3GPP TSG-RAN Working Group2 meeting#2 TSGR2#2(99) 130

Stockholm, 8-11 March 1999

Agenda Item: 6.2

Source: Motorola (rapporteur of USCH email discussion group)

Report from the USCH email discussion group

Abstract

In this paper a brief summary is given of the 'USCH email' group discussions. The main questions are identified along with some of the answers where they are not already provided by other documents. Most of the questions and comments originated from emails sent by France Telecom (CNET), Mitsubishi and Alcatel.

Comments

1) It was noted that efficient management of uplink interference is important and that the issues and benefits of the USCH concept should be quickly clarified in order to be able to incorporate it in the first release if the benefits appear to justify the incremental cost (Source: France Telecom).

2) Agreement that optimisation of uplink resource usage deserves a proper MAC scheduling in the CRNC. Concern that when RRC is used there could be heavy RRC signalling and RNSAP signalling over Iur required (Source: France Telecom).

3) A few companies (France Telecom, Alcatel, Mitsubishi) questioned whether the USCH concept needs to be defined as a new transport channel. It was suggested that a DCH-like transport channel could be used. The difference would be that TFCI selection would take place within the CRNC MAC instead of within the UE MAC.

Response from Motorola: There are a number of features about the USCH which we believe warrants defining it as a separate transport channel:

a) It is distinguished from DCH since framing is always synchronised to one of the BS's in the active set.

b) Protocol termination points are different (there is a MAC_sh entity in the CRNC)

c) Association with ACCH

d) Option that link maintenance channel is only provided during packet bursts and for a one frame pre-cursor [3].

e) Possibility to use timing advance/retard.

Motorola believes that since there are a number of features which distinguish this concept from the DCH concept then for clarity it is useful to define the USCH as being a different transport channel (as is the case for the DSCH)

4) Alcatel raised the question: do you think the USCH can make use of soft hand-over?

Response from Motorola: Yes, under some conditions soft hand-over can improve performance and we do not see any reasons why the USCH could not be operated in SHO. This is discussed further in [1]

5) Alcatel and Mitsubishi raised the question: how could we make use of a DCH in the event that one already exists for another service eg speech?

Motorola response: It would be possible to make use of such a DCH for signalling and power control purposes if one already exists. However, there are also benefits in keeping power control and signalling mechanisms separate (see Appendix A [2] which addresses the benefits of code multiplexing). This topic will be explained further in future contributions.

6) Alcatel - Can you send signalling information from more than one ACCH in the event that the UE is in SHO?

Response from Motorola: We would envision that the UE would only have to listen to one ACCH for signalling purposes, the ACCH of the Synch-BS. The power of the ACCH would be chosen so that a reasonable signal would be obtained by the most distant UE in the cell. Since the information transmitted on the ACCH in each cell would be different and since the framing of each ACCH in each cell could be different it would not be possible to coherently combine the D/L signals in the UE RAKE receiver. We do not believe that the gain from listening to two ACCH's without use of coherent combining in the UE would be worthwhile. Perhaps of more interest is the possibility of using multiple ACCH's for power control purposes, this is discussed further in [1].

7) Mitsubishi - When you're at the boundary of two cells each connected to a different RNC, is it realistic to allocate resources only taking account of the impact in one of these two cells?

Response from Motorola: We agree with the concern raised, the system (RRC/MAC) must take into account the effect of any interference caused in both of the cells, see [1, 2].

8) Mitsubishi - query as to whether one or several low rate dedicated channels would be used for signalling (in the event that link maintenance between bursts is used)

Response from Motorola: Essentially, in the scenario under consideration we have a hybrid of DCH + USCH, hence there need be only one DCH (see [1] for more details).

9) Mitsubishi - In the event that a UE uses a DCH for one service and also requires access to the USCH - is re-synch of DCH's necessary ?

Response from Motorola: Code multiplexing is required when base site framing is not synchronised and when one of the services being carried cannot tolerate re-synch on hand-off (eg speech). See Appendix A [2] for more details .

10) Mitsubishi - >In our understanding, with USCH, you also lose one advantage of RRC scheduling in the case of multiplexing of services. I guess that for RT VBR services, you will have to guarantee the PBR. With USCH, even if this bearer is not constantly transmitted at the PBR, you will lose the unused resources, whereas with RRC TFCS control, you can probably take profit of RT service lower rate to transmit packet data with the corresponding unused resources.

Response from Motorola: Motorola disagreed on this point - There are a number of ways of taking advantage of unused uplink bandwidth on a RT VBR DCH:

a) The UE (running the RT VBR DCH) fills the unused resource with any NRT packets of its own (through conventional TF selection procedures). Note that this is not 100 % satisfactory since other users may have higher priority packets to send but no resource available.

b) If the UE has no NRT packets of its own to transmit then the resource could be assigned to another user. In order to do this in a tightly managed way then the UE would have to signal its future VBR RT requirements to the network in advance of actually transmitting the data (and in order to minimise delay on the RT service this would probably have to be done in every frame). So actually this solution is more likely to be achievable with a frame by frame messaging/scheduling, similar to that proposed for the USCH.

[c) Actually something which I did not mention in my response to Mitsubishi - A third possibility is that UE's do not signal their requirements on the RT-VBR service in advance but instead the MAC/RRC monitors usage of the RT-VBR resources and dynamically changes the size of the USCH on a frame by frame basis to exploit any spare capacity. To do this effectively there would have to be a good degree of auto-correlation in bit rate requirements across multiple frames on the RT-VBR connections being carried - this might be the case for DTX speech services for example . This gain could only be exploited where there is a mechanism for managing resource re-allocation between users very quickly and ideally on a frame by frame basis (ie. on the shared channels)]

d) Statistical averaging on the RRC layer

In actual fact I think you have hit upon a wider problem with the RRC/DCH approach which I'll elaborate on. In order for RRC (as it has been described to date) to take any advantage of the VBR nature of RT calls it must rely purely on statistical averaging. This is because to date the possibility of frame by frame (or at least) fast RRC signalling has not been proposed (and in any case even if it were, it would be less efficient than performing it on MAC [2]). Statistical averaging only works well when there is a lot of simultaneously active calls involved. For this to be the case the bit rate of the services must be low (since capacity is limited). Thus statistical averaging is therefore fine for low rate RT services such as speech. However, if a service requires (or would

benefit from) a high data rate then access to the channel has to be MANAGED - you can't rely on statistical averaging. And in the case of the uplink we believe that this management has to be centralised and performed in the network. As you will have seen from our papers it is well known that the performance of packet services will be improved if users are given access to the highest rate possible (a 'fat' shared pipe). This then is why we have advocated the use of a mechanism which enables tight frame by frame managed access to the uplink resource.

If we return to the example you consider, in my view, in its simplest form the RRC would make a decision as to how much power it has to allocate to the RT-VBR services (taking into account statistical averaging) and what remains would be divided up between the other channels of which one would be the shared channel. Hence implementation of the shared channel certainly wouldn't cause any problems and would actually provide an additional flexibility for more efficiently managing the resource over that which is currently available.

11) One question which I have heard expressed privately by a few companies is as follows - Why bother to design efficient packet support in the uplink when we expect that the capacity limit will be in the downlink?

Response from Motorola: We believe that the USCH will be important for optimising uplink spectral efficiency and packet call completion times/QoS. Whilst it is true that current WIRELINE trends tend to suggest that the uplink is not likely to represent the major bottle-neck we believe that it always makes sense to design a system which is as efficient as possible. This is important because it is always hard to predict future applications and somewhat risky to assume that the traffic characteristics of FUTURE WIRELESS applications will be the same as those of EXISTING WIRELINE applications. In addition we would expect that operators would price services so as to encourage usage of the uplink resource and thereby make the most of their investment.

However, even in the event that the traffic characteristics of future wireless services do turn out to be similar to those currently seen in the fixed network the USCH still provides a major benefit - improved speed of packet transmission. This is achievable because the USCH makes it possible to efficiently assign all the available uplink capacity to a single UE (if you want to). To understand the importance of fast packet transfer in service terms imagine a number of users in a tele-conference, jointly editing a document for example, in this case fast uplink FTP transfer of the document from one conference attendee to the others will be very valuable in improving the quality of the service. To take another example consider a user sending an email (which may have lengthy attachments). In this case it is often important that the email be sent as quickly as possible so that the user can get on with other work, or switch off his computer. Numerous other examples can also be envisaged.

References

[1] Motorola, 'Operating the USCH in SHO', 3GPP WG2, Stockholm, March 8-11, 99, TSGR2#2(99)126

[2] Motorola, 'Comparison of RRC and MAC based methods for dynamic scheduling between users on the uplink', 3GPP WG2, Stockholm, March 8-11, 99, TSGR2#2(99)127

[3]Motorola, 'Operation of the USCH without link maintenance', 3GPP WG2, Stockholm, March 8-11, 99, TSGR2#2(99)129