3GPP TR 30.301 V0.2.0 (2005-09)

Technical Report

3rd Generation Partnership Project;
Technical Specification Group Radio Access Network;
3.84 Mcps TDD Enhanced Uplink;
RAN WG2 Stage 2 Decisions>
(Release 7)

Keywords
<keyword[, keyword]>

3GPP

Postal address

3GPP support office address
650 Route des Lucioles - Sophia Antipolis
Valbonne - FRANCE
Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Internet
http://www.3gpp.org

Contents

Foreword

This Technical Report has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

- x the first digit:
  - 1 presented to TSG for information;
  - 2 presented to TSG for approval;
  - 3 or greater indicates TSG approved document under change control.
- y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.
- z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

This document is a Technical Report which captures the Stage 2 decisions on the support of 3.84 Mcps TDD Enhanced Uplink in UTRA.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 25.804: "Feasibility Study on Uplink Enhancements for UTRA TDD".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[3] 3GPP TR 25.309: FDD Enhanced Uplink; Overall description; Stage 2

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [2] and the following apply:

Data Description Indicator (DDI): MAC-e header field used to identify the logical channel, MAC-d flow and the size of the MAC-d PDUs concatenated into a MAC-es PDU.

E-DCH: Enhanced DCH, a new dedicated transport channel type.

Serving E-DCH cell: Cell from which the UE receives Absolute Grants from the Node-B scheduler. A UE has one Serving E-DCH cell.

T1: difference between the index of the frame in which Absolute Grant is received and the index of the frame in which the UE must transmit/retransmit data, e.g. if an Absolute Grant is received in Frame (i) and data must be transmitted/retransmitted in Frame (i+3) then T1 = 3.

T2: difference between the index of the frame in which a data block is transmitted/retransmitted and the index of the frame in which ACK/NACK is received for that data block, e.g. if a data block is sent in Frame (k) and ACK/NACK is received in Frame (k+2) then T2=2.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [2] and the following apply:

AG	Absolute Grant
E-AGCH	E-DCH Absolute Grant Channel
E-HICH	E-DCH HARQ Acknowledgement Indicator Channel

E-RNTI	E-DCH Radio Network Temporary Identifier
E-RUCCH	E-DCH Random Access Uplink Control Channel
E-TFC	E-DCH Transport Format Combination
E-UCCH	E-DCH Uplink Control Channel
HARQ	Hybrid Automatic Repeat Request
RSN	Retransmission Sequence Number
TSN	Transmission Sequence Number

4 Background and Introduction

The technical objective of the work item "3.84Mcps TDD Enhanced Uplink" is to improve the performance of uplink dedicated logical channels, i.e. to increase capacity and throughput and reduce delay. This work item is applicable for UTRA TDD at 3.84 Mcps only.

Of the techniques considered in [1], the following techniques are part of the work item:

- Node B controlled rate scheduling
- Node-B controlled physical resource scheduling
- Hybrid ARQ
- Higher order modulation (including 8-PSK at a minimum)
- Intra-frame code hopping.

It relies upon a new type of transport channel, the E-DCH which is terminated at the Node B.

5 Requirements

- The Enhanced Uplink feature shall aim at providing significant enhancements in terms of user experience (throughput and delay) and/or capacity. The coverage is an important aspect of the user experience and it is desirable to allow an operator to provide for consistency of performance across the whole cell area.
- The focus shall be on urban, sub-urban and rural deployment scenarios.
- Full mobility shall be supported, i.e., mobility should be supported for high-speed cases also, but optimisation should be for low-speed to medium-speed scenarios.
- Improvements to the uplink performance of the dedicated logical channels in general are required, with priority given to improving the uplink performance with respect to streaming, interactive and background services. Relevant QoS mechanisms shall allow the support of streaming, interactive and background PS services.
- It is highly desirable to keep the Enhanced Uplink as simple as possible. New techniques or group of techniques shall therefore provide significant incremental gain for an acceptable complexity. The value added per feature/technique shall be considered in the evaluation. It is also desirable to avoid unnecessary options in the specification of the feature.
- The UE and network complexity shall be minimised for a given level of system performance.
- The impact on current releases in terms of both protocol and hardware perspectives shall be taken into account.
- It shall be possible to introduce the Enhanced Uplink feature in a network which has terminals from Release'99, Release 4, Release 5 and Release 6. The Enhanced Uplink feature shall enable significant improvements in overall system performance when operated together with HSDPA. A terminal supporting the Enhanced Uplink feature must support HSDPA.

- Enhancements shall improve uplink performance for 3.84 Mcps TDD. Commonality with the FDD E-DCH feature [3] is desired as long as this does not impair the system performance of 3.84 Mcps TDD.
- Although operation of the enhanced uplink is targeted at cell_DCH state, it shall be possible to operate enhanced uplink without assigning any dedicated physical resources to a UE. It shall thus be possible to run enhanced uplink "stand-alone" or in parallel with HS-DSCH without associated (or otherwise) uplink or downlink dedicated physical channels.

6 Overall architecture of enhanced uplink DCH

6.1 Protocol architecture

The following modifications to the existing nodes are needed to support enhanced uplink:

UE

A new MAC entity (MAC-es/MAC-e) is added in the UE located below MAC-d. MAC- es/MAC-e in the UE handles HARQ retransmissions, scheduling, MAC-e multiplexing and E-DCH TFC selection.

Node B

A new MAC entity (MAC-e) is added in Node B which handles HARQ retransmissions, scheduling and MAC-e demultiplexing.

S-RNC

A new MAC entity (MAC-es) is added in the SRNC to provide in-sequence delivery (reordering) .

The resulting protocol architecture is shown in Figure 6.1-1:

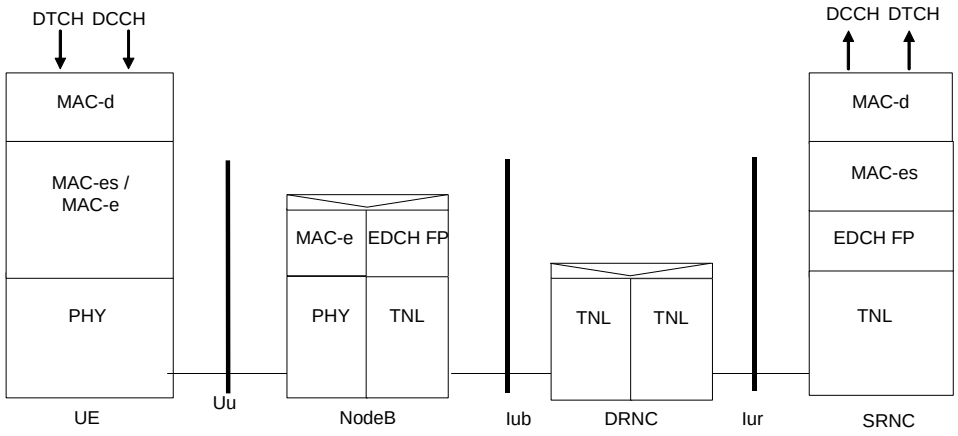


Figure 6.1-1: Protocol Architecture of E-DCH

<Editor's Note: The need for an E-DCH FP for 3.84 Mcps TDD in the DRNC is to be discussed (this is under the scope of RAN WG3)>.

6.2 Transport channel attributes

The E-DCH transport channel has the following characteristics:

- E-DCH uses a separate CCTrCH to any CCTrCHs used to provide DCH (there is no necessity to have a DCH in conjunction with E-DCH)
- There is only one CCTrCH of E-DCH type per UE;
- There is only one E-DCH per CCTrCH of E-DCH type;
- There is only one MAC-e transport block per TTI;
- A 10 ms TTI is supported by the E-DCH;

6.3 Basic physical structure

6.3.1 UL Physical layer model

E-DCH model with HS-DSCH

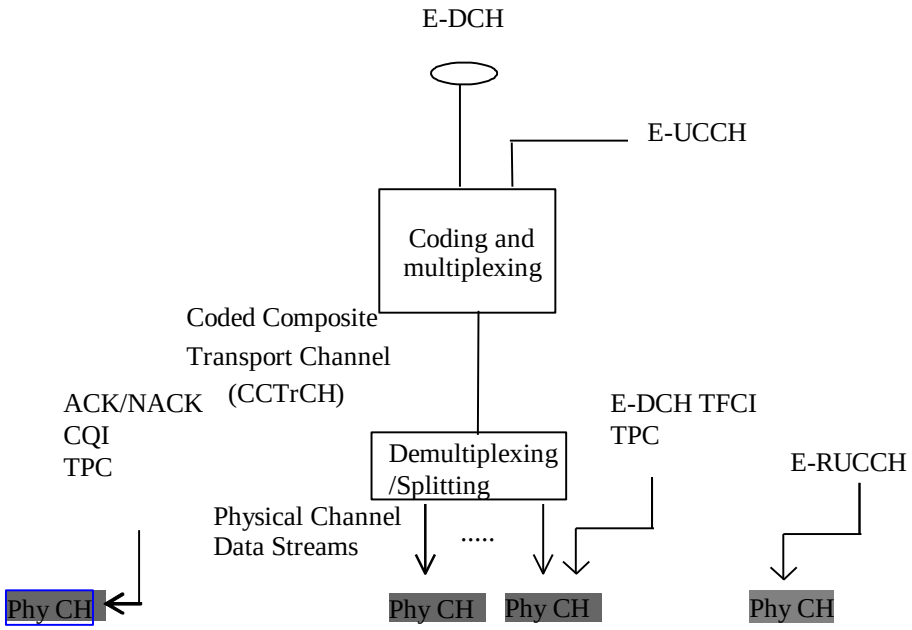


Figure 6.3.1-1a: Model of the UE's Uplink physical layer

E-DCH model with DCH and HS-DSCH

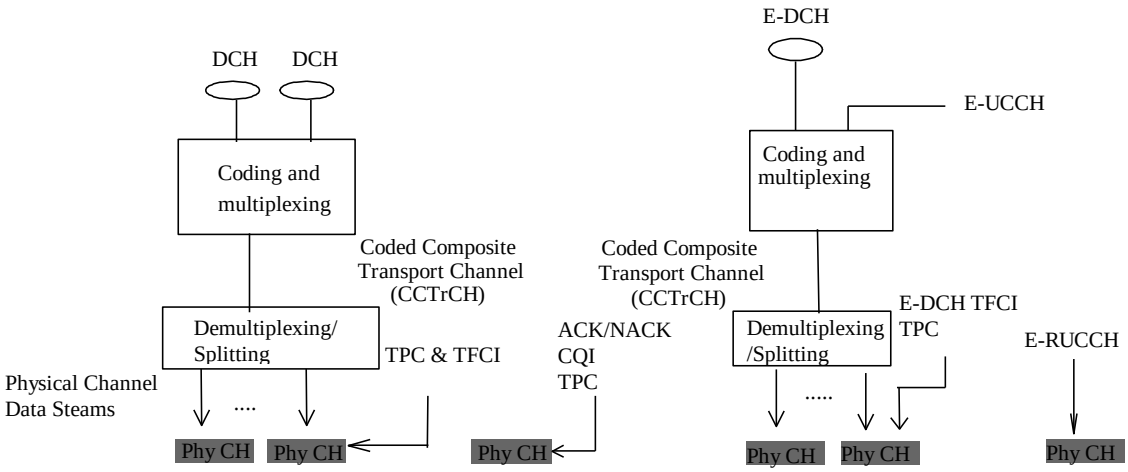


Figure 6.3.1-1b: Model of the UE's Uplink physical layer (E-DCH with DCH and HS-DSCH)

<Editor's Note: The exact contents of E-UCCH and E-RUCCH are FFS>

<Editor's Note: The means of mapping E-UCCH to Physical Channels is to be confirmed by RAN WG1>

6.3.2 DL Physical layer model

E-DCH model with HS-DSCH

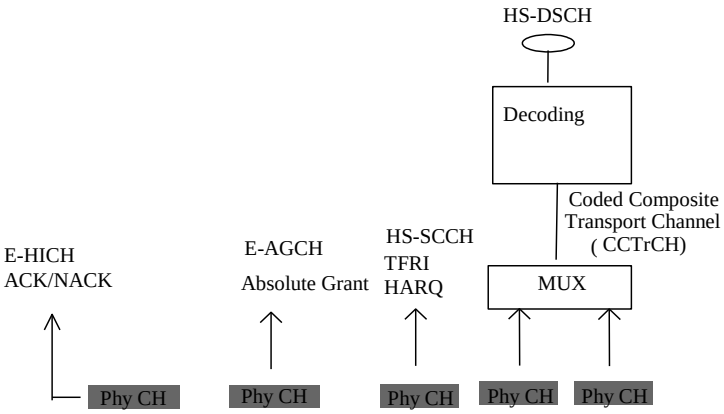


Figure 6.3.2-1a: Model of the UE's Downlink physical layer.

E-DCH model with DCH and HS-DSCH

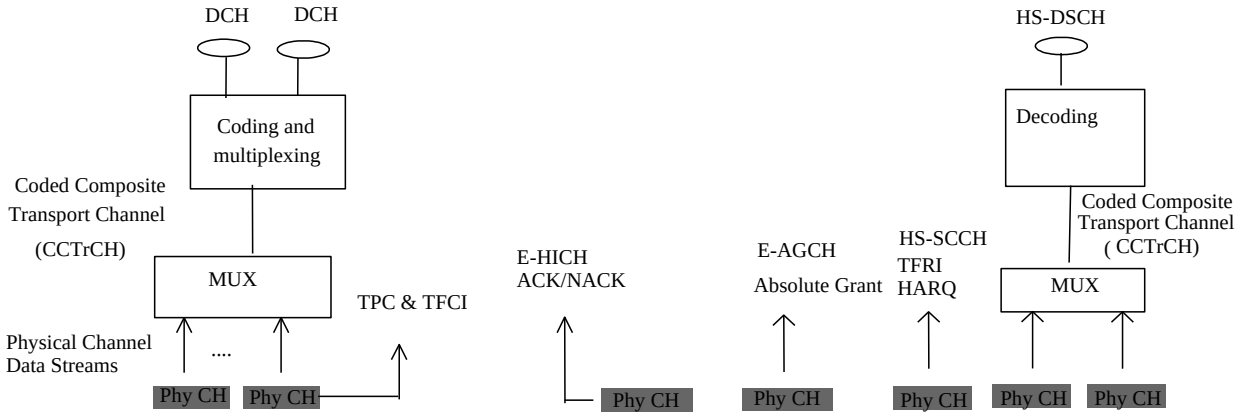


Figure 6.3.2-1b: Model of the UE's Downlink physical layer (E-DCH with DCH and HS-DSCH)

The ACK/NACKs received from UTRAN are all sent to MAC by L1.

The UE monitors a set of E-AGCH channels in every frame (E-AGCH$_1$, E-AGCH$_2$, ……..., E-AGCH$_{max}$). It receives an Absolute Grant if it decodes its E-RNTI on one of these E-AGCHs.

E-DCH ACK/NACKs are transmitted on a physical channel called the E-HICH. A single E-HICH per frame shall carry the ACK/NACK for all of the UE's requiring H-ARQ acknowledgement in that frame.

7 MAC architecture

7.1 General Principle

7.1.1 MAC multiplexing

The E-DCH MAC multiplexing has the following characteristics:

- Logical channel multiplexing is supported at MAC-e level;
- Multiple MAC-d flows can be configured for one UE;
- The multiplexing of different MAC-d flows within the same MAC-e PDU is supported. <Editor's Note: Any restriction on multiplexing options is FFS>.
- There can be up to 8 MAC-d flows for a UE.
- Up to 16 logical channels can be multiplexed on an E-DCH transport channel

7.1.2 Reordering entity

The re-ordering entity is part of a separate MAC sub-layer, MAC-es, in the SRNC. Data coming from different MAC-d flows are reordered in different reordering queues. There is one reordering queue per logical channel.

The reordering is based on a specific TSN included in the MAC-es PDU. For each MAC-es PDU, the SRNC receives the TSN originating from the UE to perform the re-ordering. Additional mechanisms (e.g. timer-based and/or window-based) are up to SRNC implementation and will not be standardised. Furthermore, the reordering entity detects and removes duplicated received MAC-es PDUs.

7.2 MAC architecture – UE side

7.2.1 Overall architecture

The overall UE MAC architecture, which is shown in Figure 7.2.1-1, includes a new MAC-es/MAC-e entity which controls access to the E-DCH. A new connection from MAC-d to MAC-es/MAC-e is added to the architecture, as well as a connection between MAC-es/MAC-e and the MAC Control SAP.

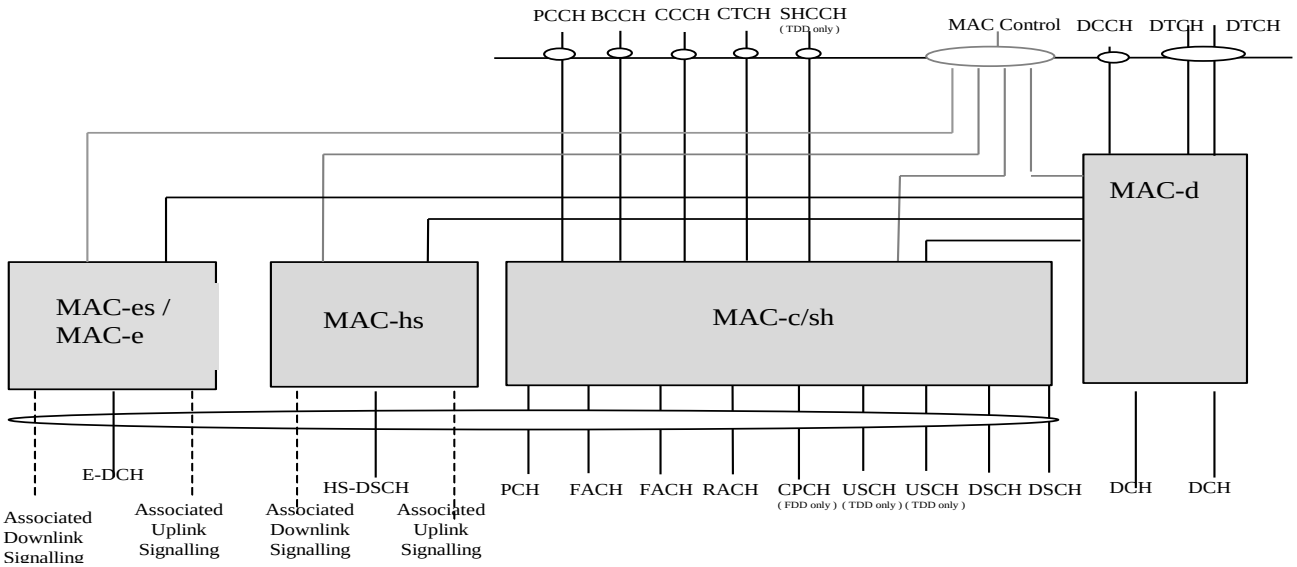


Figure 7.2.1-1: UE side MAC architecture

As shown in Figure 7.2.1-2, a RLC PDU enters MAC-d on a logical channel. The MAC-d C/T multiplexing is bypassed. In the MAC-e header, the DDI (Data Description Indicator) field (6 bits) identifies the logical channel, MAC-d flow and MAC-d PDU size. A mapping table is signalled over RRC, to allow the UE to set DDI values. The N field (fixed size of 6 bits) indicates the number of consecutive MAC-d PDUs corresponding to the same DDI value. A special value of the DDI field indicates that no more data is contained in the remaining part of the MAC-e PDU.The TSN field (6 bits) provides the transmission sequence number on the E-DCH. The MAC-e PDU is forwarded to a Hybrid ARQ entity, which then forwards the MAC-e PDU to layer 1 for transmission in one TTI.

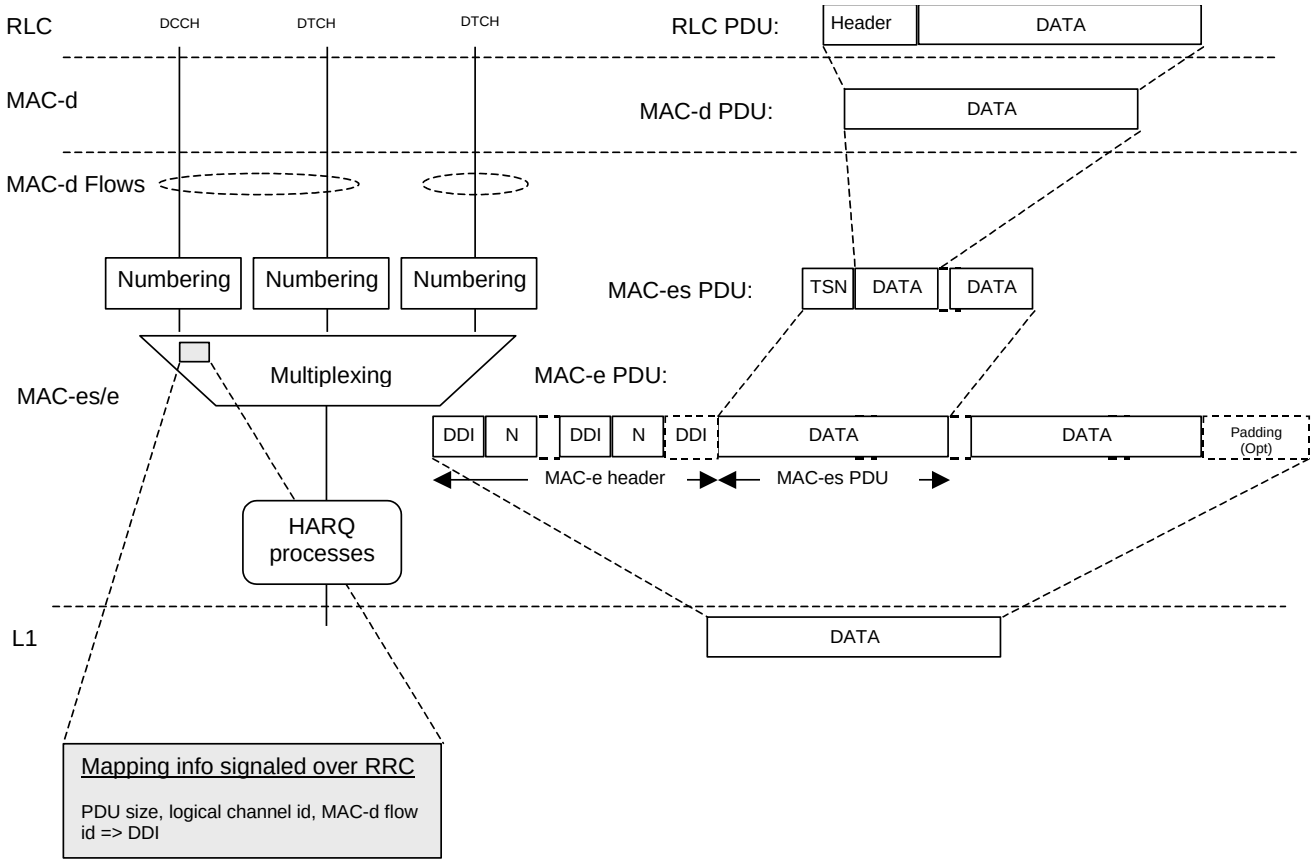


Figure 7.2.1-2: Simplified architecture showing MAC inter-working in UE. The left part shows the functional split while the right part shows PDU construction.

7.2.2 Details of MAC-d

For support of E-DCH a new connection to MAC-es is added.

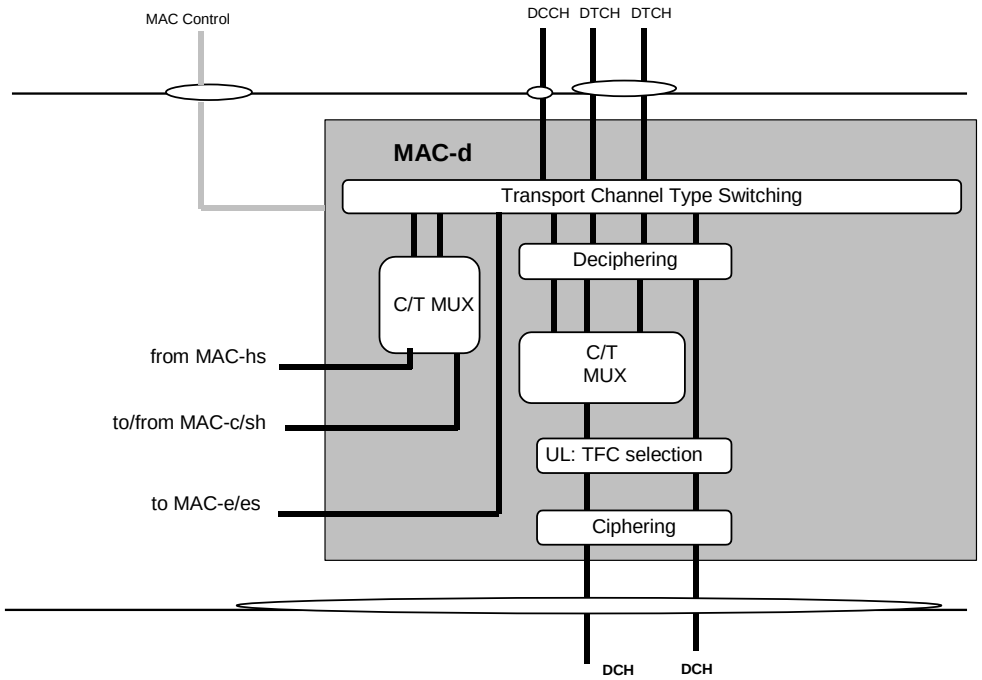


Figure 7.2.2-1: UE side MAC architecture/ MAC-d details

7.2.3 Details of MAC-c/sh

The support of E-DCH implies no change to the UE MAC-c/sh entity.

7.2.4 Details of MAC-hs

The support of E-DCH implies no change to the UE MAC-hs entity. <Editor's Note: Further study is required to confirm this>.

7.2.5 Details of MAC-es/MAC-e

The MAC-es/e handles the E-DCH specific functions. The split between MAC-e and MAC-es in the UE is not detailed. In the model below the MAC-e/es comprises the following entities:

- HARQ:
  The HARQ entity is responsible for handling the MAC functions relating to the HARQ protocol. It is responsible for storing MAC-e payloads and re-transmitting them. The detailed configuration of the hybrid ARQ protocol is provided by RRC over the MAC-Control SAP. The HARQ entity provides the HARQ process identity, the E-TFC, the retransmission sequence number (RSN) and an indication of the power to be used by L1. The redundancy version (RV) of the HARQ transmission is derived by L1 from RSN. RRC signalling can also configure the HARQ entity to use RV=0 for every transmission.

- Multiplexing:
  The multiplexing entity is responsible for concatenating multiple MAC-d PDUs into MAC-es PDUs, and to multiplex one or multiple MAC-es PDUs into a single MAC-e PDU, to be transmitted at the next TTI, and as instructed by the E-TFC selection function. It is also responsible for managing and setting the TSN per logical channel for each MAC-es PDU.

- E-TFC selection:
  This entity is responsible for E-TFC selection according to the scheduling information (Absolute Grants) received from UTRAN via L1, and for arbitration among the different flows mapped on the E-DCH. The detailed configuration of the E-TFC entity is provided by RRC over the MAC-Control SAP. The E-TFC selection function controls the multiplexing function.

- Scheduling Access Control:

  The Scheduling Access Control entity is responsible is responsible for routing associated uplink signalling via E-UCCH (in the case that E-DCH resources are assigned) or via E-RUCCH (in the case that no E-DCH resources are assigned). It is also responsible for obtaining and formatting the appropriate information to be carried on E-UCCH/E-RUCCH.

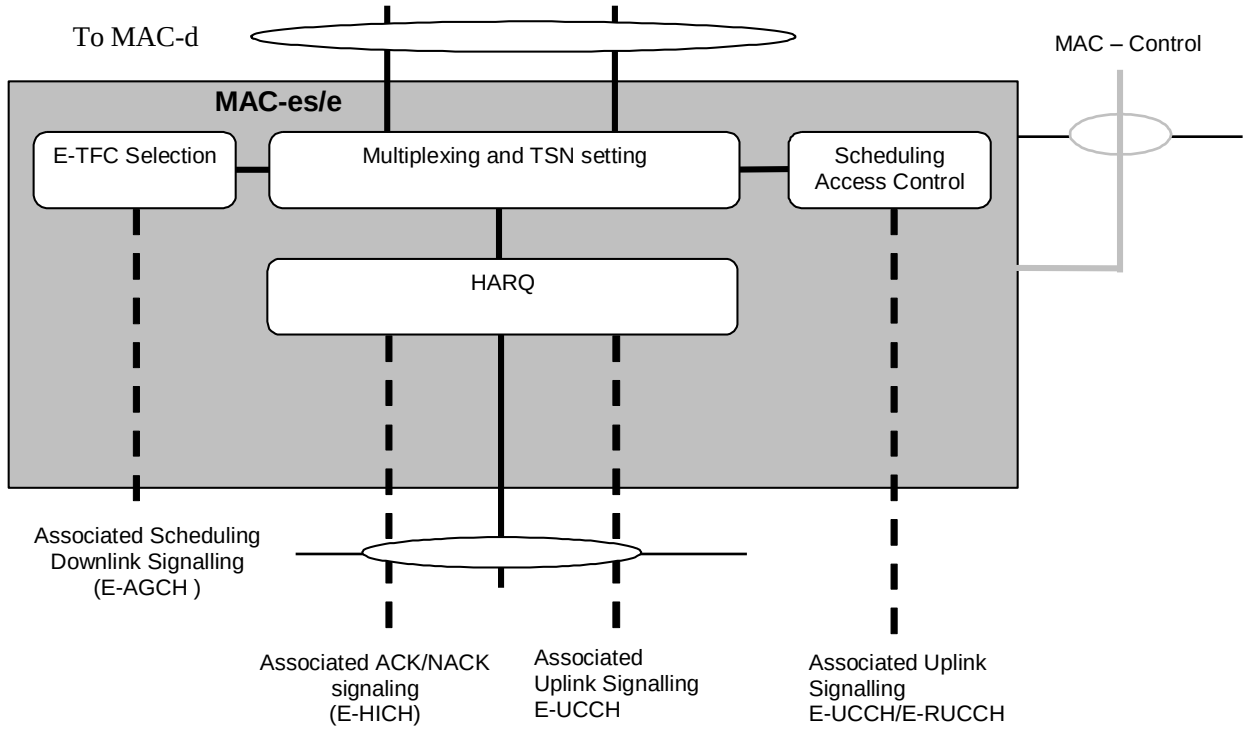


Figure 7.2.5-1: UE side MAC architecture / MAC-es/e details

7.3 MAC architecture – UTRAN side

7.3.1 Overall architecture

The overall UTRAN MAC architecture, which is shown in Figure 7.3.1-1, includes a new MAC-e entity and a new MAC-es entity. For each UE that uses E-DCH, one MAC-e entity per Node-B and one MAC-es entity in the SRNC are configured. MAC-e, located in the Node B, controls access to the E-DCH and is connected to MAC-es, located in the SRNC. MAC-es is further connected to MAC-d. For control information, new connections are defined between MAC-e and a MAC Control SAP in the Node B, and between MAC-es and the MAC Control SAP in the SRNC.

There is one Iub transport bearer per MAC-d flow (i.e. MAC-es PDUs carrying MAC-d PDUs from the same MAC-d flow).

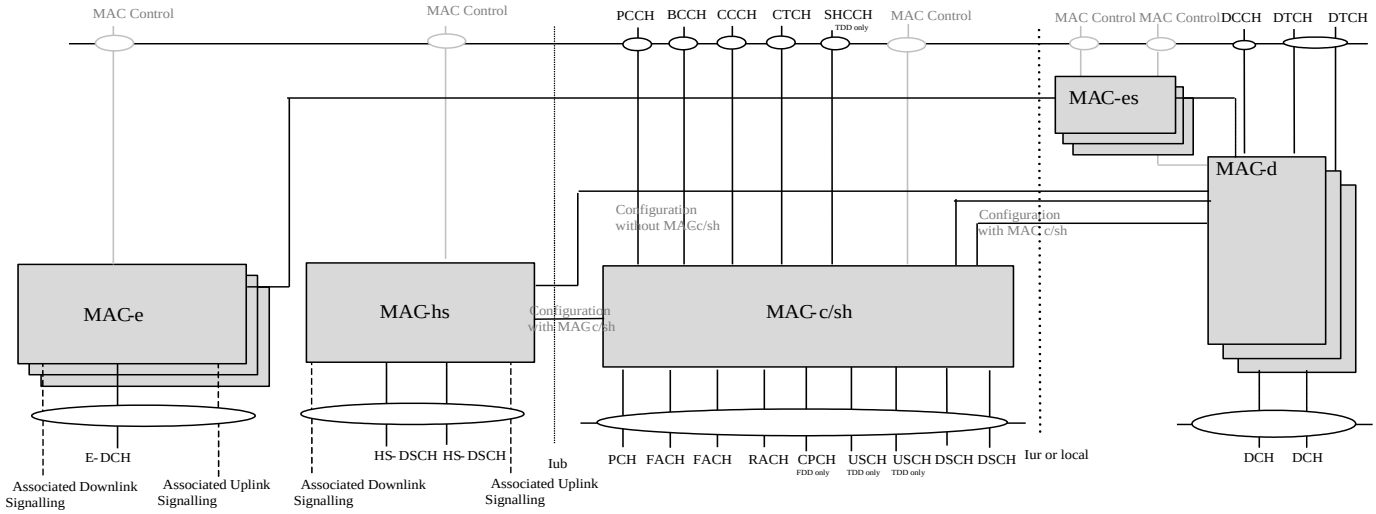


Figure 7.3.1-1: UTRAN side MAC architecture

As shown in Figure 7.3.1-2, a MAC-e PDU enters MAC from layer 1. After Hybrid ARQ handling, the MAC-e PDU is demultiplexed to form MAC-es PDUs aimed for one or more MAC-d flows. The mapping between the DDI (Data Description Indicator) fields (6 bits) and the MAC-d flow and MAC-d PDU size is provided to the Node B by the SRNC. The mapping of the MAC-d flow into its Iub bearer is defined by the SRNC. A special value of the DDI field indicates that no more data is contained in the remaining part of the MAC-e PDU. The MAC-es PDUs are sent over Iub to MAC-es, where they are distributed on the reordering queue of each logical channel. After re-ordering, the in-sequence data units are disassembled. The resulting MAC-d PDUs are forwarded to MAC-d and RLC.

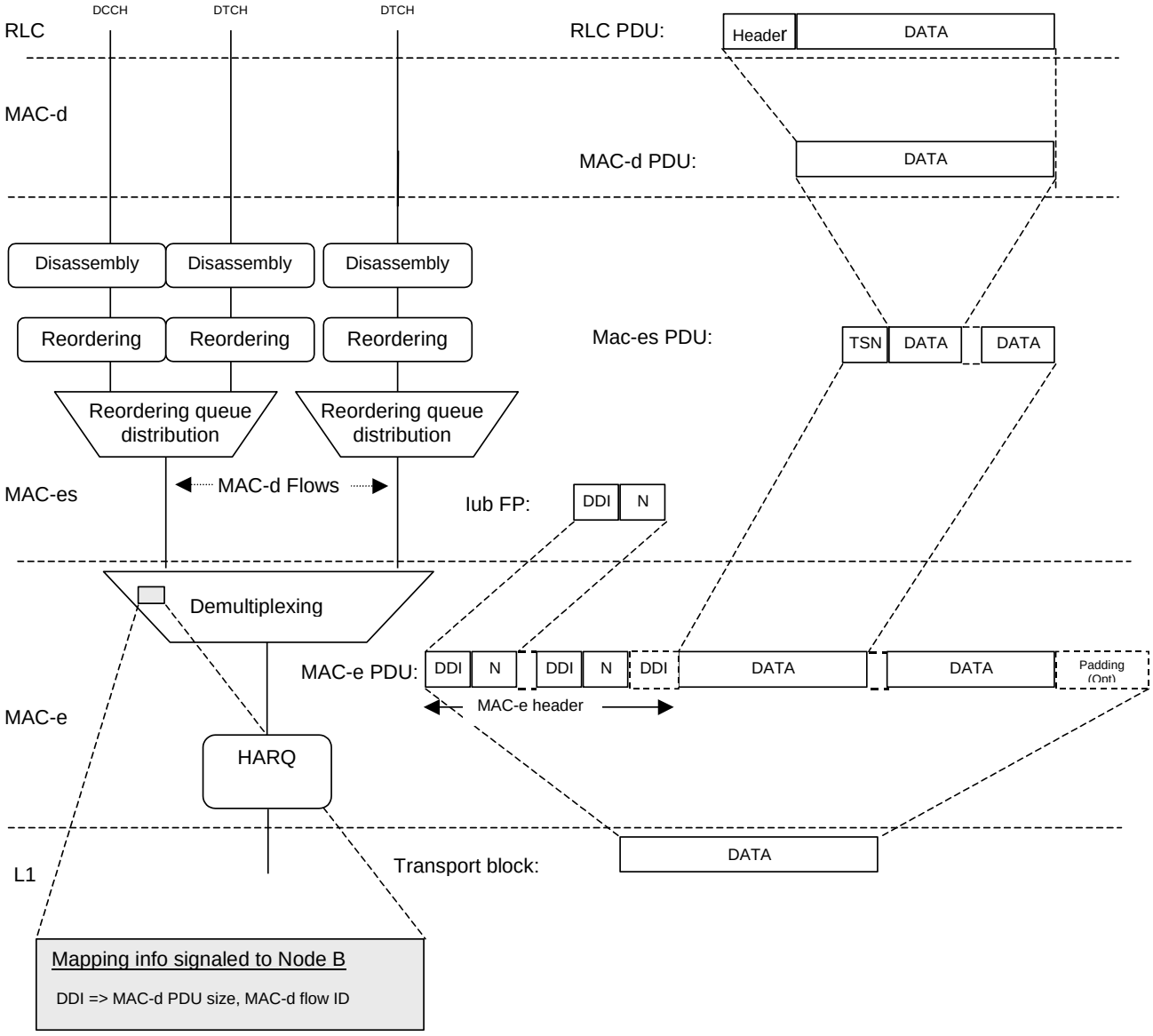


Figure 7.3.1-2: Simplified architecture showing MAC inter-working in UTRAN. The left part shows the functional split while the right part shows PDU decomposition.

7.3.2 Details of MAC-d

For support of E-DCH a new connection to MAC-es is added.

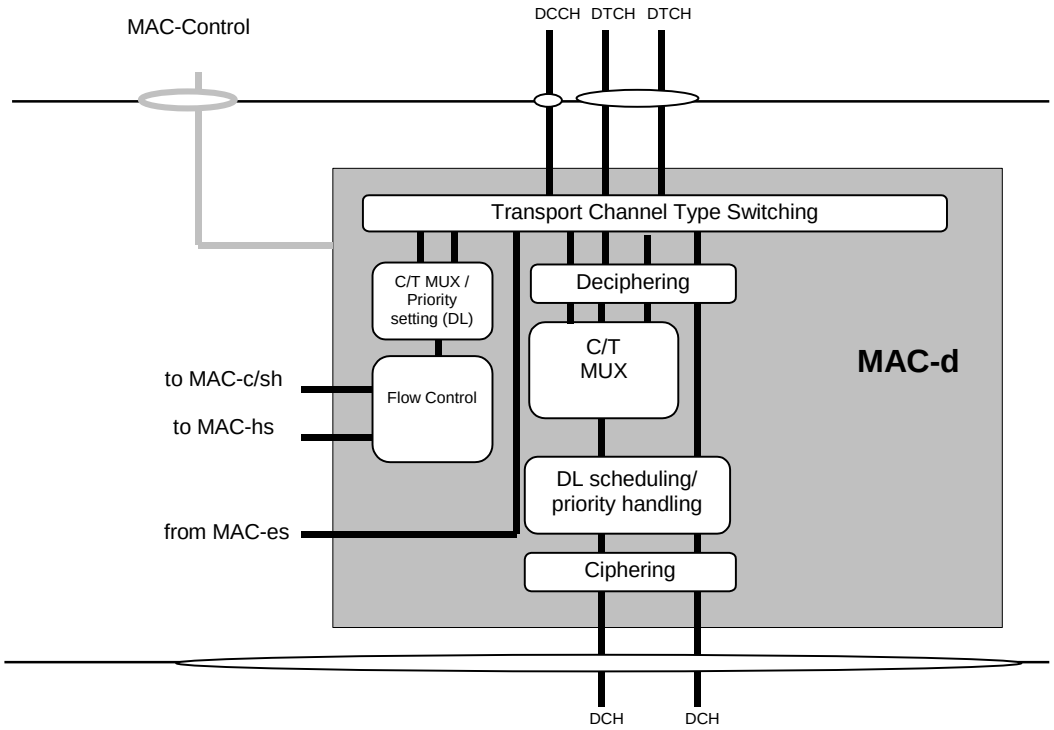


Figure 7.3.2-1: UTRAN side MAC architecture / MAC-d details

7.3.3 Details of MAC-c/sh

The support of E-DCH implies no change to the UTRAN MAC-c/sh entity

7.3.4 Details of MAC-hs

The support of E-DCH implies no change to the UTRAN MAC-hs entity. <Editor's Note: Further study is required to confirm this>.

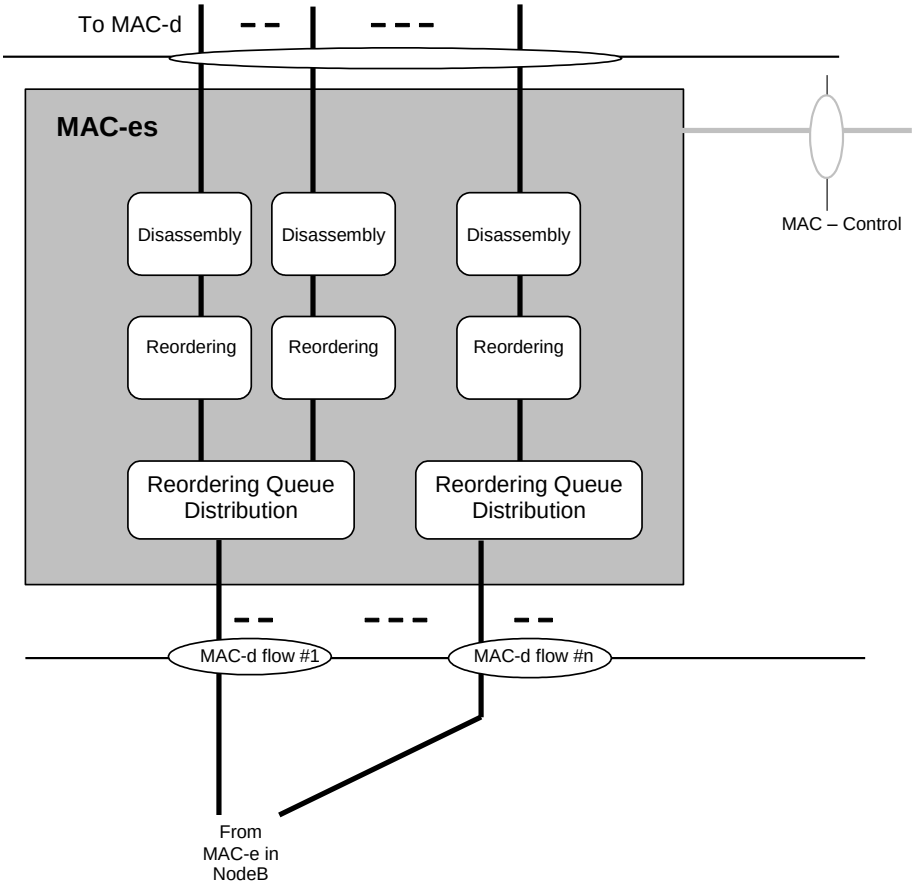
7.3.5 Details of MAC-es

For each UE, there is one MAC-es entity in the SRNC. The MAC-es sublayer handles E-DCH specific functionality, which is not covered in the MAC-e entity in Node B. In the model below, the MAC-es comprises the following entities:

- Reordering Queue Distribution:
  The reordering queue distribution function routes the MAC-es PDUs to the correct reordering buffer based the SRNC configuration.

- Reordering:
  This function reorders received MAC-es PDUs according to the received TSN. MAC-es PDUs with consecutive TSNs are delivered to the disassembly function upon reception. PDUs are not delivered to the disassembly function if PDUs with a lower TSN are missing. The number of reordering entities is controlled by the SRNC. There is one Reordering Queue per logical channel.

- Disassembly:
  The disassembly function is responsible for disassembly of MAC-es PDUs. When a MAC-es PDU is disassembled the MAC-es header is removed, the MAC-d PDU's are extracted and delivered to MAC-d.



< **Figure 7.3.5-1: UTRAN side MAC architecture / MAC-es details**

7.3.6 Details of MAC-e

There is one MAC-e entity in Node B for each UE and one E-DCH scheduler function in the Node-B. The MAC-e and E-DCH scheduler handle Enhanced Uplink specific functions in Node B. In the model below, the MAC-e and E-DCH scheduler comprises the following entities:

- E-DCH Scheduling :
  This function manages E-DCH cell resources between UEs. Based on scheduling requests, scheduling assignments are determined and transmitted. The general principles of the E-DCH scheduling are described in subclause 9.1 below. However implementation is not specified (i.e. depends on RRM strategy).

- E-DCH Control :
  The E-DCH control entity is responsible for reception of scheduling requests and transmission of scheduling assignments. The general principles of the E-DCH scheduling are described in subclause 9.1 below.

- De-multiplexing:
  This function provides de-multiplexing of MAC-e PDUs. MAC-es PDUs are forwarded to the associated MAC-d flow.

- HARQ:
  One HARQ entity is capable of supporting multiple instances of the stop and wait HARQ protocol. Each instance is termed a H-ARQ process and is responsible for generating ACKs or NACKs indicating delivery status of a single MAC-e PDU . The HARQ entity handles all tasks that are required for the HARQ protocol.

The associated signalling shown in the figure illustrates the exchange of information between layer 1 and layer 2 provided by primitives.

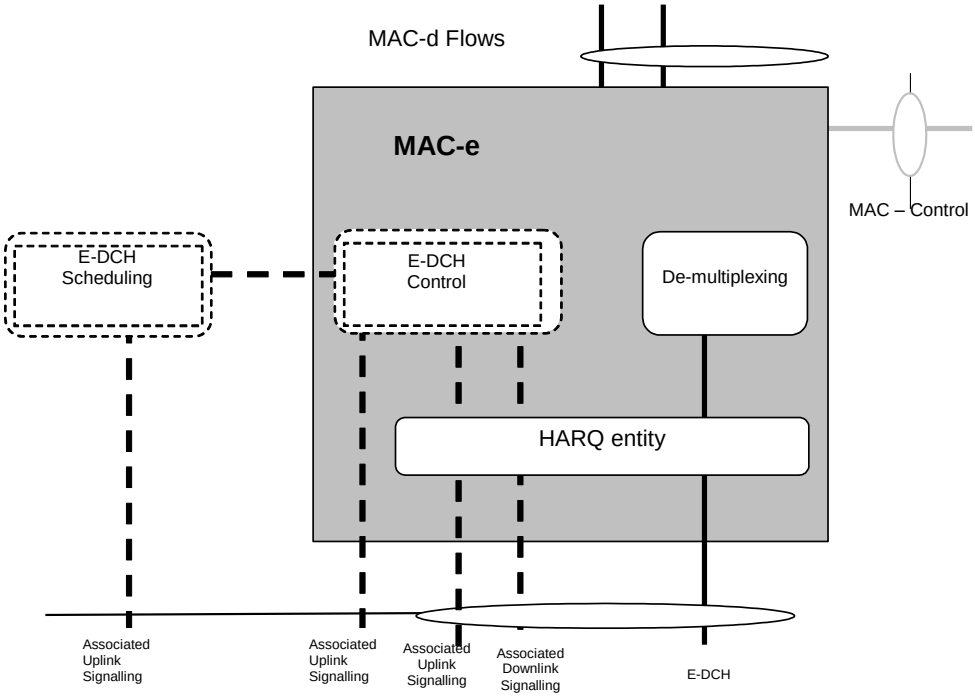


Figure 7.3.6-1: UTRAN side MAC architecture / MAC-e details

8 HARQ protocol

8.1 General Principle

The HARQ protocol has the following characteristics:

- Stop and wait HARQ is used;
- The HARQ is based on synchronous downlink ACK/NACKs;
- The HARQ is based on asynchronous retransmissions in the uplink
  - There are 4 processes for the 10ms TTI;
  - If an Absolute Grant is received in Frame (i) then the UE transmits a data block in Frame (i+T1)
  - For a data block transmitted in Frame (i+T1) the UE receives an ACK/NACK in Frame (i+T1+T2)
  - If NACK is received in Frame (i+T1+T2) then the UE cannot retransmit any data block previously transmitted in Frame (i+T1) (now stored for potential retransmission) until it receives an Absolute Grant.
  - The interval T3 between reception of NACK and reception of a Grant for a subsequent retransmission is variable and depends on a Node B scheduling decision.
  - If an ACK is received in Frame (i+T1+T2) then data blocks previously transmitted in Frame (i+T1) (stored for potential retransmission) are discarded and the HARQ process identity associated with the previously transmitted data blocks can now be reassigned.
  - The number of HARQ processes is a function of T1 and T2 <Editor's Note: T1 and T2 to be confirmed by RAN1>

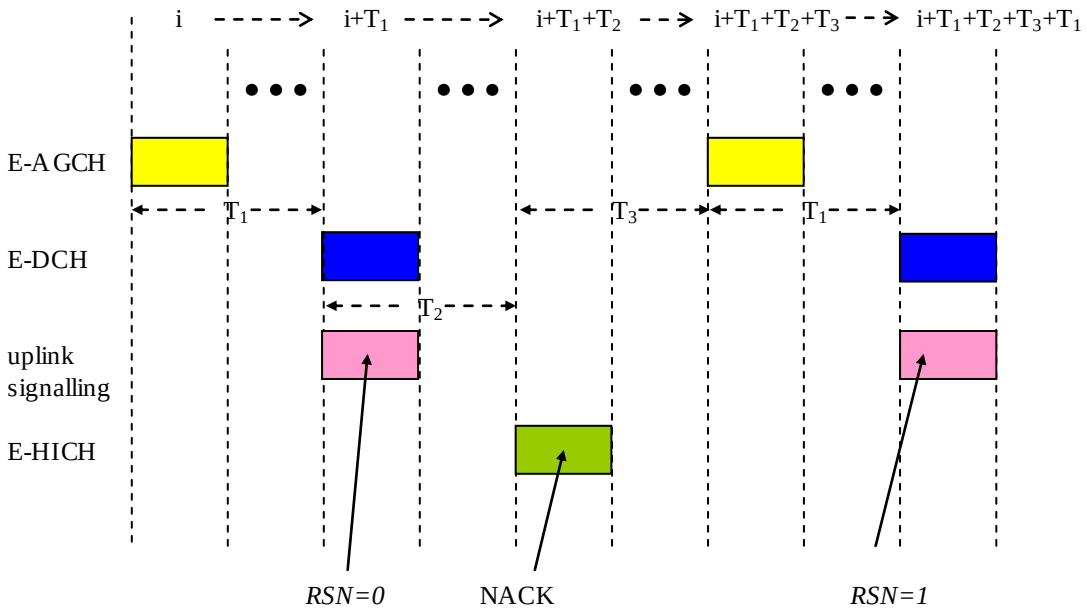


Figure 8.1.1: TDD E-DCH HARQ

- There will be an upper limit to the number of retransmissions. The UE decides on a maximum number of transmissions for a MAC-e PDU based on the maximum number of transmissions attribute (see subclause 11.1.1) according to the following principles:
  - The UE selects the highest maximum number of transmissions among all the considered HARQ profiles associated to the MAC-d flows in the MAC-e PDU;
  - Further optimisations such as explicit rules set by the SRNC are FFS.
- Incremental redundancy shall be supported by the specifications with Chase combining a a subcase:
  - The first transmission shall be self decodable
  - The UTRAN configures the UE to either use the same incremental redundancy version (RV) for all transmissions, or to set the RV according to the set of rules based on E-TF, Retransmission Sequence Number (RSN) and the transmission timing;

8.2 Error handling

The most frequent error cases to be handled are the following:

- NACK is detected as an ACK: The previously transmitted data block is discarded (retransmission is left up to higher layers). When the next Grant is received, the UE starts afresh by transmitting new data (it may reuse the HARQ process Id.) or by retransmitting data associated with some other HARQ process Id;
- ACK is detected as a NACK: The UE cannot retransmit a data block until an Absolute Grant is received;

8.3 Signalling

8.3.1 Uplink

HARQ Process Identifier and Retransmission Sequence Number (RSN) are signalled on the E-UCCH.

8.3.2 Downlink

In the downlink, a report is used to indicate either ACK (positive acknowledgement) or NACK (negative acknowledgement).

9 Node B controlled scheduling

9.1 General Principle

The Node B controlled scheduling is based on uplink and downlink control together with a set of rules on how the UE shall behave with respect to this signaling.

In the downlink, a resource indication (Scheduling Grant) is required to indicate to the UE the maximum amount of uplink resources it may use. When issuing Scheduling Grants, the Node B may use QoS-related information provided by the SRNC (see subclause 11.1.1) and from the UE in Scheduling Requests (see subclause 9.3.1)

The Scheduling Grants have the following characteristics:

- Scheduling Grants do not to influence the TFC selection for other transport channels;
- Scheduling Grants control the maximum allowed rate to be used in E-TFC selection according to information received in the Absolute Grant;
- Scheduling Grants can be sent once per TTI or slower;
- There is only one type of grant:
  - The Absolute Grant provides an absolute limitation of the maximum amount of UL resources the UE may use;
- Absolute Grants are sent by the Serving E-DCH cell:
  - They are valid for one UE

  They can have an associated duration (FFS)
  - The Absolute Grant contains:
    - the identity (E-RNTI) of the UE for which the grant is intended;
    - the physical resources to be used for transmission (timeslots, codes, C/I per resource unit, highest TFCI);
    - other parameters are FFS

    -One identity (E-RNTI) is allocated to a UE at a time. The allocation is performed by the Node-B and is sent to the UE by the SRNC, carried via RRC.
  - The identity consists of 16 bits (16 bits CRC at layer 1);
- An Absolute Grant is sent via one of a set of E-AGCHs
  - For each frame, a UE is required to monitor a set of E-AGCHs
  - An Absolute Grant is received by the UE if it decodes it using the E-RNTI that it has been allocated
  - Details of the set of E-AGCHs to be monitored are signalled to the UE via RRC

9.2 UE scheduling operation

9.2.1 Grants from the Serving Cell

The UE shall be able to receive Absolute Grant from the Serving E-DCH cell and shall select the maximum allowed rate in E-TFC selection according to information received in the Absolute Grant.

When the UE receives an Absolute Grant:

- **if** there are MAC-e PDUs awaiting retransmission and the resources assigned by the Grant enable transmission of a MAC-e PDU awaiting retransmission **then** it is used for a retransmission (oldest first) **else** it is used for a new transmission.

9.3 Signalling

9.3.1 Uplink

For the UE to request resources from the Node B(s), Scheduling Requests will be transmitted in the uplink in the form of Scheduling Information The Scheduling information will be transmitted with respect to the logical channels which RRC has configured to be mapped to E-DCH.

9.3.1.1 Information Required for Scheduling

9.3.1.1.1 Content

The UE provides the following in the information for scheduling:

- Buffer Information:
    - Logical channel ID of the highest priority channel with data in buffer (4 bits). The logical channel ID field identifies unambiguously the highest priority logical channel with available data;
    - UE buffer occupancy (in Bytes):
        - Buffer status for the highest priority logical channel with data in buffer (4 bits), as a fraction of the total reported buffer;
        - Total buffer occupancy (5 bits);
- Physical Layer Information:
    - Path Loss:
        - Information derived from measurements of serving cell and neighbour cells' RSCP (details are FFS and are dependent on decision by RAN1)
    - Transmit Power;

9.3.1.1.2 Triggers

In the case where the UE has no Grant and it has data to send:

- Buffer Information and Physical Layer Information shall be sent to the Node B on the E-RUCCH (E-DCH Random access Uplink Control Channel)

In the case where the UE has a Grant and has data to send:

- It shall send Buffer Information to the Node B in the MAC-e PDU and Physical Layer Information on the E-UCCH (E-DCH Uplink Control Channel)

The details on how Buffer Information is included in the MAC-e PDU are FFS.

9.3.1.1.3 Transmission and Reliability scheme

Two transmission mechanisms are defined:

1. When Buffer Information is included in the MAC-e PDU (with Physical Layer Information sent on the E-UCCH) it is always sent with data and therefore resources are assigned for data transmission/retransmission by the Node B scheduler. HARQ retransmissions are performed until an ACK is received or until the maximum number of transmissions is reached.

2. Buffer Information plus Physical Layer Information sent via the E-RUCCH (no Scheduling Grant) is transmitted at appropriate power and forward error correction, as defined by physical layer specifications. If no response in the form of an Absolute Grant is received then the UE is required to resend Buffering Information and Physical Layer Information.

9.3.2 Downlink

For each allocated UE, there is at-most one Absolute Grant transmitted by the serving E-DCH cell per TTI using the E-AGCH.

10 Non-scheduled transmissions

There is a need to support Signalling Radio Bearers, Guaranteed Bit Rate Services, Constant Bit rate Services and services that generally require low latency and/or low jitter in an efficient manner taking into account:

- the need to support a high number of E-DCH users per cell
- the limited code resources available for uplink assignment in TDD

Further study is required is required to determine whether these services/applications are best served via scheduled or by non-scheduled means.

11 QoS control

11.1 General Principle

The QoS of ongoing flows mapped on E-DCH for a UE is maintained by the serving Node B and by the UE. The Node B controls the resources allocated to a UE versus other UEs by means of scheduling as specified in clause 9. The UE controls the QoS of all its logical channels mapped on E-DCH by means of E-TFC selection as specified in subclause 11.2, and by HARQ operation, specified in clause 8.

In addition to these mechanisms, guaranteed bit rate services for MAC-d flows should also be supported (mechanisms to be used require further study).

11.1.1 QoS configuration principles

RAB attributes are available in the SRNC according to R'99 principles. To enable QoS control for the E-DCH, QoS-related information is made available to the UE and to the Node B.

<Editor's Note: details are FFS>.

12 Signalling parameters

12.1 Uplink signalling parameters

<FFS>.

12.2 Downlink signalling parameters

<FFS>

13 Mobility procedures

Annex A (informative): Change history

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New