

Nomor 3GPP Newsletter – March 2007

Progress in HSPA Evolution

Authors: Eiko Seidel

RAN Plenary Meeting

RAN Progress

General

- RAN1/2/3/4 have been working heavily on Release 7 features
- The first set of Release 7 CRs has been approved by RAN plenary
- Release 7 Change Requests were mainly dedicated to the introduction of 1.28 Mcps TDD Enhanced Uplink, MIMO and continuous connectivity for packet data users, and TEI7
- Completion of Rel.7 WI as 64QAM DL, 16QAM UL, Enhanced Cell_FACH, Improved L2 for higher data rates etc. has been postponed by at least 2 months
- Rel.99 – 5 stable, Release 6 corrections were mainly for MBMS
- LTE Stage 2 almost completed (RAN1 95%, RAN2/3 75%). Major architectural changes have been agreed at last working group meeting.
- Physical layer stage 3 specification 50% completed.
- Correspondence between GERAN and RAN concerning GSM – LTE interworking
- Workshop will be held on the May 2007, on the subject of radio mobility with non-3GPP radio technologies

RAN Work and Study Items

Completed Rel.7 RAN Work Items

- ROHC Performance Conformance: Test Aspects

- 1.28 Mcps TDD Enhanced Uplink - Physical Layer, Layer 2 and 3 Protocol Aspects, UTRAN Iub/Iur Protocol Aspects
- MIMO - Physical layer, Layer 2,3 aspects, Iub/Iur Protocol Aspects
- Interface to Control Tower Mounted Amplifiers (TMAs)
- Continuous connectivity for packet data users

Not Completed Rel7. RAN Work Items (shifted to end of Mai 2007)

- UE Antenna Performance Evaluation Method and Requirements
- Inclusion of Uplink TDOA UE positioning method in the UTRAN specifications
- Global Navigation Satellite System (GNSS) in UTRAN
- MIMO - RF Radio Transmission/Reception, System Performance Requirements and Conformance Testing
- 1.28 Mcps TDD Enhanced Uplink - RF Radio Transmission/ Reception, System Performance Requirements and Conformance Testing
- 64QAM for HSDPA
- Higher Order Modulation in HSUPA
- MBMS FDD and TDD Physical Layer Enhancements
- L2 support for high data rates
- Enhanced CELL_FACH state in FDD
- TEI7

Study Items

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- Study Item on HSPA evolution was kept open

Newly approved work items

- Conformance test aspects for new Release 7 items
 - 64QAM for HSDPA (FDD)
 - L2 support for high data rates
 - MIMO for FDD
 - 16QAM in HSUPA (FDD)
 - Continuous connectivity for packet data users
 - Enhanced Cell_FACH State FDD
- UMTS in 1500, 700, 2300 MHz Bands
- MBMS LCR TDD physical layer enhancements
- Further Improved Minimum Performance Requirements for HSDPA UE (FDD) - Two-Branch Interference Cancellation

Newly approved study item

- 3G Home NodeB
 - receiver performance requirements for the local area base station class will be revised e.g. to relax the frequency stability requirement and exclude the 250kmph performance requirement for the local cell
 - Strong relation to the LTE Home eNodeB

HSPA Evolution

Continuous Packet Connectivity

- CRs have been approved for Rel.7

- "Continuous connectivity for packet data users" consists of the following UL & DL improvements:

- A new UL DPCCH slot format configurable by L3
- UL DPCCH gating/discontinuous transmission (DTX) in 2 cycles
- In DL: Discontinuous reception (DRX) at the UE
- In DL: A so called HS-SCCH-less operation which includes an HS-SCCH less initial transmission and modified HS-SCCH for retransmission(s)

MIMO for HSPA

- A complete set of Rel.7 CRs is agreed for introduction of MIMO in the L1 specifications.
- See figure 1 for downlink MIMO transmitter structure.
- The MIMO technical report in TR25.876 is approved and put under version control. This concludes one of the longest work items for RAN WG1 lasting for more than 7 years
- MIMO should only be used with the Enhanced Mac-hs (Mac-ehs) described in the WI "Enhanced Layer 2 for support of high data rates".
- Two new UE categories have been introduced.
- In downlink transmission with MIMO the maximum bit rate will be 28.8 Mbps.
- Currently RAN1 is discussing the combination of 64QAM and MIMO for HSDPA in a future release, which would result in a maximum bit rate of 43.2 Mbps.

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64QAM for HSPA Downlink

- Completion date shifted to June. Mainly RAN4 testing to be completed.
- Two new UE categories have been introduced.
- For downlink transmission with 64QAM the maximum bit rate will be 21.6 Mbps.

16QAM for HSPA Uplink

- Only stage 2 CRs agreed
- Completion date shifted to June, RAN4 to September. Open issues: RAN1 supported gain factors, RAN2 interworking with legacy Node B and UE memory requirements, RAN4 testing to be completed.
- A new E-DCH category 7 was introduced that supports 16QAM.
- For uplink transmission with 16QAM maximum bit rate will be 11.52 Mbps.

L2 Support for higher data rates and Enhanced Cell_FACH state

- First set of CRs approved. Completion date shifted to June

MAC/RLC

- Major Stage 2 level decisions have been done:
 - support for flexible RLC AM PDU size
 - introduction of MAC segmentation
 - introduction of multiplexing data from several priority queues in one TTI
 - octet aligned MAC header format

- same layer 2 for both the CELL_DCH State and the enhanced CELL_FACH State
- based on flexible RLC PDU size and Mac-hs supporting segmentation
- The new functionality will be provided by new MAC sub-layer called MAC-ehs (enhanced hs). Depending on configuration either MAC-hs or MACehs will be used.
- See figure 2 for the new enhanced MAC-hs PDU structure

Enhanced Cell_FACH (and Cell_PCH, URA_PCH)

- When operating in CELL_FACH, CELL_PCH and URA_PCH state the HS-DSCH can be used in downlink (without power control on an associated dedicated channel and without dynamic link adaptation) and the RACH for uplink transmission.
- The transmission of HS-DPCCH for HS-DSCH related ACK/NACK and CQI signalling is not supported.
- In CELL_FACH, CELL_PCH and URA_PCH state retransmission can be handled by MAC-ehs without ACK/NACK feedback signalling.
- The UE obtains the HS-SCCH and HS-PDSCH configuration from system information broadcast
- The direct UE to Node B uplink CQI signalling on RACH, which could be used for link adaptation, is still being discussed. Agreed so far is that RNC forwards the RRC measurements to Node B.

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- BCCH is also mapped on HS-DSCH for transmitting system information change information to the UE
- Seamless state transition between CELL_FACH and CELL_DCH is ensured by requiring the HS-DSCH reception during state transition between those states
- No S-CCPCH usage for enhanced CELL_FACH except for MBMS reception
- Mandatory UE support of Enhanced CELL_FACH state in Rel7 is FFS.
- LTE Stage 2 - TS 36.300 has been completed in principle and the specification will be put under version control. Some open issues in RAN2 and RAN3.
- Stage 3 completion date at RAN#37 (September 2007)
- SA4 has not yet started to work on services for Release 8
- SA5 and RAN3 are discussing their work split concerning future O&M specification. Each group will edit a TR. A joint meeting might be organized.

lub/lur Impact

- Utilization of HS-DSCH FP for Enhanced CELL_FACH
- Due to the decision to use the flexible RLC PDU size also for the Enhanced CELL_FACH state, it was decided to have a common frame protocol on lub and lur for the two work items and the corresponding CRs were merged. Main issue is the support of flexible RLC PDU sizes on lub and lur.
- A new HS-DSCH DATA FRAME format (TYPE 2) was defined (please look at figure 3) for the lub/lur interface. The length of every MAC-d PDU within the frame is signalled.
- A new HS-DSCH CAPACITY ALLOCATION TYPE 2 Control Frame was also specified. The allocation message specifies a number of octets instead of a number of MAC-d PDUs.
- Operators are pushing the LTE Home eNodeB for the first version of the LTE specifications to be captured in the LTE Stage 2. The LTE Home Node B shall meet various requirements concerning security and to avoid interference with operator controlled Node Bs. The operator decides on configuration and might want to control some parameters dynamically e.g. maximum power and might modify the software/firmware. It will be challenging to complete the required O&M interface specification at the same time as the LTE specification.
- Updated set of L1 specifications (stage 3) has been presented for information TS 36.201, TS 36.211, TS 36.212, TS 36.213
- More details on LTE will be presented within the next newsletter

Long Term Evolution

General

System Architecture Evolution

Evolved 3GPP System

- SA1 defined the term *Evolved 3GPP System (E3S)* comprising the evolved 3GPP system architecture (SAE)

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together with the evolved radio access network (E-UTRA and E-UTRAN)

- See Figure 4 for detailed architecture
- The objectives of the evolved 3GPP system are to:
 - Provide higher data rates, lower latency, high level of security and enhanced QoS;
 - Support a variety of different access systems (existing and future), ensuring mobility and service continuity between these access systems;
 - Support access system selection based on a combination of operator policies, user preference and access network conditions;
 - Realise improvements in basic system performance whilst maintaining the negotiated QoS across the whole system;
 - Provide capabilities for co-existence with legacy systems and migration to the evolved 3GPP system

QoS Concept

- The evolved 3GPP network shall support a minimum of 8 levels of QoS in parallel
- The evolved 3GPP network shall support a minimum of 4 parallel real-time QoS levels
- More detail on SAE will be presented within the next newsletter

The next newsletter ...

We will, besides others, look at:

- **System Architecture Evolution**
 - The latest state of **work and study items of 3GPP SA** (the system architecture group)
- **Long Term Evolution**

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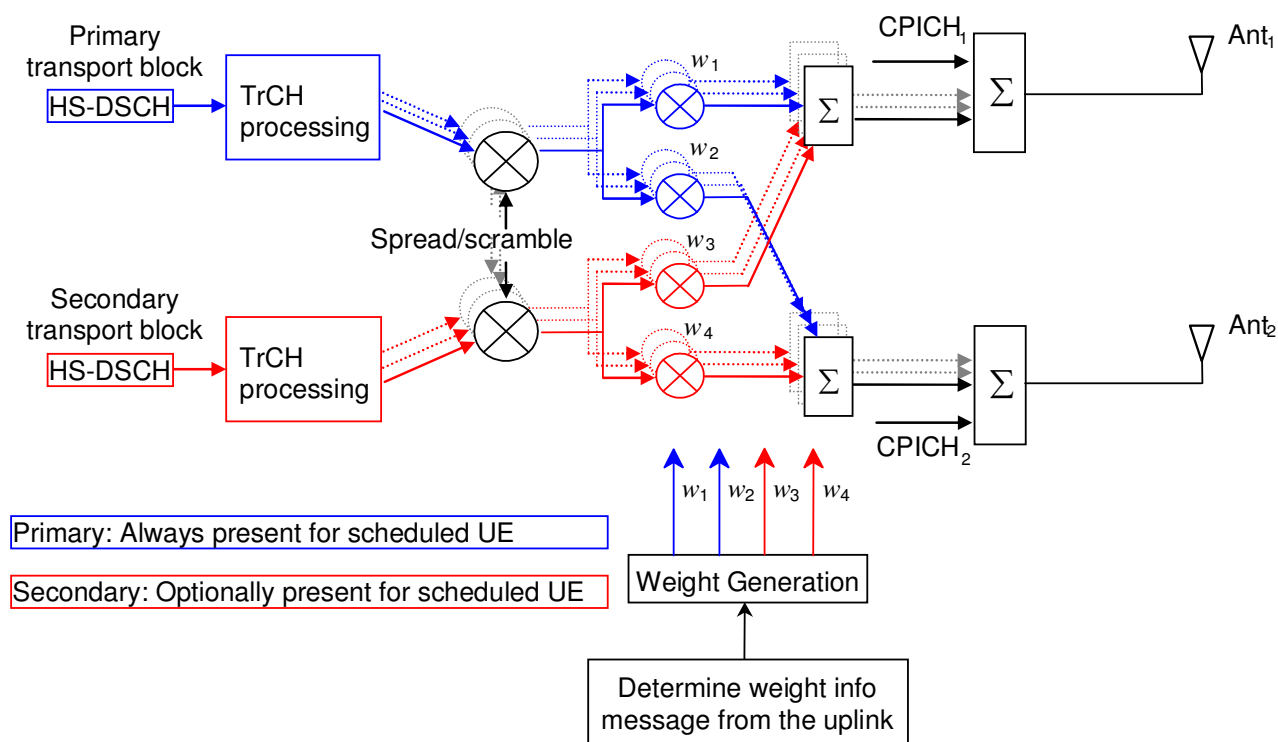
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Annex

Figure 1: Generic downlink transmitter structure to support MIMO operation for HS-PDSCH transmission



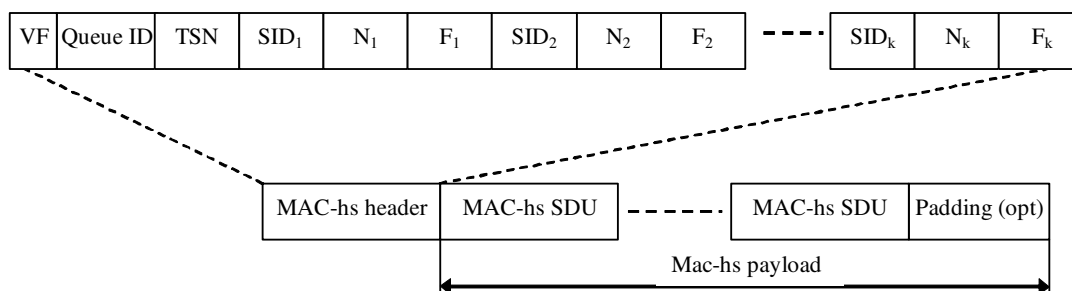
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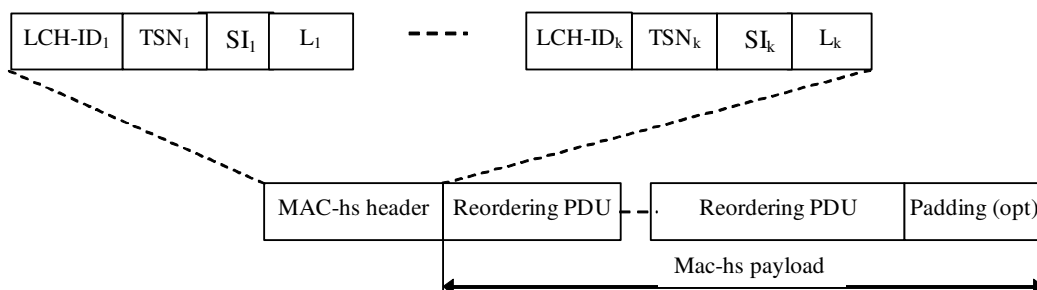
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Figure 2: Enhanced MAC-hs PDU structure

Release 5 MAC-hs PDU format



Release 7 MAC-ehs PDU format (not yet approved)

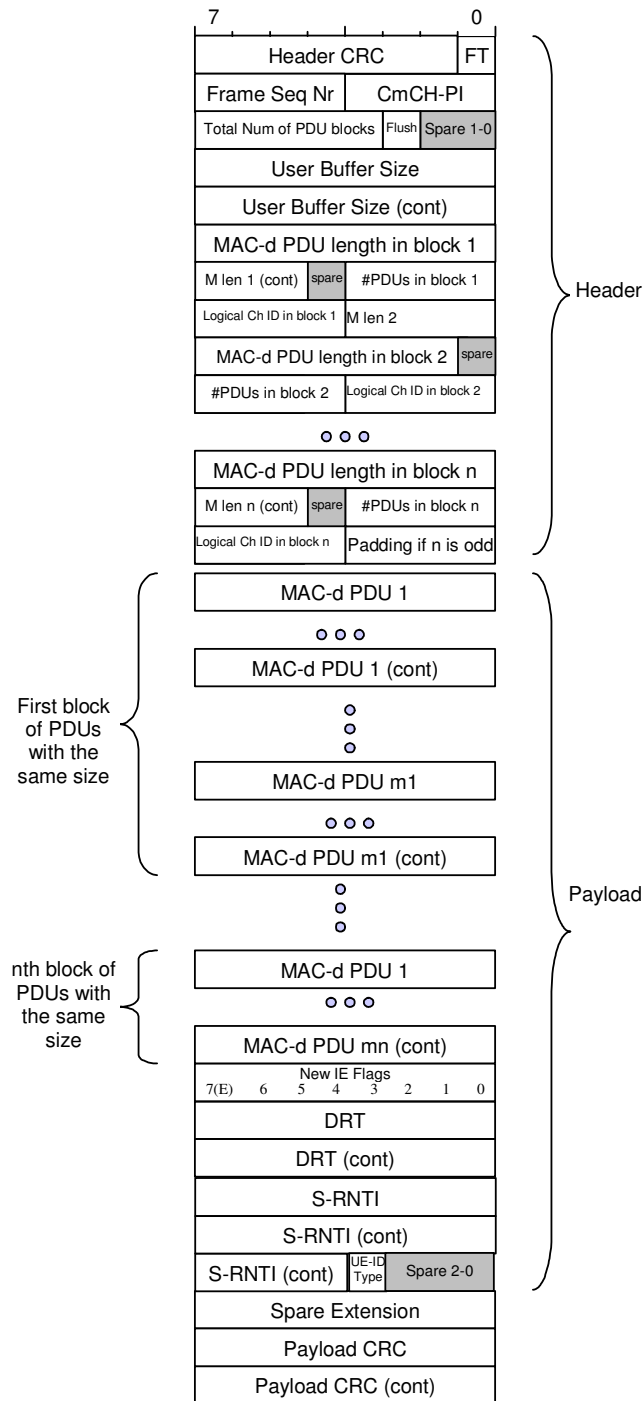


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Figure 3: HS-DSCH DATA FRAME TYPE 2 structure



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Figure 4: Multi-access architecture and seamless mobility for the Evolved 3GPP System

