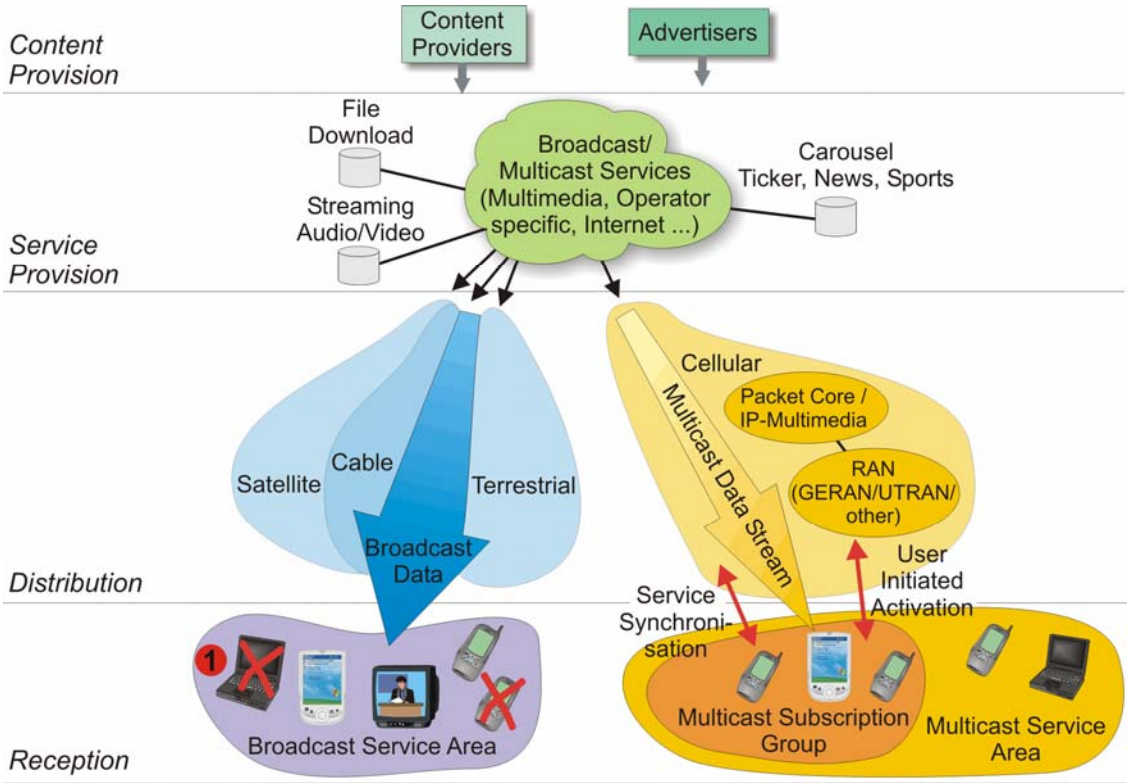
1.1. Important Broadcast Technologies

1.1.1 What is Broadcast and Multicast and how does it work?



The objective of this section is to provide the student with an overview how Broadcast and Multicast content may be delivered to the user equipment(s) [3GTS 22.146].

The key points of this section are:

1. A point to multipoint (PTM) service provides multimedia data (e.g. text, audio, graphics, video) from a single source entity over a packet switched network to multiple endpoints using a unidirectional bearer service.
2. In broadcast mode, all capable recipients within a Broadcast Service Area may receive the service.
3. In multicast mode, the recipient has to register to a corresponding multicast subscription group in order to receive the service(s). Reception may thus be limited to a subset of the available services.

- **Content and Service Provision:**
  Both Broadcast and Multicast Services are provided in a unidirectional PTM transmission from a single service source to multiple recipients. The content itself may be purchased from external content creators (e.g. film studios etc.) or provided by advertisers.

- **Distribution:**
  ⇒ The data may be broadcasted to the receivers over several distribution channels, via satellite, via terrestrial antennas, via cable or through cellular / wireless networks.
  ⇒ Data distribution may be through one single channel only or over several of these channels in parallel.

- **Broadcast mode:**
  ⇒ This mode enables delivery of high bit rate broadcast of multimedia services (audio, video, data etc.) to all interested and capable recipients in a Broadcast Service Area.
  ⇒ Users may enable / disable the reception of the service on their UE's. There is no registration or subscription to the service necessary.
  ⇒ The data reception in broadcast mode is not guaranteed and the receiver may therefore recognize loss of data.

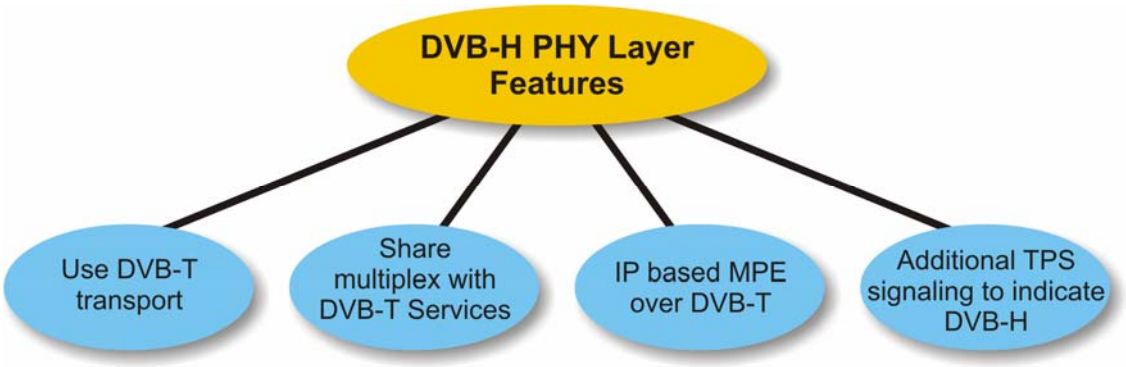
- **Multicast mode:**
  ⇒ This mode enables delivery of high bit rate broadcast of multimedia services (audio, video, data etc.) to all interested and capable members of a Multicast Subscription Group within a Multicast Service Area.
  ⇒ This mode generally requires the subscription to a Multicast Subscription Group in order to receive the content.
  ⇒ Subscription to the multicast service may be continuous (⇔ defined by a user contract), time limited or generated by the subscriber on a one-time basis.
  ⇒ Availability of a multicast service will be announced through the connected network (⇔ service announcements, SMS etc.).

If the network decides, that multicast connection is not justified (⇔ insufficient number of users), it may optionally setup a unicast (PTP) connection for some users.

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**RAN**	Radio Access Network
GERAN	GSM EDGE Radio Access Network	**SMS**	Short Message Service (3GTS 24.011, 3GTS 23.040)
IP	Internet Protocol (RFC 791)	**UE**	User Equipment
PTM	Point to Multipoint	**UTRAN**	UMTS (Universal Mobile Telecommunication System)Terrestrial Radio Access Network
PTP	Point to Point		

1.2.3 Important DVB-H Features of the Physical Layer



The objective of this section is to provide the student with an overview of the features supported by the physical layer of DVB-H. [ETSI TR 102 377]

The key points of this section are:
1. Additional optional parameters have been introduced for the DVB-T transmitter, marked in green in the picture above.
2. There is no own transport channel for DVB-H. Instead, DVB-T with some enhanced parameters is used. DVB-H and DVB-T services may therefore be multiplexed on the same channels.
3. DVB-H supports the seamless integration with different IP based technologies through the MPE mechanism. These MPE sections will then be multiplexed into the MPEG2-TS for transmission.
4. The distinction between DVB-T and DVB-H is provided through the TPS signalling.

- **DVB-H reuses the DVB-T transport channels and is therefore completely backwards compatible with DVB-T.**
  DVB-H specific information elements are transported in sections currently unused by DVB-T transport (⇔TPS Signaling for DVB-H, MPE-FEC and Time Slice info).

- **DVB services and DVB-H bursts can be transmitted on the same multiplexed MPEG2-TS.**

- **MPE allows the transport of standard IP based datagrams (or other protocols).**
  This enables the seamless integration with different technologies from IT, Internet and other mobile communication protocols.

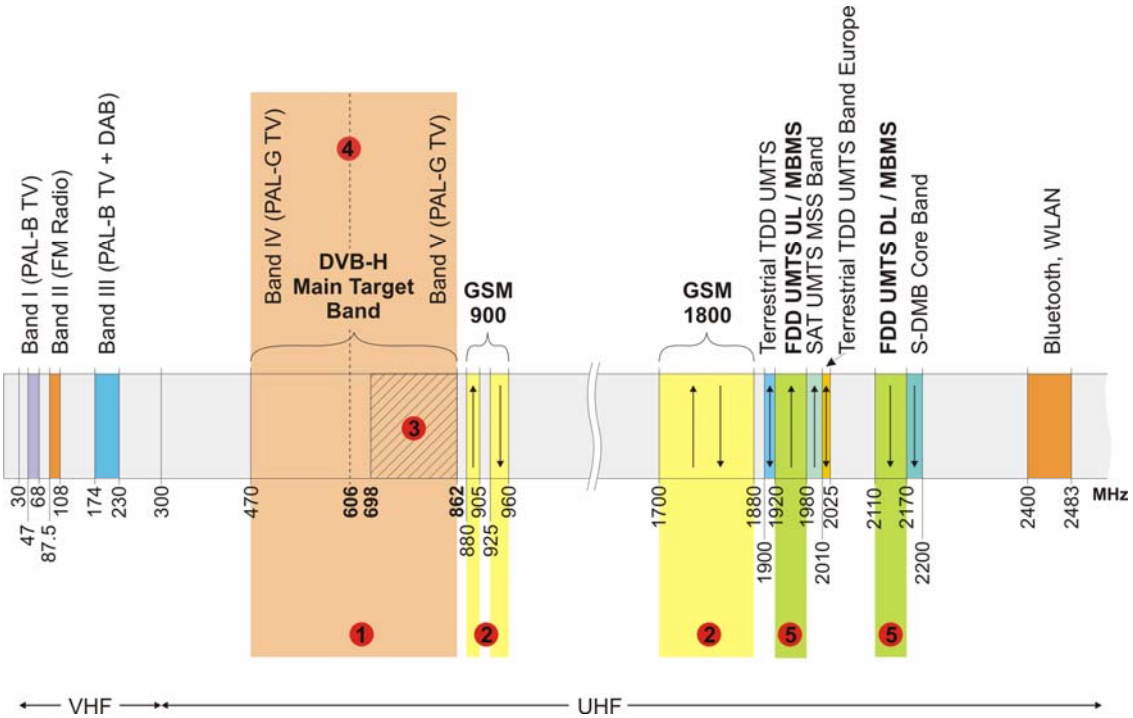
- **TPS signaling options**
  used to signal if Time Slicing or MPE-FEC are applicable in higher layers of the system. [ETSI TR 102 377 6.3]

- **5 MHz channels in addition to 6, 7 and 8 MHz channels**
  Allows the installation of DVB-H systems outside broadcasting channels (VHF, UHF).This is of interest e.g. in the United States, where a network of about 1,7 GHz is using DVB-H with 5 MHz channel.

- **Abbreviations of this Section:**

DVB	Digital Video Broadcasting	**MPE**	Multi Protocol Encapsulation (DVB-H)
DVB-H	Digital Video Broadcasting – Handheld	**MPEG2-TS**	MPEG-2 Transport Stream (DVB)
DVB-T	Digital Video Broadcasting – Terrestrial	**OFDM**	Orthogonal Frequency Division Multiplexing
ETSI	European Telecommunications Standard Institute	**PHY**	Physical Layer
FEC	Forward Error Correction	**TPS**	Transmission Parameter Signalling (DVB-H)
FFT	Fast Fourier Transformation	**TS**	Transport Stream
GHz	Giga Hertz	**UHF**	Ultra High Frequency
IP	Internet Protocol (RFC 791)	**VHF**	Very High Frequency
IT	Information Technology	**WiMAX**	??
MHz	Mega Hertz		

1.3.3 Frequency Bands Overview – Example: European Situation



The objective of this section is to provide the student with an overview, which frequency bands are preferred for DVB-H and MBMS transmissions.

The key points of this section are:
1. DVB-H is targeting the TV bands IV and V in the range between 470 MHz to 862 MHz.
2. In case a receiver terminal supports both GSM 900 and DVB-H, the usable frequency range is limited to channels below 698 MHz.
3. MBMS utilizes the standard UMTS and GPRS bands (UL 1920 MHz – 1980 MHz, DL 2110 MHz – 2170 MHz)

- **DVB-H**
  Transmission network only needs a few high-power transmitters to cover vast areas.
  DVB-H can offer a maximum capacity of 11 Mbit/s on an 8 MHz channel.

- **MBMS**
  MBMS must share the spectrum with unicast applications. It can offer a maximum capacity of 384 kbps in 5 MHz band.
  MBMS targets the delivery of local content over a limited area to a limited audience.

This area is allocated as the preferred band for DVB-T / H in Europe. 1

GSM bands are allocated in the areas marked yellow in the figure above. As the drawing shows, there is only a guard band of 18 Mhz between GSM 900 and the DVB-T / H band, which may cause interference problems 2
Therefore, if a terminal supports both GSM and DVB-H, the DVB-T / H target band will be limited to 698 Mhz. 3

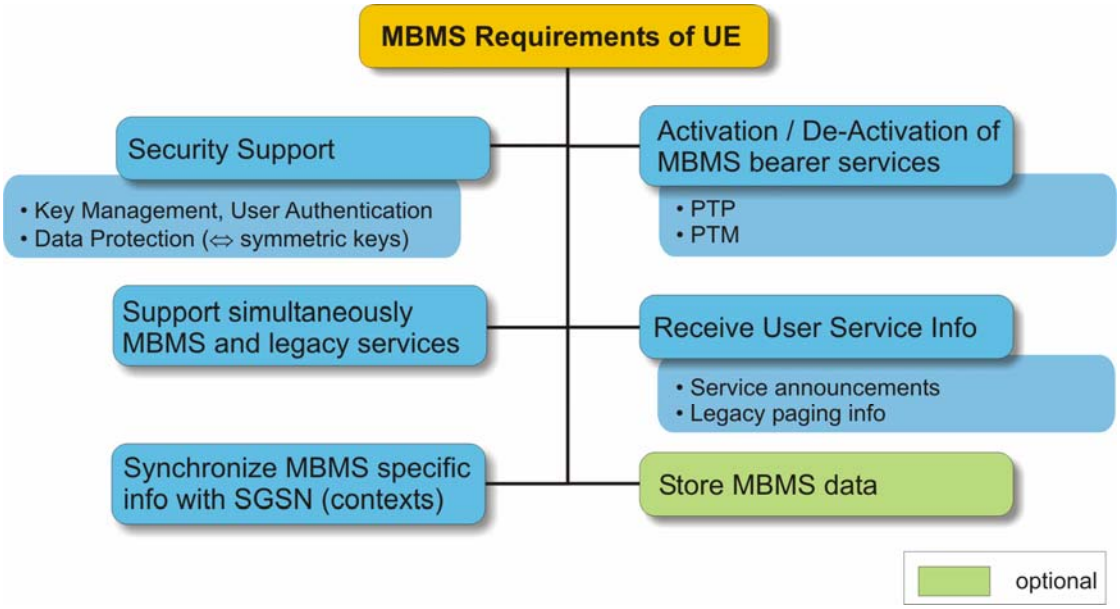
The area allocated for DVB-T / H are the TV bands IV (470 – 582 Mhz, channels 21 - 34) and V (582 – 862 Mhz, channels 35 -69) 4

MBMS uses the same frequency bands as the legacy UMTS bands. 5

- **Abbreviations of this Section:**

DAB	Digital Audio Broadcasting	**MSS**	Maximum Segment Size (TCP)
DL	Downlink	**PAL**	Phase Alternating Line (TV Norm)
DMB	Digital Multimedia Broadcasting	**SAT**	Satellite
DVB	Digital Video Broadcasting	**TDD**	Time Division Duplex
DVB-H	Digital Video Broadcasting - Handheld	**TV**	Television
DVB-T	Digital Video Broadcasting – Terrestrial	**UHF**	Ultra High Frequency
FDD	Frequency Division Duplex	**UL**	Uplink
FM	Frequency Modulation	**UMTS**	Universal Mobile Telecommunication System
GPRS	General Packet Radio Service	**US**	United States
GSM	Global System for Mobile Communication	**VHF**	Very High Frequency
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**WLAN**	Wireless LAN
MHz	Mega Hertz	**kbps**	kilo-bits per second

2.2.3 MBMS Specific Requirements on the UE



The objective of this section is to provide the student with a list of functions required in the UE to support MBMS. [3GTS 23.246]

The key points of this section are:
1. The UE needs to able to discover and join MBMS services, detect the start times of MBMS sessions, synchronize with the network components and finally receive the service.
2. For certain type of services, the UE may need storage capabilities to be able to download content and play it later locally.

Detailed Description

- **Security support**
  This relates to key generation and validation function and the associated storage, authentication of the UE and service authorization based on registration data held in the HSS. Data protection of MBMS content uses symmetric key principles. [3GTS 33.246]

- **Activation / deactivation of MBMS bearer services**
  With the activation of the MBMS bearer services, no further request is required to receive MBMS data. The user will be notified, that data transfer is about to start.

Based on the MBMS session identifier, the UE may decide, whether it can ignore a scheduled transmission, because the content has been already received. The MBMS session identifier is provided with session start from the BM-SC and received by the UE with paging message notifying the forthcoming data transfer.

The MBMS session identifier is only applicable to MBMS download delivery services.

- **Support simultaneous services**
  MBMS content may be received simultaneously to an ongoing call or messaging, depending on terminal capability. This may result in losses in the MBMS data reception. MBMS user services should be able to cope with that.

- **Receive User Service Info**
  This relates to reception of MBMS specific user service announcements and non MBMS specific paging information. The reception depends on the terminal capabilities and may cause losses in MBMS data reception. In that case, the MBMS user service should be able to handle such losses.

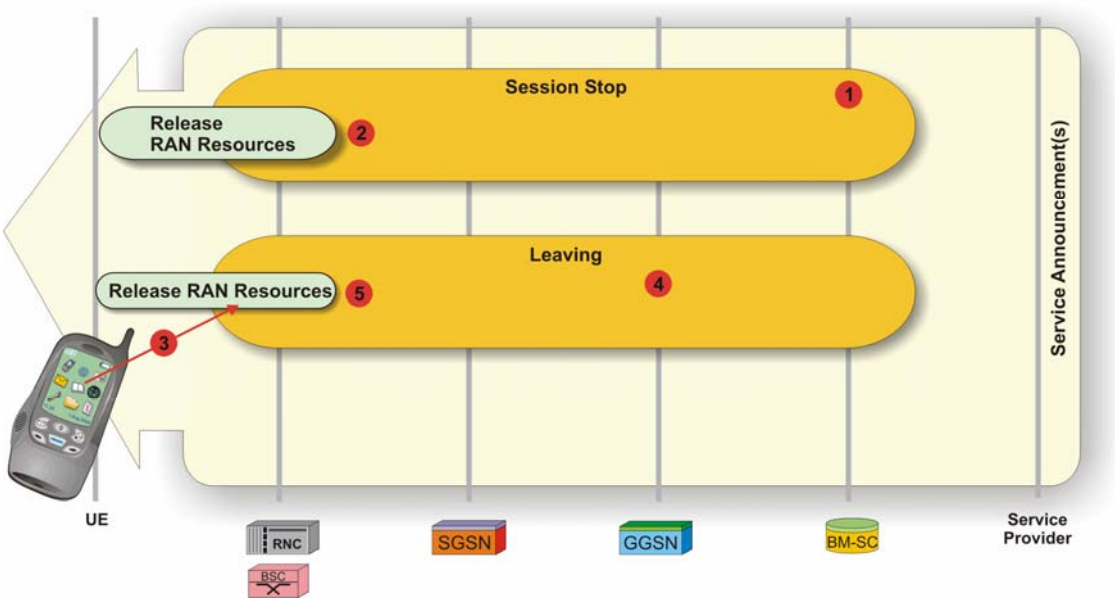
- **Synchronize MBMS specific info with SGSN (contexts)**
  This is used to determine, which of the MBMS UE contexts are still active.
  Upon request from The SGSN, the UE will generate a UE context with its reception parameters and capabilities. This information will be distributed by the SGSN to the uplink nodes and to the RAN and will be linked in the nodes to the bearer context, which conveys the parameters and requirements for a particular MBMS service. In the multicast case, a MBMS context will be generated with the first UE requesting the reception of such service.

- **Optional store MBMS data**
  A UE may be able to store the received MBMS data, i.e. download services, depending on the terminal capabilities. This may also involve DRM.

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**PTM**	Point to Multipoint
BM-SC	Broadcast Multicast Service Center (3GTS 23.346)	**PTP**	Point to Point
DRM	Digital Rights Management	**RAN**	Radio Access Network
HSS	Home Subscriber Server (3GTS 23.002). HSS replaces the HLR with 3GPP Rel. 5	**SGSN**	Serving GPRS Support Node
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**UE**	User Equipment

2.3.3 Overview of Multicast Mode Service Phases (continued)



The objective of this section is to provide the student with an overview, how a multicast session is terminated at the end of a service and how a UE may de-register from the reception of services. [3GTS 23.246]

The key points of this section are:
1. The BM-SC controls the release of the MBMS user plane by switching the MBMS context from “Active” state to “Standby” state. This may trigger the release of RAN resources towards the UE, if no more MBMS services shall be transmitted towards the UE’s in the cell.
2. When a UE leaves the subscription to a service, the UE contexts for that terminal will be de-activated in the network entities. Also the MBMS bearer contexts will be de-activated, if this has been the very last MBMS UE context in the entity.

1

The BM-SC Session and Transport function stops a session with a Session Stop Request message towards the downstream nodes. The session would typically be terminated, when no more data transmission is expected for a certain period of time. The purpose is to release the bearer plane resources in the network and reduce the UE power consumption.
The BM-SC and the downstream nodes will consequently change the state attribute of their MBMS bearer context to “Standby”. The BM-SC Membership function will be notified for charging purpose.

Triggered by the Session Stop message, the RAN will update the notification information for the UE and release the RAN resources provided they are not used by other services for that cell.
Upon reception of this information, the UE stops receiving the MBMS traffic data.

Multicast service deactivation may be desired, when the UE should no longer receive MBMS data and wants to leave a multicast group This could be initiated at any time by:

- ⇒ the UE – as in the example above,
- ⇒ the GGSN
- ⇒ the BM-SC
- ⇒ the SGSN

In the example above, the user de-selects the MBMS service it is registered to at the UE. As a result, the UE will send an IGMP Leave or MLD Leave message over the PDP context to exit from a particular multicast service identified by an IP multicast address.

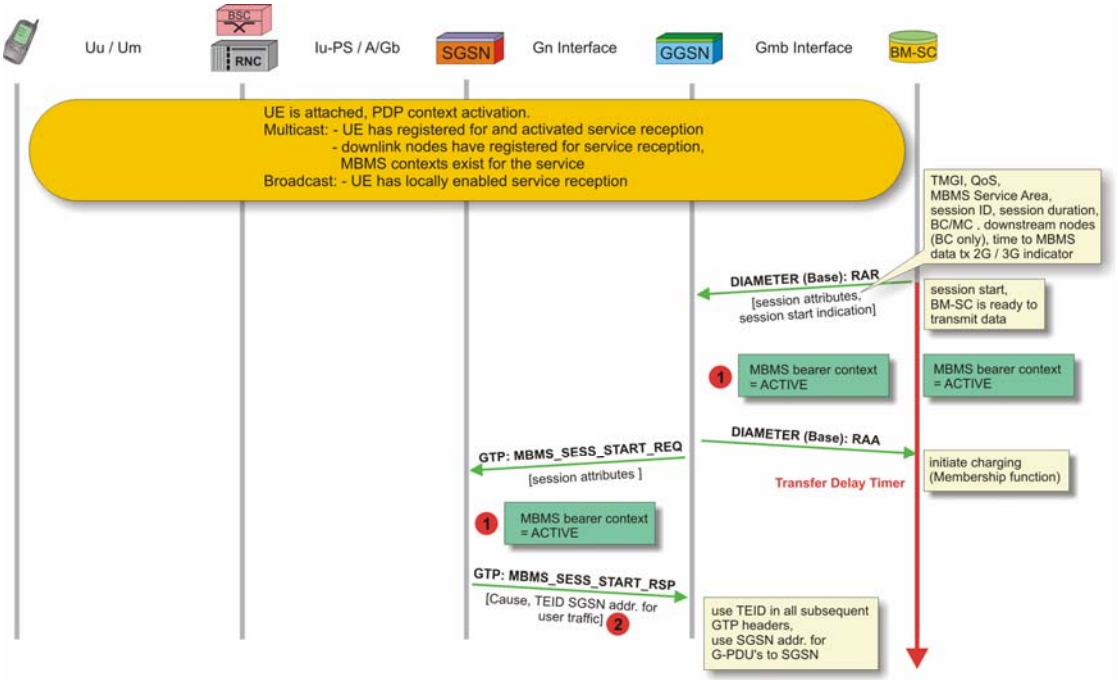
The GGSN forwards the information to the BM-SC indicating the UE which is requesting to leave. The BM-SC will then issue a UE Removal Request to the GGSN which will result in the release of the MBMS UE contexts in the downstream nodes.

If PTP resources have been assigned to the UE for MBMS data reception, they will released by the RAN. If shared PTM resources were assigned, the RAN may decide to move the remining UE's to dedicated PTP resources.

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**MLD**	Multicast Listener Discovery (RFC 2710)
BM-SC	Broadcast Multicast Service Center (3GTS 23.346)	**PDP**	Packet Data Protocol
GGSN	Gateway GPRS Support Node	**PTM**	Point to Multipoint
IGMP	Internet Group Multicast Protocol (RFC 1112, RFC 2236)	**PTP**	Point to Point
IP	Internet Protocol (RFC 791)	**RAN**	Radio Access Network
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**SGSN**	Serving GPRS Support Node
		UE	User Equipment

2.4.4 MBMS Session Start



The objective of this section is to illustrate the process of starting a MBMS session for broadcast or multicast delivery towards the RAN.
[3GTS 23.246, 29.061]

The key points of this section are:
1. The session start is initiated by the BM-SC.
2. All entities receiving session start information will set their MBMS context to Active state.
3. The BM-SC will set a transfer delay timeout to ensure that all downstream nodes can receive the associated service notification and setup the required resources.

Detailed Description:

- **Initial Conditions**
  The BM-SC initiates the MBMS Session Start, when it is ready to transmit data. This may happen independent of the status of the UE's, i.e. before they joined the service or enabled reception, during the registration or when they have become a member of a service group. In the example above, it is assumed, that the UE is attached to the network and a default PDP context has been established. The UE has joined the service and is prepared for the delivery of MBMS data.

- **Applicability of this procedure**
  The procedure applies to both broadcast and multicast service delivery. It requests to activate all necessary bearer resources in the network to prepare for the data transfer and to notify interested UE's.

- **Description**
  The BM-SC will communicate important session attributes with a Diameter RAR message to the GGSN's that have previously registered for the corresponding bearer service and the GGSN will forward the information to the registered SGSN's and all BSC'S / RNC's that are connected to those SGSN's.
  The session attributes include QoS, MBMS Service Area, estimated session duration, time to MBMS data transfer, service delivery type (broadcast / multicast) and a 2G/3G indicator for the SGSN's. For a broadcast delivery, also the list of downstream nodes as configured in the BM-SC will be provided.

  The GGSN will confirm session start indication with a Diameter RAA message and both GGSN and BM-SC will set the state attributes for the related bearer context to active. The BM-SC will inform the Membership function of the session start in order to enable charging. [3GTS 29.061]
  The BM-SC will start a transfer delay timer of multiple seconds or tens of seconds to allow the downstream entities to prepare for the data reception i.e. establish the necessary bearers, notify the UE's, possibly count the interested users in a cell etc.

  An SGSN receiving MBMS_SESS-START_REQ message over the GTP tunnel will store the session attributes, set the state attribute to active and sends a confirmation with MBMS_SESS-START_RSP providing a cause the TEID for the bearer plane that the GGSN shall use for data transmission and the SGSN address for G-PDU's to the SGSN.

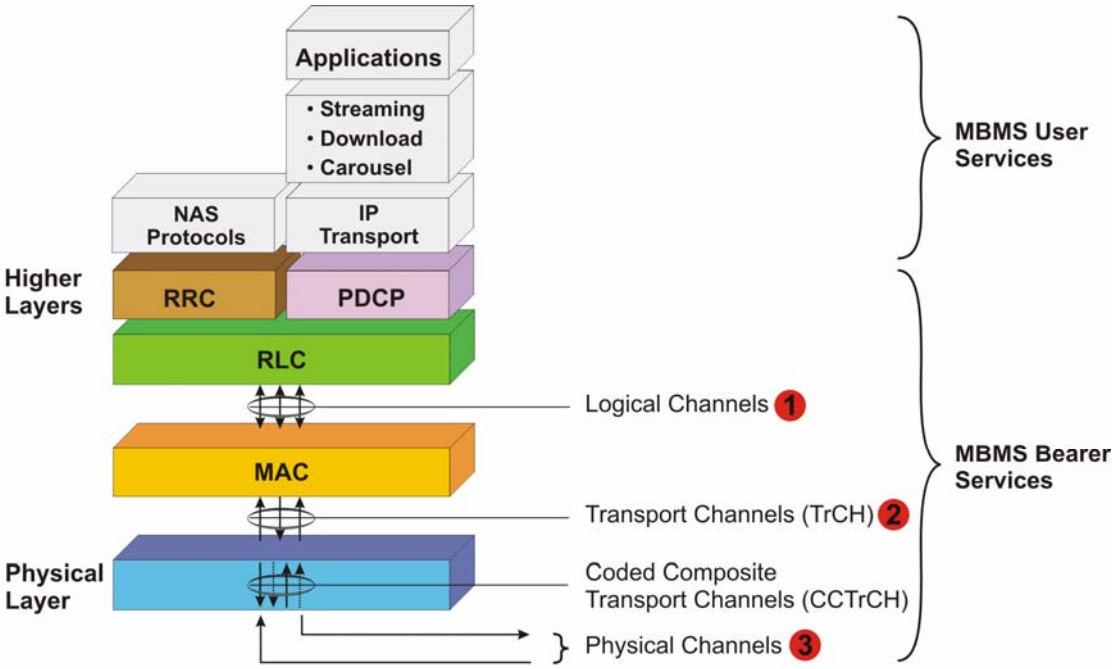
  

Note, that the SGSN will only establish one bearer plane with one GGSN for a bearer service, even if multiple MBMS_SESS_START_REQ messages have been received.

3GTS	3rd Generation Technical Specification	**QoS**	Quality of Service
BM-SC	Broadcast Multicast Service Center (3GTS 23.346)	**RAA**	RE-Auth-Answer command (Diameter BASE, RFC 3588)
BSC	Base Station Controller	**RAN**	Radio Access Network
G-PDU	T-PDU + GTP-Header	**RAR**	RE-Auth-Request command (Diameter BASE, RFC 3588)
GGSN	Gateway GPRS Support Node	**RNC**	Radio Network Controller
GTP	GPRS Tunneling Protocol (3GTS 29.060)	**SGSN**	Serving GPRS Support Node
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**TEID**	Tunnel Endpoint Identifier (GTP / 3GTS 29.060)
PDP	Packet Data Protocol	**UE**	User Equipment
PDU	Protocol Data Unit or Packet Data Unit		

3.5 Overview of New Logical Channels in UMTS Rel. 6

3.5.1 An Overview of channels in UMTS



The objective of this section is to provide a structural overview of logical, transport and physical channels and how they relate to the protocol layers. The picture also identifies the levels used for the MBMS bearer services and MBMS user services.

The key point of this section is that the different protocol layers provide the mapping of the MBMS User Services towards the Bearer Services. This relates to the structure shown in section 1.3.2 and provides the channel details of the MBMS Bearer Services.

Detailed Description:

Note: The comprehension of the channel concept, the channel mapping and the functions and differences of the different channels is *the* milestone in the understanding how UMTS operates.

In general, there are 3 different types of channels defined for the UMTS:

Logical Channels
Logical channels provide the bearers for the information exchange between the MAC-protocol and the RLC-protocol. Logical channels can be unidirectional or bi-directional. There are two types of logical channels:

⇒ Traffic channels to convey user data within the user data planes.
⇒ Control channels to convey signaling information within the control planes.

Transport Channels
Transport Channels provide the bearers for the information exchange between the MAC-protocol and the physical layer. All transport channels are unidirectional.
Within the physical layer there is multiplexing unit that maps the transport channels of one type (e.g. all DCH's) onto one CCTrCH. The data from one CCTrCH is finally mapped onto one or more physical channels. For each UE, there can be only one CCTrCH per transport channel type.

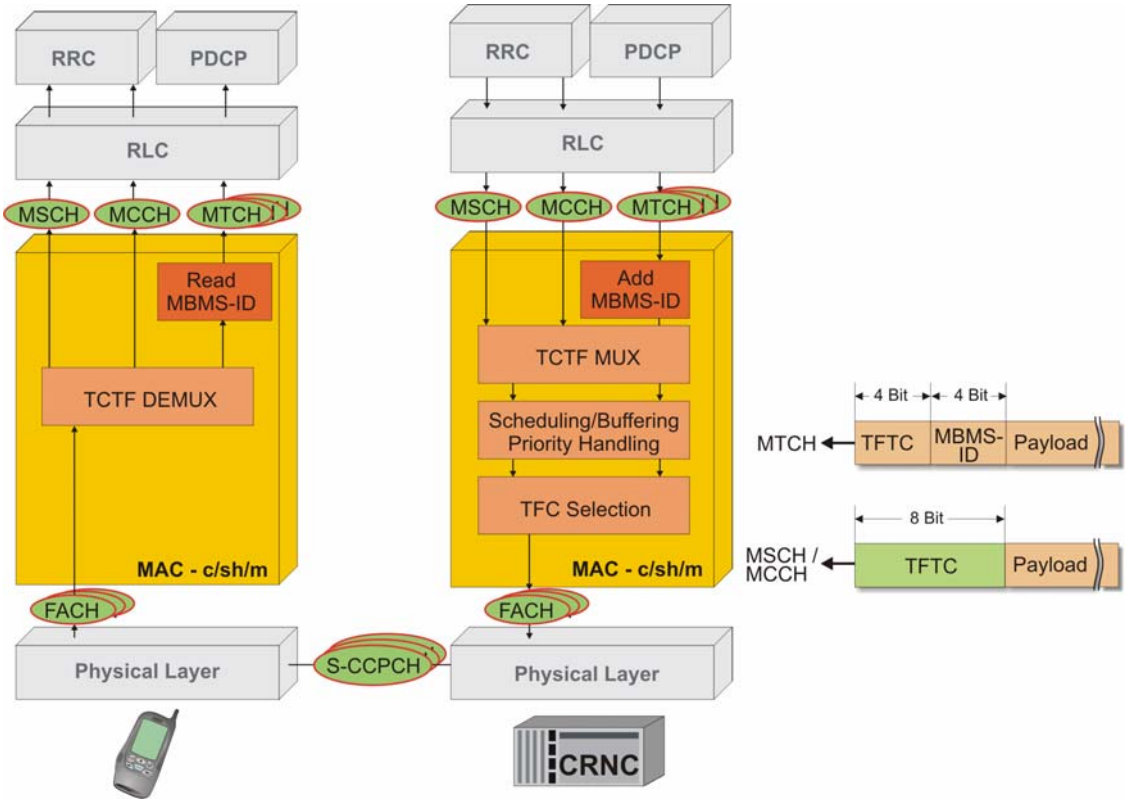
Physical Channels
Physical channels provide the bearers for the different CCTrCH's / TrCH's. Each physical channel is identified through its frequency (UARFCN), spreading code, scrambling code and duration. In uplink direction, the phase of the signal (0 or 90°) is also required for identification and differentiation.

[3GTS 25.301, 3GTS 25.302, 3GTS 25.211]

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**PDCP**	Packet Data Convergence Protocol (3GTS 25.323)
CCTrCH	Coded Composite Transport Channel (UMTS)	**RLC**	Radio Link Control (UMTS 3GTS 25.322)
DCH	Dedicated Channel (Transport)	**RRC**	Radio Resource Control (3GTS 25.331)
IP	Internet Protocol (RFC 791)	**TrCH**	Transport Channel (UMTS)
MAC	Medium Access Control (UMTS 3GTS 25.321)	**UARFCN**	UMTS Absolute Radio Frequency Channel Number
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**UE**	User Equipment
NAS	Non-Access-Stratum (UMTS)	**UMTS**	Universal Mobile Telecommunication System

3.8.2 The MAC-m Entity Additions



The objective of this section is to show the MAC-m additions on UTRAN side (CRNC) and on the UE side and the interaction with the logical channels and the common transport channel (FACH). [3GTS 25.346]

The key point of this section is that there is one MAC-c/sh/m entity in the CRNC for each cell and one MAC-m entity in the UE.

In case of selection combining, there is one MAC-m entity in the UE for each selectively combined cell.

Detailed Description:

- **MBMS-Id**
  The MBMS-Id field in the MAC header is used to distinguish between data of specific MBMS services.

- **TCTF MUX**
  This function handles the insertion of the TCTF field in the MAC header and also the respective mapping between logical channels (i.e. MTCH and MCCH) and transport channels. The TCTF field is used for channel type selection.

- **TCTF DEMUX**
  This function handles the detection and deletion of the TCTF field in the MAC header, and also the respective mapping between logical channels (i.e. MTCH and MCCH) and transport channels.

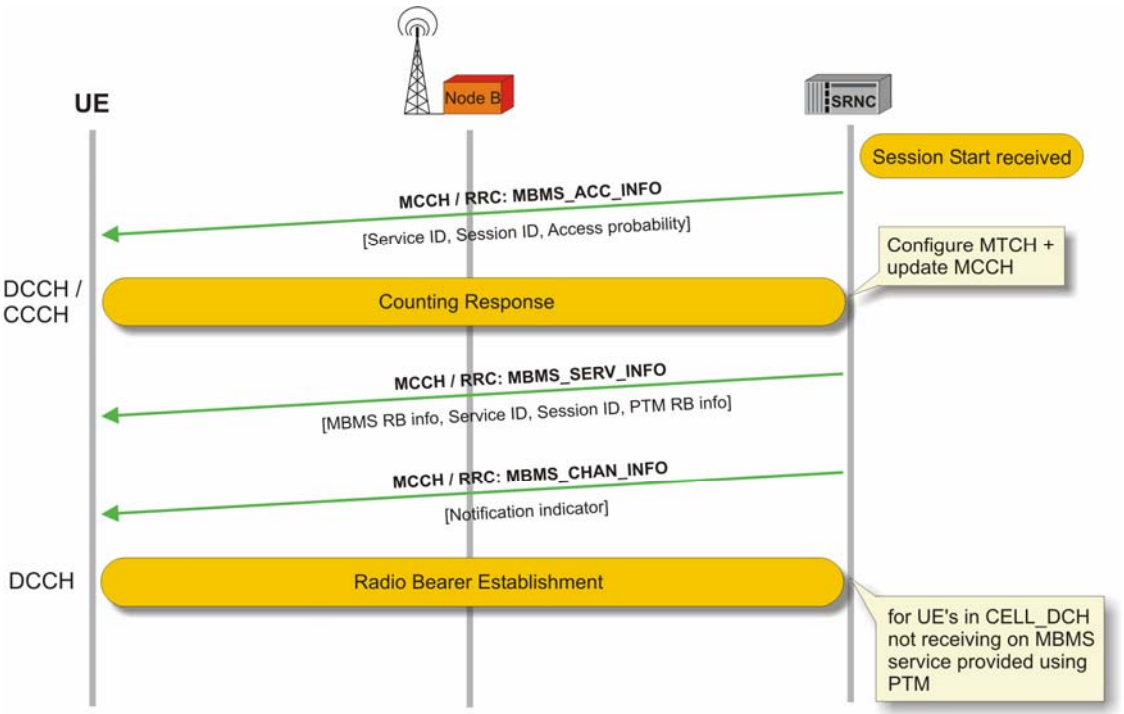
- **Scheduling / Buffering / Priority Handling**
  This function manages common transport resources between MBMS and other data flows in respect to their priority and delay requirements provided by higher layers.

- **TFC selection**
  TFC selection is done for a FACH mapped to MTCH, MSCH and MCCH. In the case of MBMS soft combining, the combinable S-CCPCH channels shall have the same TFC during the TTI's in which L1 combining is used.

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**MSCH**	MBMS point-to-multipoint Scheduling Channel
CCPCH	Common Control Physical Channel (see also P-CCPCH and S-CCPCH)	**MTCH**	MBMS point-to-multipoint Traffic Channel
CRNC	Controlling RNC	**MUX**	Multiplexer
DEMUX	De-Multiplexer	**S-CCPCH**	Secondary Common Control Physical Channel (used as bearer for the FACH and PCH TrCH's / UMTS Physical Channel)
FACH	Forward Access Channel (UMTS Transport Channel)	**TCTF**	Target Channel Type Field
L1	Layer 1 (physical layer)	**TFC**	Transport Format Combination
MAC	Medium Access Control (UMTS 3GTS 25.321)	**TTI**	Transmission Time Interval
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**UE**	User Equipment
MCCH	MBMS point-to-multipoint Control Channel	**UTRAN**	UMTS (Universal Mobile Telecommunication System) Terrestrial Radio Access Network

3.9.2.2 Bearer Setup Initiation (UTRAN)



The objective of this section is to provide an overview, how the MBMS bearer setup may be initiated by notifying the UE and possibly requesting counting from the UE's.

The key point of this section are
1. Prior to the setup of radio bearers, the RNC may need to determine the optimum transmission i.e PTP or PTM by initiating a counting procedure for the UE's in a cell being interested to receive the service.
2. The scenario is part of the session initiation picture as illustrated in section 2.3.3. To be more precise, it represents the green bubble "RAN Resource Setup".

Detailed Description:

- **Initial Conditions**
  The user has registered for one or more MBMS service. The session has been started by the BM-SC in order to prepare for data delivery to the interested users.

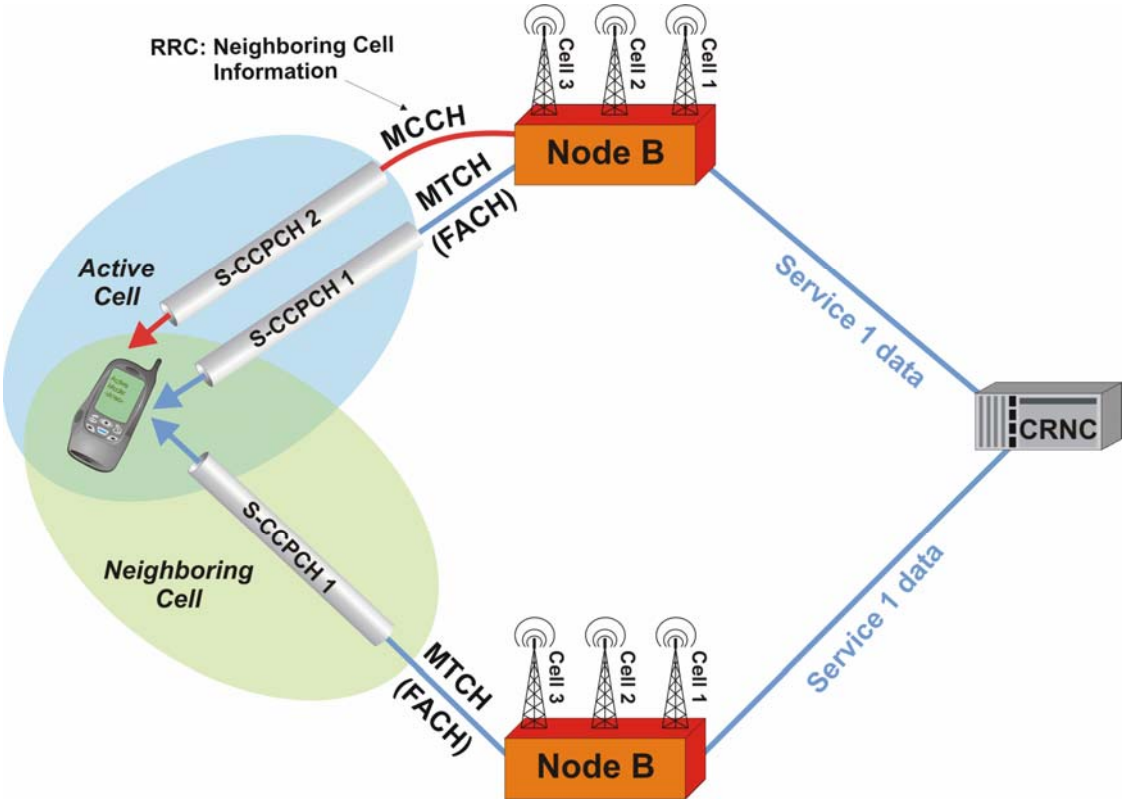
- **Applicability of this procedure**
  This procedure applies to UE's in UTRAN which have activated a MBMS service reception on their terminals. The UE need to read the notification information to verify if the service it is interested in is concerned by the notification. If that is the case, the UE has to act on the information provided, e.g. by responding to a counting indication.

- **Description**
  When the RNC receives the session start request from the CN, it has to decide whether it applies counting to determine the optimum transfer mode or not. The RNC will send the RRC message MBMS_ACC_INFO on the MCCH. This message will provide the Service Id, in the multicast case possibly a session Id and an Access Probability value to be used for scheduling a possible counting response.
  For each joined or selected service, the UE shall validate, whether the notification concerns such services.
  If a response is requested for these applicable services, the UE will have to provide a counting response using the Access Probability value to calculate the response time.
  Following the counting response, the UE needs to read additional service info on MCCH if the notification concerned the services it has joined or selected.
  Such information may require to establish PTP radio bearer.

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**MTCH**	MBMS point-to-multipoint Traffic Channel
ARIB	Association of Radio Industries and Businesses (Japanese)	**NI**	Network Indicator
BM-SC	Broadcast Multicast Service Center (3GTS 23.346)	**PTM**	Point to Multipoint
CCCH	Common Control Channel (UMTS Logical Channel)	**PTP**	Point to Point
CN	Core Network	**RAN**	Radio Access Network
DCCH	Dedicated Control Channel (UMTS Logical Channel)	**RB**	Radio Bearer
ID	Identity	**RNC**	Radio Network Controller
MAC	Medium Access Control (UMTS 3GTS 25.321)	**RRC**	Radio Resource Control (3GTS 25.331)
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**UE**	User Equipment
MCCH	MBMS point-to-multipoint Control Channel	**UMTS**	Universal Mobile Telecommunication System
		UTRAN	UMTS (Universal Mobile Telecommunication System) Terrestrial Radio Access Network

3.9.4 Selective and Soft Combining



The objective of this section is to explain to the student the principle and purpose of the combining function at the UE. [3GTS 23.346 (7.1)]

The key point of this section are:

1. The UE will receive neighbouring cell information on MCCH associated to a MTCH carrying the MBMS service(s). The UE therefore does not need to listen to the MCCH in the neighbour cell to detect the same service on MTCH from that cell.
2. Note that MBMS expands the soft combining to common TrCH's. In legacy UMTS, soft combining is only possible by DCH's.
3. To enable the combining functions, the RRC message MBMS_NEIGH_CELL_PTM_RB_INFO conveys the combining timing offset(s) and the type in it's parameters.

Detailed Description:
UE's may receive multiple radio links of common channels from different cells and combine them so that the block error rate is reduced in particular at cell boundary. Consequently, less transmission power of NodeB is required and the cell capacity is improved.

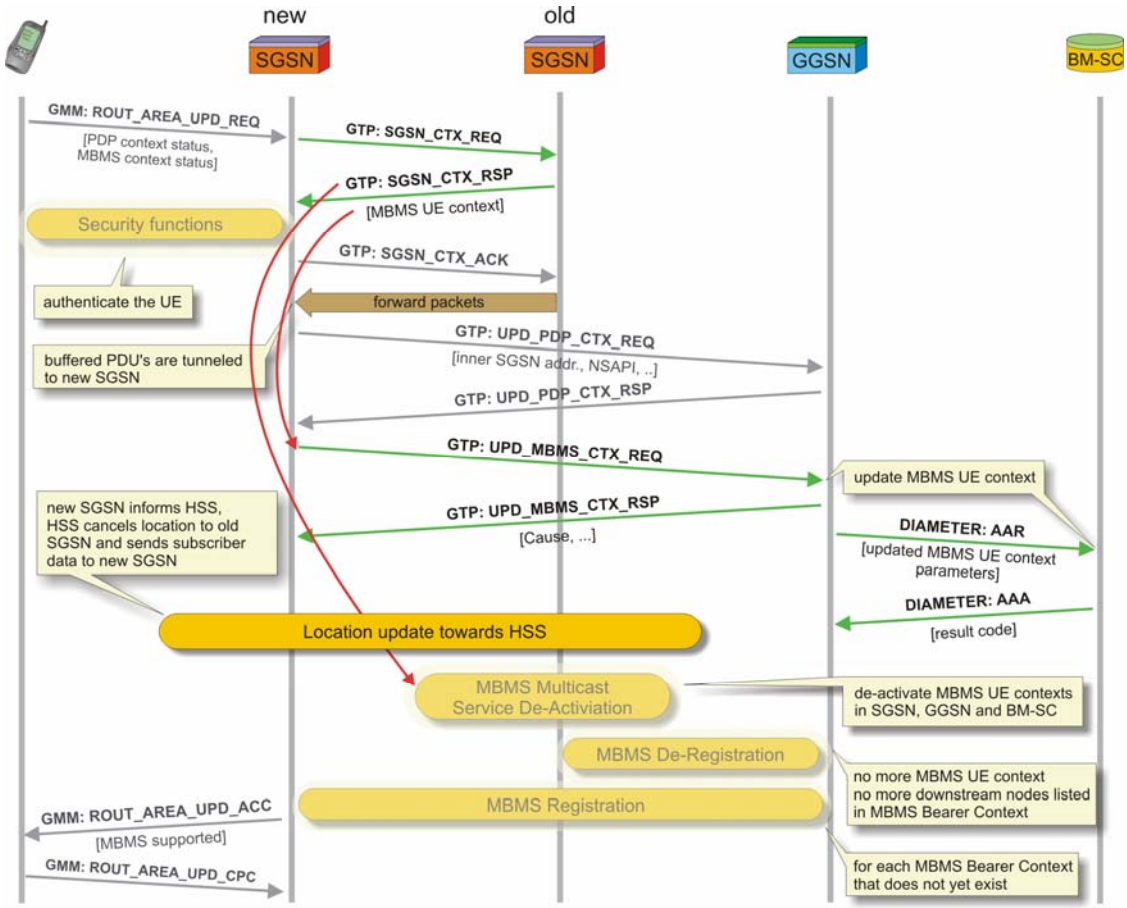
The UE determines suitable neighbouring cells combining based on measurements (e.g. CPICH Ec/No) and the presence of Neighbouring Cell Information of these cells. A maximum of 2 neighbouring cells may be combined during a MBMS reception while the S-CCPCH with the MCCH is being received. [3GTS 25.306]
The possibility of performing selective or soft combining should be signalled to the UE.
When selective or soft combining is possible between cells the UTRAN sends MBMS NEIGHBOURING CELL INFORMATION with the MTCH configuration of the neighbouring cells. With MBMS NEIGHBOURING CELL INFORMATION the UE is able to receive MTCH transmission from the neighbouring cells without reception of the MCCH of that cell.

The UE does not need to simultaneously support selectiive combining and soft combining.

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**MCCH**	MBMS point-to-multipoint Control Channel
CCPCH	Common Control Physical Channel (see also P-CCPCH and S-CCPCH)	**MTCH**	MBMS point-to-multipoint Traffic Channel
CPICH	Common Pilot Channel (UMTS Physical Channel / see also P-CPICH and S-CPICH)	**RRC**	Radio Resource Control (3GTS 25.331)
DCH	Dedicated Channel (Transport)	**S-CCPCH**	Secondary Common Control Physical Channel (used as bearer for the FACH and PCH TrCH's / UMTS Physical Channel)
Ec / No	Received energy per chip / power density in the band	**TrCH**	Transport Channel (UMTS)
FACH	Forward Access Channel (UMTS Transport Channel)	**UE**	User Equipment
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**UMTS**	Universal Mobile Telecommunication System
		UTRAN	UMTS (Universal Mobile Telecommunication System) Terrestrial Radio Access Network

3.11.3.2 MBMS Inter SGSN Routing Area Update



The objective of this section is to illustrate how a routing area update will be made for MBMS between two SGSN's and the serving SGSN changes. [3GTS 23.246, 23.060]

The key points of this section are:
1. The procedure is based on the standard Inter SGSN Routing Area Update with some extensions to request the provision of MBMS contexts and the resulting registrations towards the BM-SC. These extensions are marked with coloured arrows in the drawing above.
2. The handling of any PDP contexts established by the UE is not changed by MBMS requirements.
3. The Routing Area Update is independent of ongoing MBMS sessions.

Detailed Description:

- **Initial Conditions**
  The mobile station has joined one or more MBMS services and is moving and the serving SGSN changes.

- **Applicability of this procedure**
  The procedure applies independent of ongoing MBMS sessions. The specific MBMS actions are only applicable when a UE has joined MBMS services and the SGSN supports MBMS.

- **Description**
  The UE sends a Routing Area Update Request to the new SGSN.
  An SGSN supporting MBMS indicates the MBMS support in the SGSN Context Request message, conveyed in an extension header. In this case, the old SGSN will transfer the MBMS UE context in the SGSN Context Response message.

  For such MBMS UE context, the SGSN sends Update MBMS UE Context Request message to the GGSN's concerned, including parameters such as Serving network identity, MS Time Zone, CGI / SAI, RAT type etc.). The GGSN will update the MBMS UE Context fields and send the confirmation.
  Also, the GGSN will send Update UE Context with parameters such as RAI to the BM-SC to enable update of the MBMS UE Context information there.

  If the new SGSN indicated no support for MBMS, the old SGSN will initiate de-activation all MBMS UE contexts of the UE in the SGSN, GGSN and BM-SC. Also, if no more MBMS UE Contexts for the applicable MBMS bearer service exist and no more downstream nodes are configured in the MBMS Bearer Context, the SGSN initiates MBMS de-registration towards the GGSN.

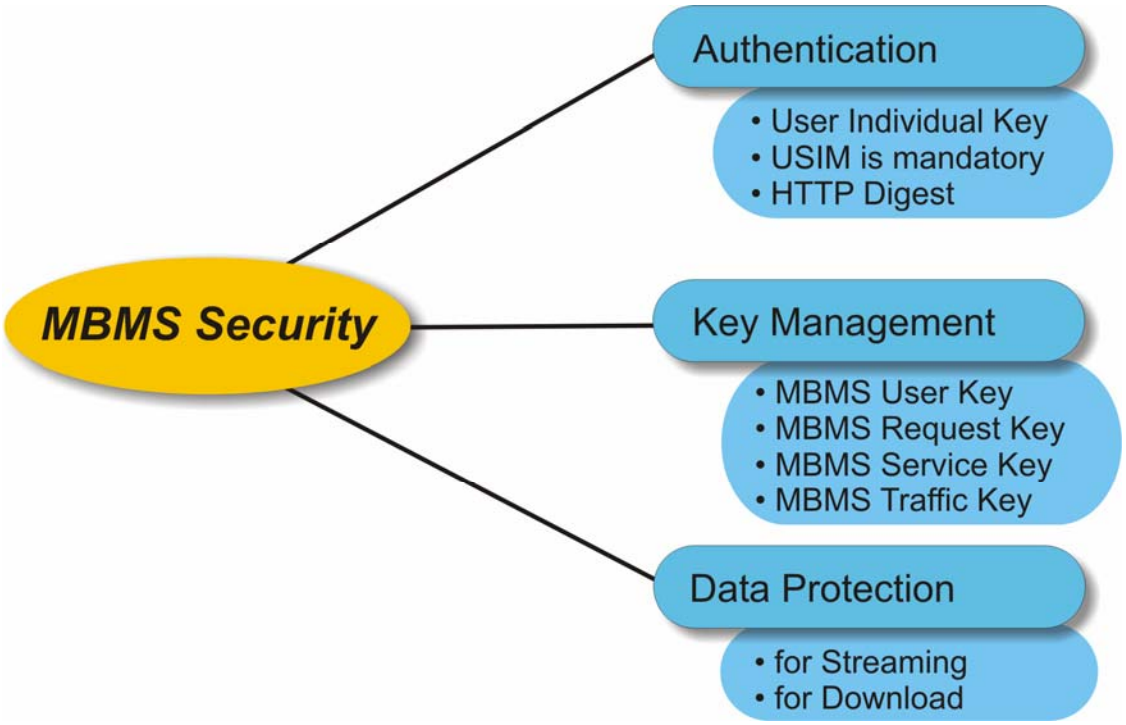
  When the new SGSN supports MBMS, it has to verify for each MBMS UE Context it has received, whether it already has an existing MBMS Bearer Context. For the missing services, it will initiate MBMS Registration towards the GGSN in order to receive the service.

  The SGSN will indicate with the Routing Area Update Accept message whether MBMS is supported or not.

3GTS	3rd Generation Technical Specification	**MS**	Mobile Subscriber Station (IEEE 802.16e)
BM-SC	Broadcast Multicast Service Center (3GTS 23.346)	**PDP**	Packet Data Protocol
CGI	Cell Global Identification	**RAI**	Routing Area Identification
GGSN	Gateway GPRS Support Node	**RAT**	Radio Access Technology (e.g. GERAN, UTRAN, ...)
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**SAI**	Service Area Identifier
MS	Mobile Station	**SGSN**	Serving GPRS Support Node
		UE	User Equipment

4.4 MBMS Security

4.4.1 User Authentication and Authorization



The objective of this section is to show the mechanisms to ensure a safe delivery of MBMS services only for authorized users. [3GTS 26.346]

The key points of this section are:
1. The MBMS security is similar but independent from security mechanisms in the RAN.
2. Authentication for MBMS and for IMS is using the same methods.
3. The UE needs an USIM where keys can be stored securely and which provides the security algorithms.

Detailed Description:
In order to achieve a secure transfer of data to a given set of users three functions have been defined: Authentication, Key Management and Data Protection
These security functions are optional and may run on top of the security the UTRAN/GERAN offers during its GMM procedures and while in packet transfer mode. This means that MBMS security runs on top of the IP layer of an existing PDP context, mainly between the UE and BM-SC.

The UE gets knowledge of the security functions to be performed by the service announcement parameters or just by being challenged to authenticate while the UE attempts to activate an MBMS service.

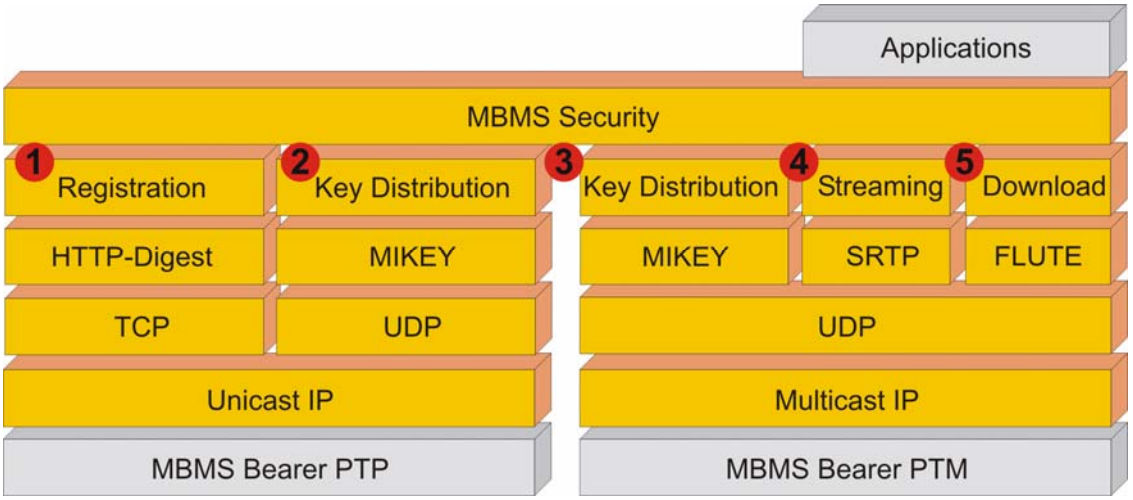
Authentication and authorizing the user
MBMS security functions itself appear to be very similar to the mechanisms used for the legacy authentication in UMTS. Like in UMTS it is based on a user individual key stored on the USIM and in the HSS.
A UE may be authenticated during service registration and deregistration or during its request for an MBMS-session-key.
The Authentication and Key Agreement security protocol (AKA) used performs the authentication and session key distribution. AKA is a challenge-response type protocol.
Once the UE is authenticated it is allowed to derive the keys for a particular service and traffic data stream from the BM-SC.

Method / Protocol: HTTP Digest delivers RAND and AUTN, asking for a user Id and a password
Main Parameters: User Id = base64 encoded (RAND)@domain-name, Password = MBMS-Request-Key = RES

- **Abbreviations of this Section:**

3GTS	3rd Generation Technical Specification	**MBMS**	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)
AKA	Authentication and key agreement (3GTS 33.102)	**MBMS**	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)
AUTN	Authentication Token (3GTS 33.102)	**PDP**	Packet Data Protocol
BM-SC	Broadcast Multicast Service Center (3GTS 23.346)	**RAN**	Radio Access Network
GERAN	GSM EDGE Radio Access Network	**RAND**	Random Number
GMM	GPRS Mobility Management	**RES**	Response
HSS	Home Subscriber Server (3GTS 23.002). HSS replaces the HLR with 3GPP Rel. 5	**UE**	User Equipment
HTTP	HyperText Transfer Protocol (RFC 2616)	**UMTS**	Universal Mobile Telecommunication System
IMS	Internet Protocol Multimedia Core Network Subsystem (Rel. 5 onwards)	**USIM**	Universal Subscriber Identity Module (3GTS 31.102)
IP	Internet Protocol (RFC 791)	**UTRAN**	UMTS (Universal Mobile Telecommunication System) Terrestrial Radio Access Network

4.4.3 Security Protocols



The objective of this section is to show the protocols and methods involved in the security functions.

The key points of this section are:
1. Secure service activation commences with an individual key on a PTP bearer and leads to the delivery of shared keys used for data stream decryption on the PTM bearer.
2. The MBMS Traffic Key delivery uses the same bearer as the MBMS user service.

1 Protected by the MBMS User Key to gain a security association

2 Protected by the MBMS User and Request Keys to deliver the MBMS Service Key

3 Protected by the MBMS User and Request Keys to deliver the MBMS Traffic Key

4 Protected by the MBMS Traffic Key using the SRTP encryption method

5 Protected by the MBMS Traffic Key using the OMA DRM V.2.0 DCF encryption method

Room for your Notes

- **Abbreviations of this Section:**

DCF	DRM Content Format	**MPEG2-TS**	MPEG-2 Transport Stream (DVB)
DRM	Digital Rights Management	**OMA**	Open Mobile Alliance (http://www.openmobilealliance.org/)
FLUTE	File Delivery over Unidirectional Transport (RFC 3926)	**PID**	Packet Identifier (MPEG2-TS)
HTTP	HyperText Transfer Protocol (RFC 2616)	**PSI**	Program Specific Information (MPEG2-TS)
IP	Internet Protocol (RFC 791)	**PTM**	Point to Multipoint
MBMS	Multimedia Broadcast / Multicast Service (3GTS 23.246, 3GTS 43.846)	**PTP**	Point to Point
MIKEY	Multimedia Internet KEYing (RFC 3830)	**SRTP**	Secure RTP (RFC 3711)
MPE	Multi Protocol Encapsulation (DVB-H)	**TCP**	Transmission Control Protocol
		UDP	User Datagram Protocol (RFC 768)