TSG-RAN Working Group 3 meeting #4
Warwick, England, 1st – 4th June 1999

TSGW3#4(99)505

Agenda Item: 14.1

Source: Nortel Networks

Title: Multiplexing of DCHs over the same transport bearer

Document for:

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1 Background

This contribution refines a proposal made in [1]. [1] is a broader paper concerning both the Iu and Iub and is primarilly driven by UEP services. However, the Iur and Iub aspects are not limited to UEP services but more general to the multiplexing of several DCHs on the same DPDCH.

2 Iub/Iur Aspects

As for the Iu, services with several flows requiring different QoS shall have different channel coding for each flow. The generic way to specify a channel coding is to set-up a DCH.
It is therefore proposed that services requiring different channel coding for several flows such as Speech Services are realised through Multiple DCHs.

This have the advantage to be generic and gives a total independence of UTRAN towards Speech Coding techniques.
In order not to have penalties in the transport layers due to a higher number of DCHs, it is proposed to multiplex on the same transport bearer the DCHs towards a same UE.

Amongst the many advantages compared to the current working assumption to have one transport bearer per DCH we can note :

- Easier transport dimensioning for the BTS, since it will depend on the Radio interface Capacity but not on how this capacity is used (one or several DCHs)
- Handling of the DCH FP is made simpler since all the DCHs related to a Radio Link are received at the same time. There is no time out to manage to cope with possible lost DCH frames of late DCH compare to the other.
- Radio link Set-up and addition time is made shorter since there is only one transport bearer to set-up compared to a larger number.
- Error Handling is simpler since transport bearer failure impact all de DCHs and not only part of them
- The Network overhead is minimised
- There is less waste of Iub/Iur bandwidth when a DCH has little or no data to transmit. The use of the DCH Control Frames is reduced to the situation where no DCH at all has anything to transmit or at initial sinchronisation.

On top the benefits and feasibility of the separation on multiple transport bearer (i.e. AAL-2 connections) of DCHs multiplexed on the same DPDCH is questionned :

The MAC-d controls the multiplexing of several DCHs on a DPDCH by coordinating the TFIs of each DCH according to the source traffic and the bandwidth of the DPDCH. This means that the MAC-d function must have the knowledge of which transport block set from each DCH will be combine together in order to present a compatible set of TFI that will be combined in a TFCI.

When at least one of the DCH is variable bit rate, and this is always the case for the DCH transmitting the RRC protocol as well as for DCHs participating to a speech service, in order to be able to take advantage of available remaining bandwitdh for the other DCHs, the transport bloc sets sent by MAC-d at a given time need to be transmitted over the radio at the same CFN.

From an Iub and Iur perspective, this means that all those DCHs exibit the same QoS requirement which is due to the thoughest DCH.

3 Proposal

It is proposed to update [2] in the following way.

3.1 General aspects

The specification of I_{ub} DCH data streams is also valid for I_{ur} DCH data streams.

The SRNC is responsible for creating communications inside the SRNS. The SRNC provides to the Node B the complete configuration of the Transport channels to be provided by the Node B for a given communication.
The parameters of a Transport channel are described in [1]. These Transport channels are multiplexed on the downlink by the Node B on radio physical channels, and de-multiplexed on the uplink from radio physical channels to Transport channels.
~~Every~~ All the Transport channels related to one UE context that ~~is~~ are communicated over a set of cells that are macro-diversity combined within Node B, ~~is~~ are carried on ~~one~~ a single transport bearer (e.g. AAL2 connection). This means that there ~~are as many~~ is only one transport bearer (e.g. AAL2 connection~~s~~) on which are multiplexed all the ~~as~~ Transport channels ~~and User ports~~ for that communication.
It is FFS whether unidirectional or bi-directional AAL2 connections are used.

[…]

3.2 Data frame structure

3.2.1 Uplink data frame

Every Transmission Time Period (typically one radio frame, i.e. 10ms), for each Transport channel, the Node B sends to the SRNC the following information:

- a Transport Block Set (user data) received from the radio interface
- the Transport Format Indicator (TFI) associated to the Transport Block Set
- A Quality indicator:
  Bad / Good frame

Other Quality indications are FFS.
When the frame is incorrectly received, it is not sent on the Iur interface.

All the Transport Channels are combined in the following frame :

	Information element	**Description**
	Message type	Uplink DCH data frame
	Connection ID	Used by soft combining function to identify multiple paths of the same call
	CFN	Indicator to which radio frame the data was received.
1st DCH	Transport Format Indicator	The TFI identifies the format of the transport channel as received from the radio interface
	Transport Bloc Set	This contains the data received from the radio interface
	Quality indicator	This may update the target outer loop power control
	Timing adjustment command	Needed for synchronisation purposes
1nd DCH	Transport Format Indicator	The TFI identifies the format of the transport channel as received from the radio interface
	Transport Bloc Set	This contains the data received from the radio interface
	Quality indicator	This may update the target outer loop power control
	Timing adjustment command	Needed for synchronisation purposes
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Last DCH	Transport Format Indicator	The TFI identifies the format of the transport channel as received from the radio interface
	Transport Bloc Set	This contains the data received from the radio interface
	Quality indicator	This may update the target outer loop power control
	Timing adjustment command	Needed for synchronisation purposes

Note : the DCH association is implicit with the rank in the DL data frame. So there is no need for a explicit DCH_ID.

3.3 Downlink data frame

Every Transmission Time Period (typically one radio frame, i.e. 10ms), for each Transport channel, the SRNC provides to the Node B the following information:

- a Transport Block Set (user data) to be sent on the radio interface
- the Transport Format Indicator (TFI) to use

~~The CID of the AAL2 frame identifies the Iub data stream where a Transport channel frame is transported.~~

	Information element	Description
	Message type	Downlink DCH data frame
	Connection ID	Used by soft combining function to identify multiple paths of the same call
	CFN	Indicator to which radio frame the data shall be transmitted.
	Outer Loop Power Control (optional)	This may update the target outer loop power control
1st DCH	Transport Format Indicator	The TFI identifies the format of the transport channel to be used on the radio interface
	Transport Bloc Set	This contains the data to be sent on the radio interface
2nd DCH	Transport Format Indicator	The TFI identifies the format of the transport channel to be used on the radio interface
	Transport Bloc Set	This contains the data to be sent on the radio interface
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Last DCH	Transport Format Indicator	The TFI identifies the format of the transport channel to be used on the radio interface
	Transport Bloc Set	This contains the data to be sent on the radio interface

Note : the DCH association is implicit with the rank in the DL data frame. So there is no need for a explicit DCH_ID.

4 References

[1] Tdoc TSGW3#2(99)214 A solution for the efficient support by the UMTS of the speech services, Source Nortel Networks

[2] TS 24.427 UTRAN Iub/Iur Interface User Plane Protocol for DCH Data Streams, Source Nokia (Editor)