TSG-RAN Working Group 3 meeting #4
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Agenda Item: 14.1

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Title: **Basic structure of DCH FP frame**

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1 Introduction

This contribution proposes the basic structure of the FP frames for the DCH channel

2 Discussion

UMTS 25.427 states that one FP frame for DCH contains one TBS, and that there is one transport connection per dedicated transport channel.

The DCH frame protocol was not discussed in meetings #2 and #3, but the above mentioned assumptions were questioned by two contributions ([R3-99196] and [R3-99307]).

Those papers are briefly discussed in the following two sections. The third section is about the length indicator in FP frames.

2.1 [R3-99307]: Need for a FP multiplexing of different data frames

[R3-99307] proposes that all the DCHs allocated to one UE are multiplexed into the same transport connection, and all the TBS are carried into one FP frame.

This approach is not applicable when:

1. The DCHs have different transport requirements. Longer TBS may have longer transport delay than, for example, voice TBS: this is necessary in order to reduce the peak bit rate required by the ATM connection (the MAC co-ordination is not possible in case of two DCHs carrying RT data). DCH with different QoS requires different transport connections.
2. The DCHs have different transmission time interval (interleaving period) and/or different chip offset: in this case it is not possible (or not efficient) to convey them in one common frame.
3. The DCHs are not setup at the same time. The current Transport Network control plane signalling (q.aal2) does not allow the modification of the QoS of the transport connection that is necessary when additional bandwidth need to be reserved for the new DCH.

But, when applicable, this method reduces the required number of signalled transport connections, and the transport overhead. In particular this shall be recommended for the DCHs generated from AMR codec, and any other case of Unequal Error Protection (for example the data + outband signalling that may be required by Type II/III Hybrid ARQ).

It is then proposed that FP multiplexing among DCHs of the same UE shall be possible, but it shall not be mandatory for all the DCHs of the same UE.

2.2]R3-99196]: Need to send one TB per FP frame

[R3-99196] proposes that only one TB shall be carried in the TBS frame.

This has the following drawbacks:
1. Prevents FP multiplexing that, as discussed before, brings relevant advantages in case of AMR codec / UEP.
2. Increases the amount of messages (frames) in Iub/Iur, especially for high bit rate packet data DCHs (TB size of 300-600 bits).
3. Increases the transport overhead, due to the increased number of frames and to the necessity to repeat TBS specific control information (like CFN, TFI) for every TB (an additional TB number field is needed).

But this solution may bring a sensible reduction of the DL transport delay in case of constant bit rate services with long interleaving time.

It is proposed that this issue is further studied in WG3 for constant bit rate services with long interleaving time only, considering:
- If it is possible for the MAC layer to release a TB when the TBS has not been completely composed.
- The transport delay requirements for such services
- What is the minimum size of the TB for such services

2.3 FP Frame length

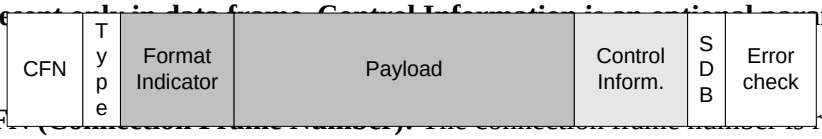
Since the ATM/AAL2 decoders are capable of providing the length of the AAL2 SDU, the length information is not needed in the FP frames, but passed to the FP by the AAL2 receiver through the SAP.

3 DCH frame structure

3.1 Basic frame structure

The basic structure of a DCH FP frame, common to all the DCH FP frame types described in the following chapters, is shown in the figure below.

Figure 1: Basic Structure of a DCH Frame Protocol Frame. Format indicator and payload are present only in data frame. Control Information is an optional parameter,



CFN (Connection Frame Number): The connection frame number is required by the frame synchronisation mechanism.

Frame type: Frame type is used to differentiate different frame types that can be conveyed over the same transport connection in the same direction.
Thus the Frame Type need to differentiate between control frames and data frames only.

Format Indicator: The format indicator specifies the format and attributes (TB size and number, L1 processing) of the data contained in the payload.
The Format indicator is for example a sequence of TFIs (the number of TFIs included in the Format indicator is a static attribute of the DCH).

Payload: The payload is a sequence of Transport Blocks plus, optionally, a quality indicator associated to the data. The presence and the nature of the quality indicator is a static attribute of the DCH, defined when the DCH is setup.

The Format Indicator plus payload are mandatory in data frames and are not present in control frames. The format indicator may indicate a payload of length zero.

Control Information: Control information field contains generic parameters not directly related to the data in the payload (if any), and it is an optional field in data and control frames.
The nature of the control information is a static attribute of the DCH (for example TA bits in UL frame and Outer Loop Power Control command in DL frame), and thus a *control information type* field is not required.

(SDB) Silence Detection Bits: This field is needed for handling the discontinuous transmission as described in [R3-99518].

Error check bits: this field contains the bit for the detection of errors in the whole FP frame.

3.2 UL data frame structure

The UL data frame structure is defined referring to the basic frame structure presented in the previous chapter, as follow:

- CFN: defines the CFN of the first radio frame used for the transmission of the TBS over the air interface. It is used for UL MDC combining, and also passed to L2 for further processing.

- Format Indicator: The format Indicator field contains a sequence of TFI, one TFI per DCH that is multiplexed in the same FP connection.

- Payload: it contains a sequence of TBS, one TBS per DCH that is multiplexed in the same FP frame, plus the result (OK, not OK) of the air interface CRC check for each TBS, to be used as quality indicator.

- Control Information: It contains the timing adjustment bits needed for the user plane synchronisation, as described in chapter 8.2. This field is optional.

- SDB: It contains the Transmit Silence Bit (TSB), for UL DTX handling, and Receive Silence Bit (RSB) for DL DTX handling, as described in [R3-99518].

The coding of the UL data frame is described in 7.3.1

3.3 DL data frame structure

The DL data frame structure is defined referring to the basic frame structure as follow:

- CFN: defines the CFN of the first radio frame that shall be used for the transmission of the TBS over the air interface. It is used for Frame synchronisation.

- Format Indicator: The format Indicator field contains a sequence of TFIs, one TFI per DCH that is multiplexed in the same FP frame.

- Payload: it contains a sequence of TBS, one TBS per DCH that is multiplexed in the same FP connection.

- Control Information: It contains the UL Eb/No setpoint control information needed for the outer loop power control, as described in chapter 8.3. This field is optional

- SDB: It contains the Transmit silence bit (TSB), for DL DTX handling, and Receive Silence Bit (RSB) for UL DTX handling, as described in [R3-99518].

The coding of the DL data frame is described in 7.3.1

3.4 UL control frame structure

The UL data frame structure is defined referring to the basic frame structure as follow:

- CFN: It contains the CFN of the DL frame that triggers the timing adjustment command.

- Control Information: It contains the timing adjustment command needed for the user plane synchronisation, as described in chapter 8.2. This field is optional.

- SDB: It contains the Transmit Silence Bit (TSB), for UL DTX handling, and Receive Silence Bit (RSB) for DL DTX handling, as described in [R3-99518].

The coding of the UL data frame is described in 7.3.2

3.5 DL control frame structure

The DL control frame is defined referring to the basic frame structure as follow:

- CFN: defines the CFN that shall be considered by the Node B as reference for the timing adjustment procedure, as described in chapter 8.2

- Control Information: It contains the UL Eb/No setpoint control information needed for the outer loop power control, as described in chapter 8.3. This field is optional.

- SDB: It contains the Transmit Silence Bit (TSB), for DL DTX handling, and Receive Silence Bit (RSB) for UL DTX handling, as described in [R3-99518].

The coding of the DL data frame is described in 7.3.2

4 Proposal

The proposals are:

- To remove the assumption/statement that there shall be one transport connection (aal2 connection) per dedicated channel in one Iub or Iur user port.

- To replace the current text in sections 7.1.1 and 7.1.2 of [25.427] with sections 3.2 and 3.3 of this document.

- To include sections 3.4 and 3.5 of this document in sections 7.2.1 and 7.2.2 of [25.427].

- To include section 3.1 of this document in a new subchapter (7.1) of chapter 7 in [25.427]

- Include in the description of the NBAP/RNSAP RL Reconfiguration procedure (UMTS 25.423/25.433) the following text:

The procedure allows the multiplexing of DCHs into the same transport connection.

Modification are also required in the RNSAP/NBAP RL Setup/Addition procedures and messages content, in order to have multiple DCHs with the same transport address.

- Create a new subchapter in 6.2 of [25.427] (6.2.1: Length Information), with the following text

  The length of the FP frame is not specified in the FP structure, as it shall be available through the SAP from the transport layer.

5 References

[25.427] *Iub/Iur Frame Protocol for DCH data streams, v. 0.1.0* (Editor)
[R3-99196] *Dedicated Channel Frame Protocol* (Ericsson)
[R3-99307] *Multiplexing of DCHs over the same transport bearer* (Nortel)
[R3-99518] *Handling of discontinuous transmission in Iub/Iur interfaces* (Nokia)