation's server or surf the public Internet. No doubt this will change in the future, but this current restriction really degrades the potential utilisation of the network.

For live communication between persons, e.g. voice calls, photo/text messaging, MMS, video calls etc., the WCDMA network is better, but not necessarily across the board.

Take voice calls - the bread and butter of cellular networks. All things being equal, i.e. no network problems/congestions, the WCDMA network speech quality is at least as good as enhanced full rate GSM. However, the drawback is, of course, coverage and roaming. For speech calls outside WCDMA coverage, the subscriber has to fall back/be handed over to GSM networks. The same is true for roaming. The first WCDMA network lists many roaming partners worldwide, almost all of which are GSM networks.

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For photo messaging or MMS, there is not much to choose between the two technologies, except perhaps speed. But if the size of the transfer is small, as in one photo, the difference is not very noticeable. It is interesting to note that the success of photo messaging and MMS perhaps depends on many factors other than the air interface technology. For example, compatibility between handsets (size of screen, type of files supported), between networks (whether network A can send to/receive from network B), the critical mass of photo/MMS capable phones in the subscriber population, tariffs, ease of use etc. lf these issues are overcome, then these services will be a success, irrespective of whether they are finally delivered over GPRS or WCDMA.

If one ignores the teething problems in WCDMA networks (e.g. lack of UE, software version compatibility between UE and node B, interop issues, coverage etc.), then the speed of transmitting a large file is the main differentiator between the choice of air technology. Indeed, this is most apparent when considering video calls.

Unless the promised implementation of more time slots, and higher coding schemes arrive in GPRS networks, it is difficult to imagine doing video calls over GPRS. However, while WCDMA would have a clear advantage here, the first implementation of video calls in WCDMA networks can still be improved upon.

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The first impression of video calls is that while the subject is stationary, e.g. the camera in the UE is pointing at the fade of the subscriber, then the video quality at the receiving end is reasonable. However, when the subject moves, e.g. the person cannot resist the temptation to wave his hand to say hello to the receiver, then the receiver would see a blur rather than a waving hand. While that is a very typical effect of the codec at both ends not being fast enough to cope with movements, possible problems with the transmission cannot be ruled out.

Furthermore, even in video transmissions where the subject is more or less stationary, sometimes the received picture can break up into not-so-perfectly-aligned rectangles. No doubt these early issues will be cleaned up as WCDMA networks/UE become more mature.

In conclusion, WCDMA technology would have a definite advantage over GPRS in video calls. Other services, as offered today, can be implemented almost just as well with GPRS. Another important plus point for WCDMA is that it offers frequencies that can be used to relieve GSM hot spots.

Both technologies can be expanded - GPRS in number of timeslots and coding scheme to give higher speed, and WCDMA will mature to overcome the lack of UE/coverage/ stability. It will be very exciting to see how these two technologies become the vehicle of choice to deliver different types of services. ☐