TSG RAN WG1#6 **TSGR1#6(99)799**
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Agenda Item:	**AH 14**
Source:	**Golden Bridge Technology**
Title:	**CPCH-related issues and concerns**
Document for:	**Discussion and Approval**

Concerns:

1. Complexity

Let's assume that 16 CPCH channels are used in a cell. What would be the resource requirements and complexity of the CPCH operation?

With 16 CPCH channels, the service provider can potentially allocate the entire cell to the packet data service (2 Mbps per cell). An example of CPCH configuration could be as follows:

1. 2 CPCH channels at 384 kbps
2. 4 CPCH channels at 144 kbps
3. 10 CPCH channels at 64 kbps

Total allocated capacity = 2 Mbps

So, we recommend the number of signatures to be less than 16. Given this scenario, the following requirements emerge:

1. 1 AP code per cell for the CPCHs (Gold Code)
2. 1 AP code per cell for the RACHs
3. 1 CD-P code per cell (Gold Code) for collision resolution
4. 16 DL channelization codes at SF=256 or SF=512 for DL-DPCCH
5. 2 channelization codes for AP-AICH and CD-AICH at SF=256
6. 8 Access slots for CPCH operation (separate from RACH)
7. 16 signature sequences for CPCH to be used with AP code and the same could be used for CD code.

If the access slots are divided between RACH and CPCH, the resource requirements will be as follows:

4 slots are allocated to CPCH and four slots are allocated to RACH. In this case only 1 AP code and 1 CD-P code are required for the joint operation of the CPCH and RACH. The same 16 signature sequences could be used for the AP and CD-P.

Can the signature sequences be divided between RACH and CPCH?

The procedures associated with RACH and CPCH are different. So the BTS will have to invoke two different sets of procedures upon detection of the signature sequence.

Yes, although the procedures are different, the signature sequences can be divided between the two services. This allows for re-use of the AP code and its corresponding receiver for both RACH and CPCH. There is still a need for CD-P code and the corresponding receiver.

Issues:

a. Operation of CPCH and DSCH

Currently DSCH operates in DSCH/DCH mode. Is it possible to have a DSCH/CPCH sub-state in the case of asymmetric downlink packet data transfer? There are two potential benefits to the operation of DSCH: 1) provision of slow power control, 2) L23 NAK and ACK for packet data.

When a packet call is originated from the UE and the service type is an asymmetric downlink traffic, then the UE shall enter the DSCH/CPCH sub-state. In this sub-state, the UE is not required to monitor the DSCH while transmitting on the CPCH. It is not expected to receive anything while transmitting control messages in the uplink direction. However, the UE can receive DPCCH and DSCH simultaneously if required.

b. Issues surrounding the use of DPCCH in the Downlink

Should the DPCCH carry signaling information as well as Pilot and Power Control?

If the DPCCH is kept to the level of carrying Pilot and Power Control, then the simultaneous reception of FACH/DPCCH will not be as complex as having two receivers. So, by avoiding transmission of signaling information on DPCCH, multiple reception requirement in the UE is avoided.

The main reason for not using the downlink DPCCH (associated with CPCH) is that the DL-DPCCH is not reliable for downlink transport since it is Uplink demand driven. The CPCH/DL-DPCCH will be up only for a short period of time and the RNC does not know when the channel is released. So, it can not schedule reliable L23 signaling over this channel.

It is recommended that we do not use DL-DPCCH (associated with CPCH) for signaling purposes (current agreement in WG2).

c. Use of idle AICH

It has been suggested that the use of N_Frames_Max to estimate when CPCH is idle is inefficient and might lead to CPCH being idle if the packet length is less than the allowed maximum level. It should be noted that currently the monitoring of AP-AICH is not a requirement either due to the complexity that will be introduced in receiving DPCCH/FACH/AICH simultaneously at the UE. So, currently, the UE will contruct a recency table (manufacturer implementation dependent) where it estimates the availability of various CPCH channels. The UE will not be able to monitor the reception of AP-AICH when it is transmitting over the CPCH in the uplink direction. In order to improve the accuracy of the entries in the recency table, GBT proposes addition of idle-

AICH in the downlink direction. This message is transmitted by the Base Node upon completion of the message reception. The idle-AICH will be the equivalent of idle indication in DSMA, whereas AP-AICH will be the implementation of busy indication in this protocol.

Recommendation: adopt idle-AICH for CPCH.

d. TFCI

Is there a need for TFCI in the CPCH scheme? (FFS item)

Not required for data rate determination
Service multiplexing in MAC
Dynamic rate down
Physical layer multiplexing (same Qos and different Qos)

The use of TFCI in CPCH is not to allow the Base Node to determine the rate since the rate is known from the initial choice of the signature sequences. Note that there should be a mapping of signature sequences to data rate for the bandwidth management purposes. However, for service multiplexing of services with different QoS and flexibility in building packets longer than 80 ms, we should keep the TFCI concept for CPCH. Another compelling reason is the ability to lower rate if signaled by UTRAN. The down-rating indication could come over a Downlink Common Channel when UTRAN identifies the need to lower the CPCH traffic loading immediately.

While the service multiplexing can be done at the MAC, it imposes limitation on the size of the transport block which will be appended by CRC. As an example, if we were to have Turbo coding with 80 ms interleaving operating at 384 kbps, then we will be limited to using a CRC for the entire 80 ms packet which is inefficient.

Another example is the case where N_Max_Frames = 11, then a block of size 80 ms, 20 ms and 10 ms can be used to build the 110 ms packet by the MAC. However, one can use different Transport Format for each transport blocks.

Recommendation: discussion and possible removal of FSS if there is agreement.

e. AICH monitoring, power consumption, multiple reception in the downlink direction (AICH/DL-DPCCH/FACH)

The AICH monitoring only occurs when the UE is in the RRC-connected mode and not transmitting, therefore there is minimal impact on power consumption. Monitoring of the AICH is not required while the UE is transmitting on the CPCH. In that mode, the UE should only monitor the DL-DPCCH and FACH.

f. Transmission Stop Control

Could there be any mechanism to stop transmission of the uplink CPCH by the base node if required?

Whenever the Base node indicates that certain CPCH channels should be shut down, then the base stops DPCCH in DL, the UE senses halt of the downlink transmission [within tbd ms]. The UE will then stops the uplink transmission over the CPCH.

Recommendation: Adopt the Transmission Stop Control method as described here to halt CPCH transmission at any time if required.