Satellite Digital Multimedia Broadcast (SDMB) Access Layer Definition

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Presentation Outline

- SDMB & IST MAESTRO project overview
- Access Scheme Requirements/Constraints
- SDMB Access Scheme Definition
  - Access Scheme Channels
  - Radio Link Layer (MAC/RLC/PDCP) Definition
  - Radio Resource Control Definition
- Procedures for the support of MBMS within SDMB RAN
- Conclusions

Introduction

SDMB Systems

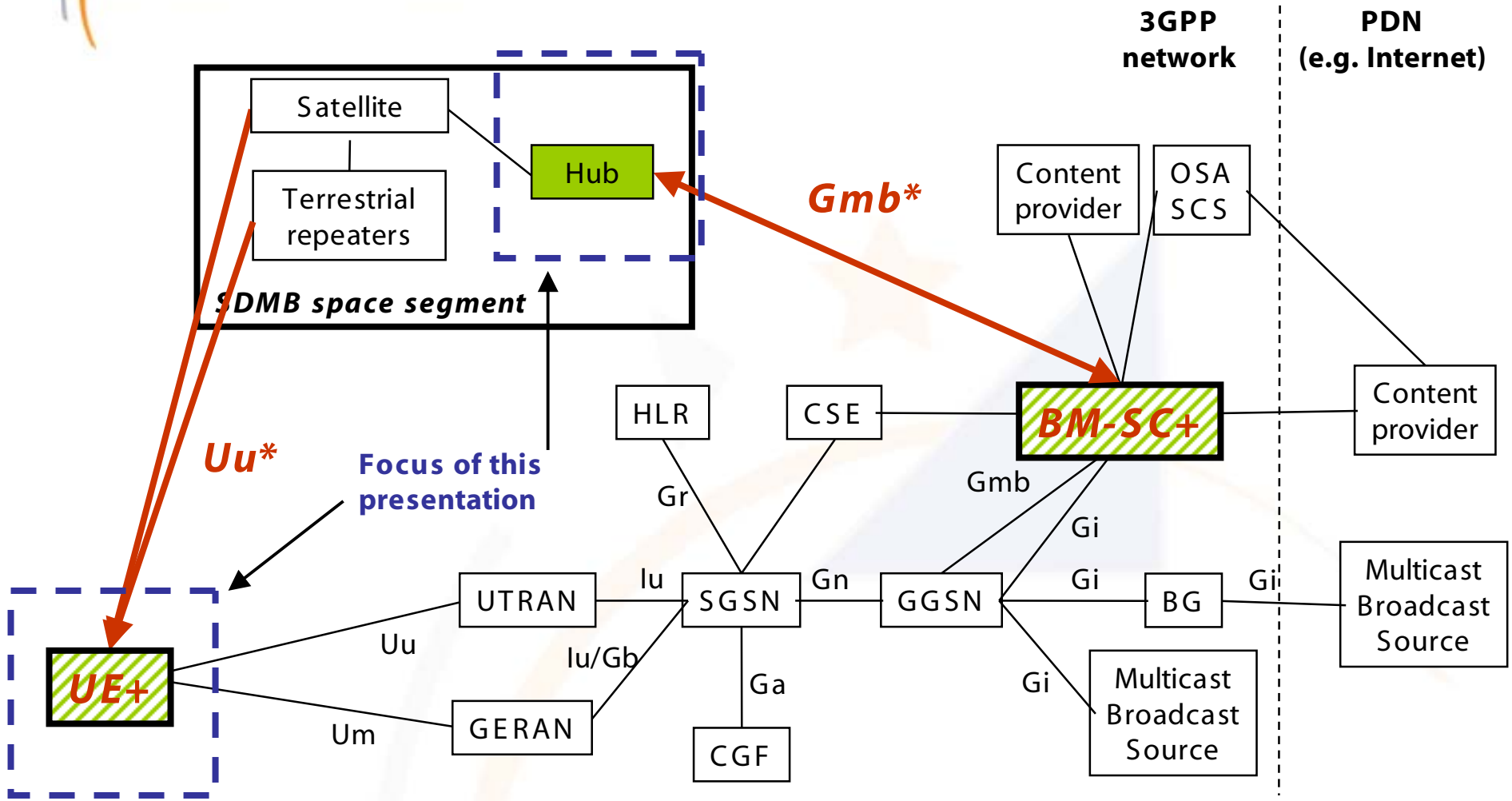
- A hybrid mobile satellite broadcast system to complement the 3G terrestrial mobile cellular networks in the delivery of broadcast and point-to-multipoint multimedia services
- Relies on the smart concept of combining high power geostationary satellites and terrestrial repeaters/gap-fillers with nationwide umbrella cells to provide outdoor and in-building coverage
- Fundamental objective to accommodate 3G standardised handsets with negligible impact on the terminal size and cost

Introduction (2)

IST MAESTRO (Mobile Applications & sErvices based on Satellite & Terrestrial inteRwOrking)

- Extend the work from the IST/FP5 MoDiS and SATIN contracts and several research activities supported by ESA and CNES
- Aims at assessing the business opportunity and validating key functions and performances of a SDMB system to be integrated into 3G terrestrial networks and systems beyond
- Main objectives are to:
  - Consolidate SDMB service, mission & commercial requirements
  - Define the architecture supporting SDMB key functions and performances
  - Validate key SDMB functions and performances with a test bed
  - Investigate potential evolutions
  - Carry out standardisation and regulatory activities required for an effective SDMB system deployment
  - Promote the system with dissemination and training

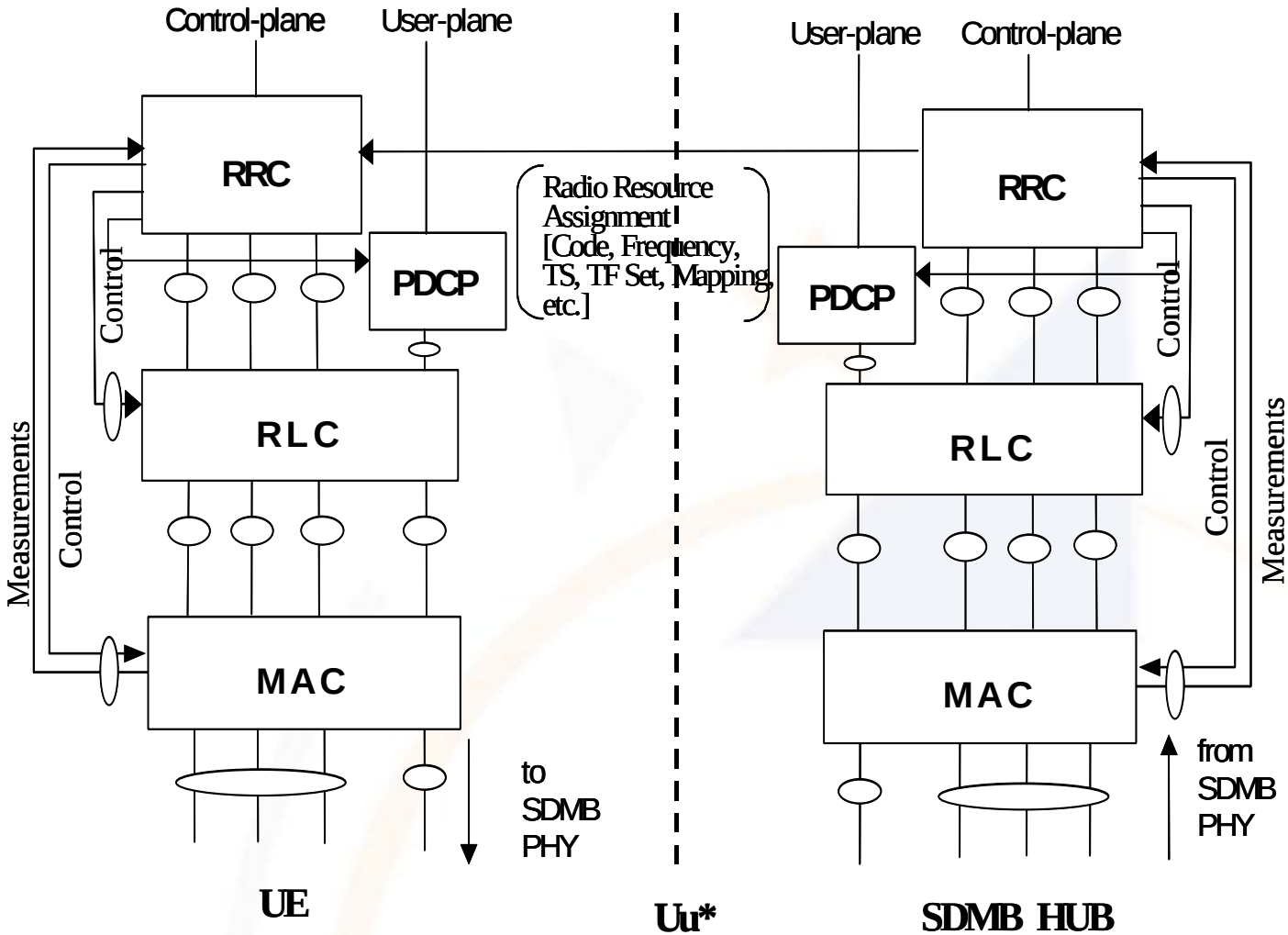
SDMB System Architecture



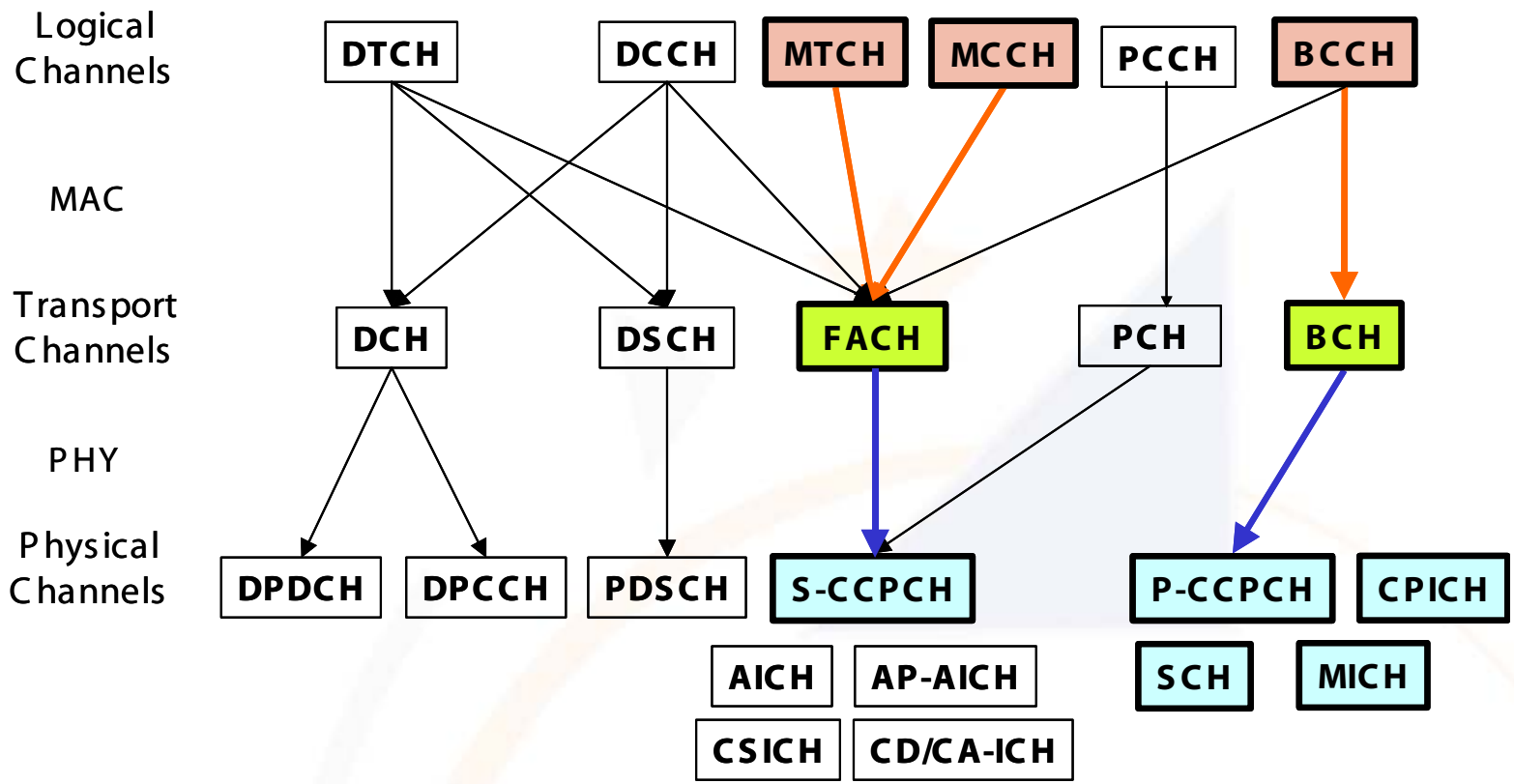
SDMB Access Scheme Requirements/Constraints

- **Requirements Inherited from 3GPP MBMS Framework**
  - SDMB data transfer shall be downlink only
  - Only the MBMS Broadcast mode shall be supported at the SDMB RAN
  - SDMB UE broadcast subscription and SDMB charging (end-user charging) should be transparent to the SDMB RAN
  - Reception of the SDMB signal is not guaranteed at SDMB RAN level
  - Replication of SDMB data streams at SDMB RAN level is not required
  - ……
- **SDMB Specific Requirements**
  - SDMB activities should not impact the terrestrial RAN procedures
  - Specific parameter configuration of System Information Broadcasting (SIB) messaging for UEs' operation within the SDMB system
- **User Service QoS Requirements**
  - Support of streaming and background traffic classes (push type) – difference with UTRAN is information loss rate

SDMB Access Scheme

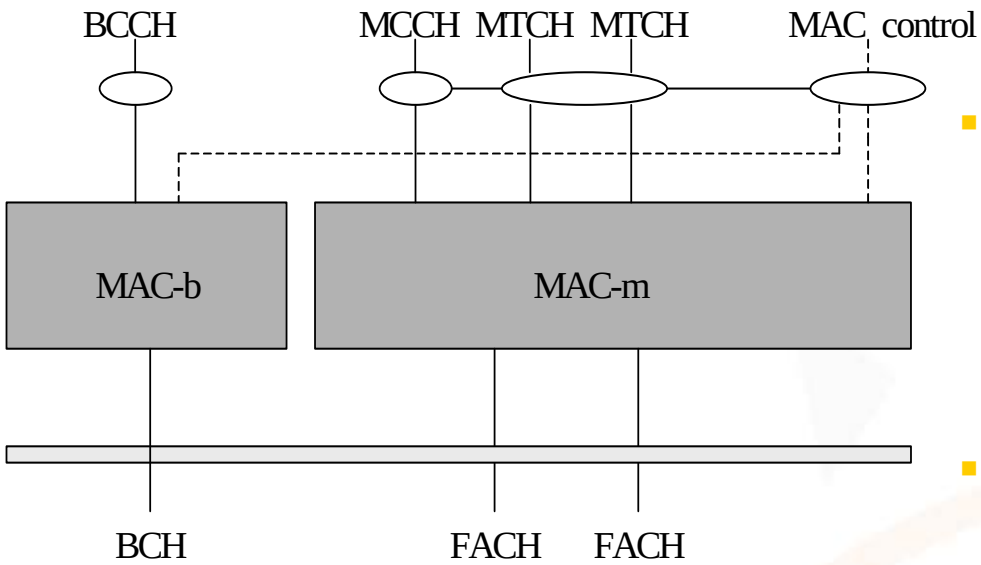


WCDMA Channels Relevant to SDMB



WCDMA channels relevant to SDMB

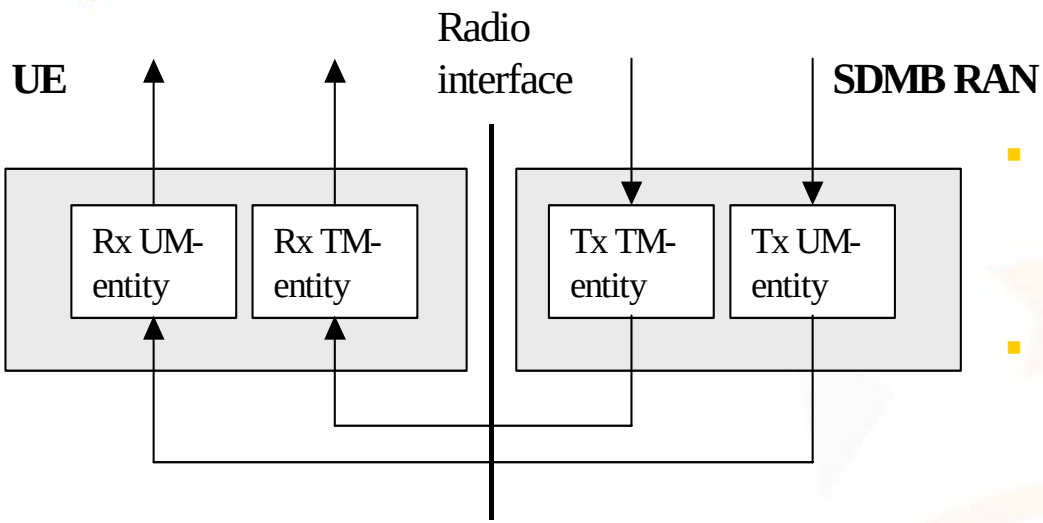
Radio Link Layer Definition: MAC



- One MAC entity in SDMB RAN for each spot and one MAC entity per UE
- On SDMB RAN, functions of MAC-m:
  - *Addition of MBMS-ID*
  - *TCTF Multiplexing*
  - *Scheduling – Priority Handling*
  - *TFC selection*
- On SDMB UE, functions of MAC-m:
  - *Reading of MBMS-ID*
  - *TCTF DEMUX*

- Provides logical channels to the RLC sub-layer and maps logical channels into transport channels
- Responsible for selecting an appropriate TF
- Provides addressing of UEs and scheduling on FACHs
- Collects statistical information about the traffic

Radio Link Layer Definition: RLC

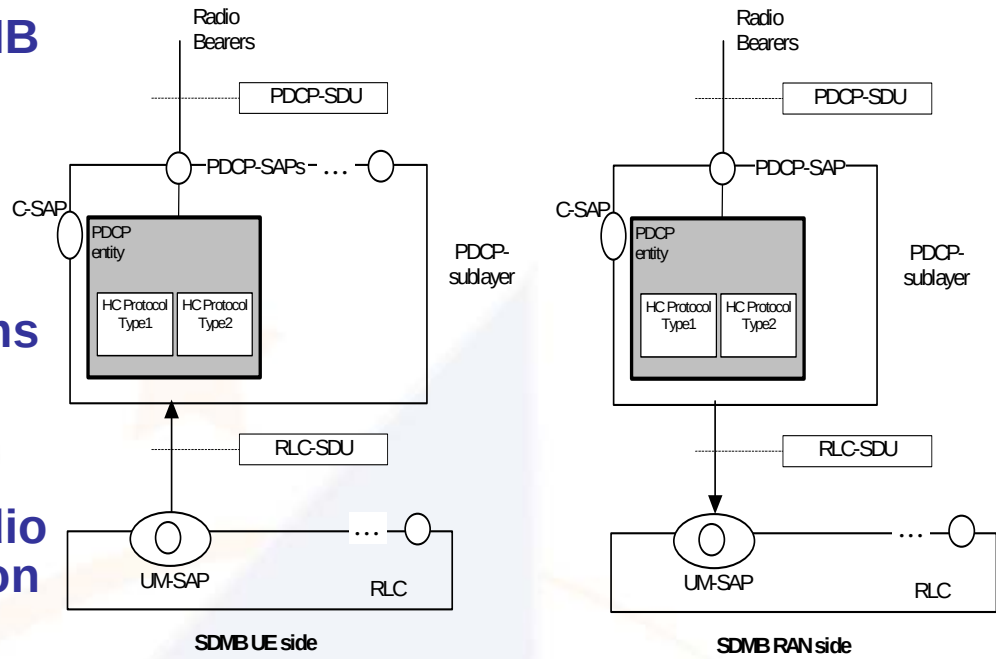


- Only the transparent mode (TM) and unacknowledged mode (UM) RLC entities are relevant
- Unidirectional - transmitting entities only reside at the SDMB RAN and receivers at the UE side
- One RLC entity in SDMB RAN for each MBMS service in each spot, and one RLC entity for each MBMS service per UE

- Logical channel making use of the RLC TM – BCCH: *transfer of user data*
- Logical channels making use of the RLC UM – MCCH/MTCH: *segmentation and reassembly, concatenation, padding, transfer of user data, sequence number check, and SDU Discard*
- As compared to p-t-p service, *ciphering* is not performed by RLC UM - encryption for MBMS is performed end-to-end, and not at either the Radio or the Core Network level

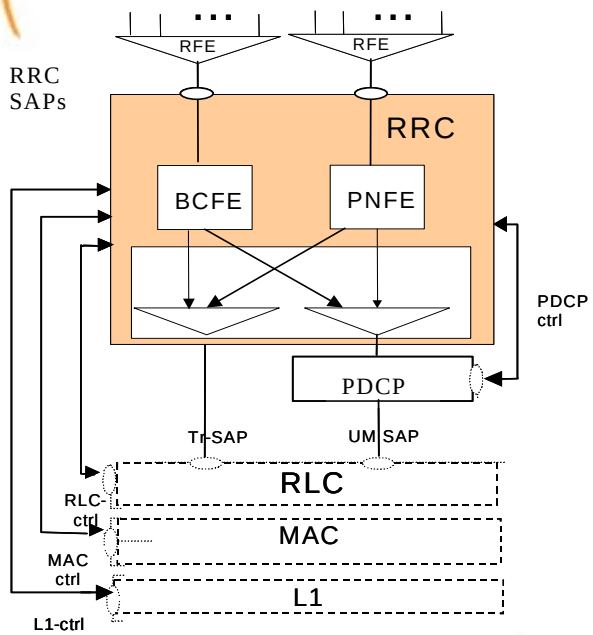
Radio Link Layer Definition: PDCP

- One PDCP entity per spot in the SDMB RAN side, and one PDCP for each SDMB service in the UE
- PDCP responsible for :
  - Header compression and decompression of IP data streams
  - Conveys data between users of PDCP services
- No support for loss-less Serving Radio Network Subsystem (SRNS) relocation

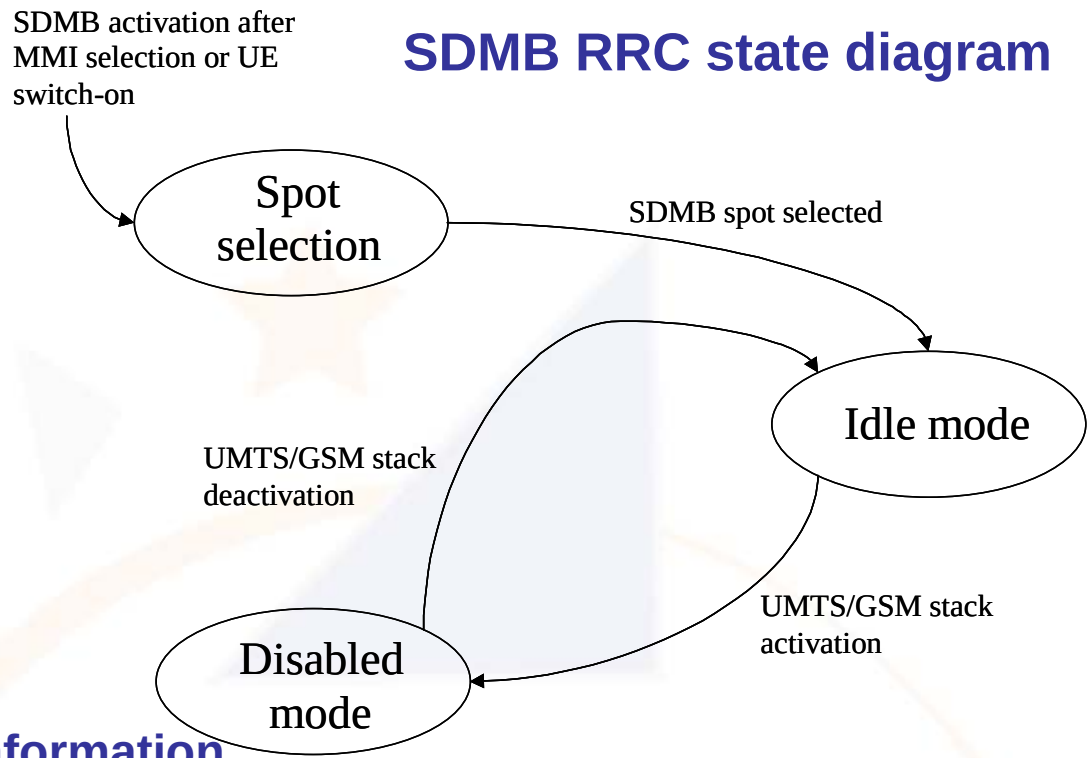


- RObust Header Compression (ROHC) - the only header compression protocol supported by 3GPP capable of compressing the RTP header used in multimedia streaming applications.
- 3 modes of ROHC operation - Unidirectional (U-mode), Bidirectional Optimistic (O-mode), and Bidirectional Reliable mode (R-mode)
- U-mode is the only mode of operation supported in SDMB
- Due to the periodic refreshes and the lack of feedback for initiation of error recovery, the compression will be less efficient

RRC Definition

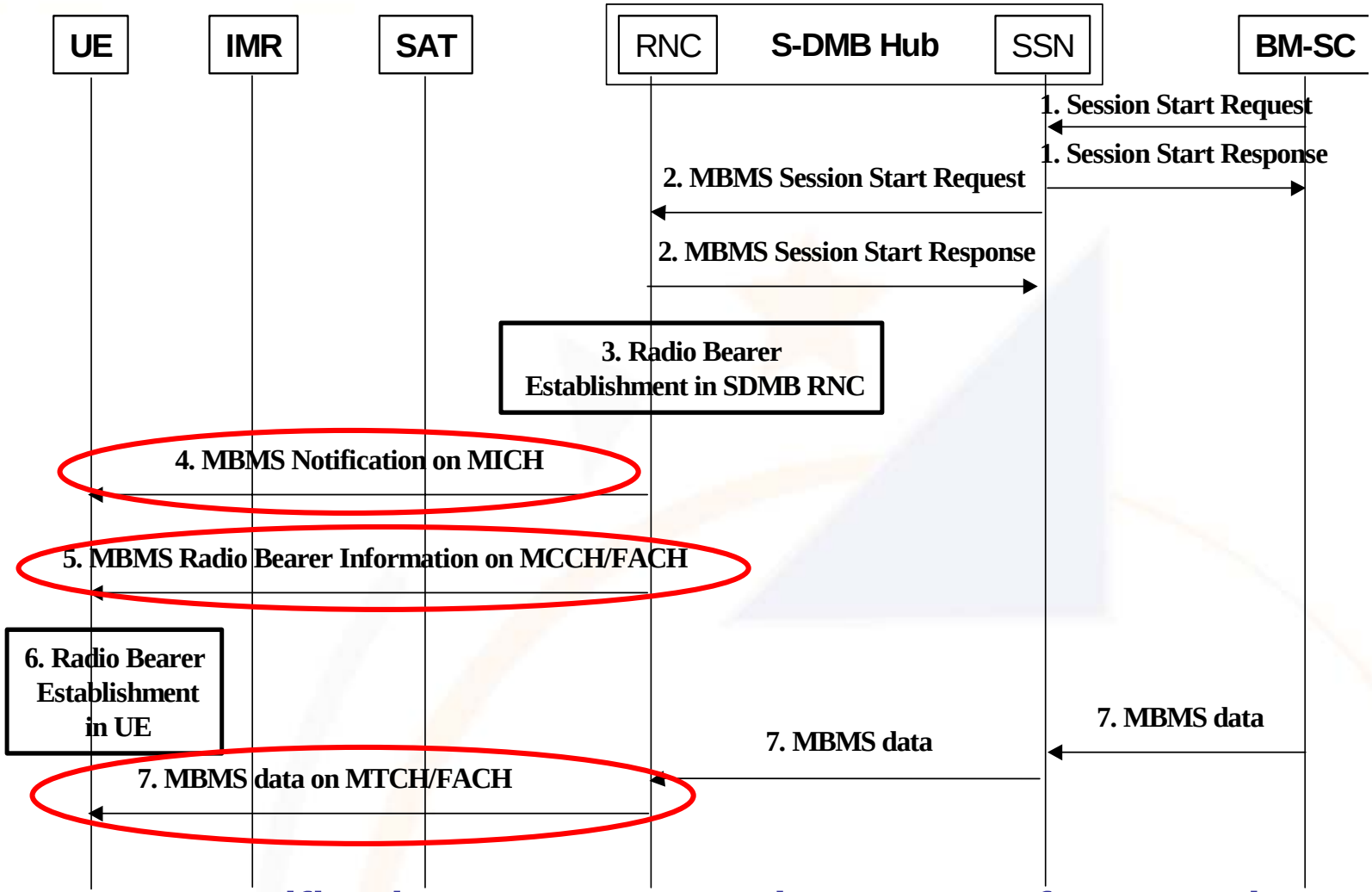


SDMB RRC state diagram



- **Functions :**
  - **Broadcast of NAS and AS information**
  - **Establishment, reconfiguration and release of Radio Bearers**
  - **Initial spot selection**
  - **Radio resource management**

Procedures within SDMB RAN for the support of MBMS



MBMS Notification, RB Setup and Data Transfer procedure

MBMS Procedures Not Relevant To SDMB

- ***Joining:*** Used to join a multicast group -with no satellite uplink available, this procedure becomes irrelevant

- ***Counting/Recounting:*** Used to determine the most optimum MBMS transmission mode (p-t-p versus p-t-m bearer) -with only p-t-m bearers being employed in SDMB, this procedure is not relevant

- ***RNC Registration/Deregistration:*** Performed on per-service basis and assumes awareness about the existence of PMM-connected UEs in the area under the RNC -in SDMB, there is one-to-one relation between SDMB RNC and SSN and SDMB RAN does not maintain any connection with UEs.

- ***Channel Switching:*** As only p-t-m bearers are relevant to SDMB, channel switching between dedicated channel and common channel is not relevant.

- ***UE Linking/De-linking:*** Used to link a UE, which has joined the MBMS service, to an MBMS service context in the RNC and only applicable for UEs in PMM-CONNECTED mode -with no PMM state defined in SDMB, this procedure is not relevant

- ***Selective Combining:*** UEs may take advantage of MBMS transmissions in neighbouring cells belonging to the same MBMS service area and perform selective combining -within the context of the mono-spot architecture defined for SDMB, this feature is not applicable

Conclusions

- Access scheme requirements and the definition of the layers 2 and 3 of the SDMB access scheme have been described
- Main features are:
  - Maximum commonalities with the UTRA WCDMA FDD air interface. The 3GPP specifications have been the starting point for the access scheme definition
  - Given that the baseline architecture of the system is unidirectional, i.e. without a satellite return link, only the downlink direction of the WCDMA interface is of interest to SDMB
  - Due to the p-t-m nature of the services, only the subset of WCDMA functionality required for the support of common/ p-t-m channels is relevant to the SDMB access scheme

Official Web site: http://ist-maestro.dyndns.org/MAESTRO