Title

Uplink TBFs on DBPSCH

Source

AT&T Wireless

Abstract

This contribution examines how uplink TBFs on DBPSCH are established, scheduled, and released.

This contribution is available in *Acrobat* and *Word* formats. The *Acrobat* format is smaller and has fewer display artifacts.

Recommendation

Decide whether MAC or RRC signalling should be used.

History

Document	Date	Description	Editor
GP-020727	15 Apr 2002	First draft.	AWS
G2-020406	14 May 2002	No change.	AWS

Contents

1. Introduction

This contribution uses sequence diagrams to examine how uplink TBFs on DBPSCH are established, scheduled, and released.

Figures in this document contain the sequence diagrams. A table following each figure describes message events in the sequence, including the values of directly relevant information elements.

Within each sequence diagram, the following conventions apply:

- Horizontal arrows indicate messages.
- Dashed horizontal arrows indicate optional messages.
- Heavy vertical or diagonal lines indicate a stimulus-response relationship between messages.
- Magenta hexagons indicate PMM and MM states. (If you do not have access to a colour display or printer, look for hexagons labelled with PMM and MM prefixes.)
- Cyan hexagons indicate RRC states and modes. (If you do not have access to a colour display or printer, look for hexagons labelled with RRC prefixes.)
- Green hexagons indicate MAC states. (If you do not have access to a colour display or printer, look for hexagons labelled with MAC prefixes.)
- Circles indicate an initiating event.

2. Simplified user perspective

The sequences in this contribution correspond to the following high-level user scenario:

- The user initiates a low-bandwidth video stream.
- The user initiates a background e-mail transfer.
- The e-mail transfer completes.
- The video stream finishes.

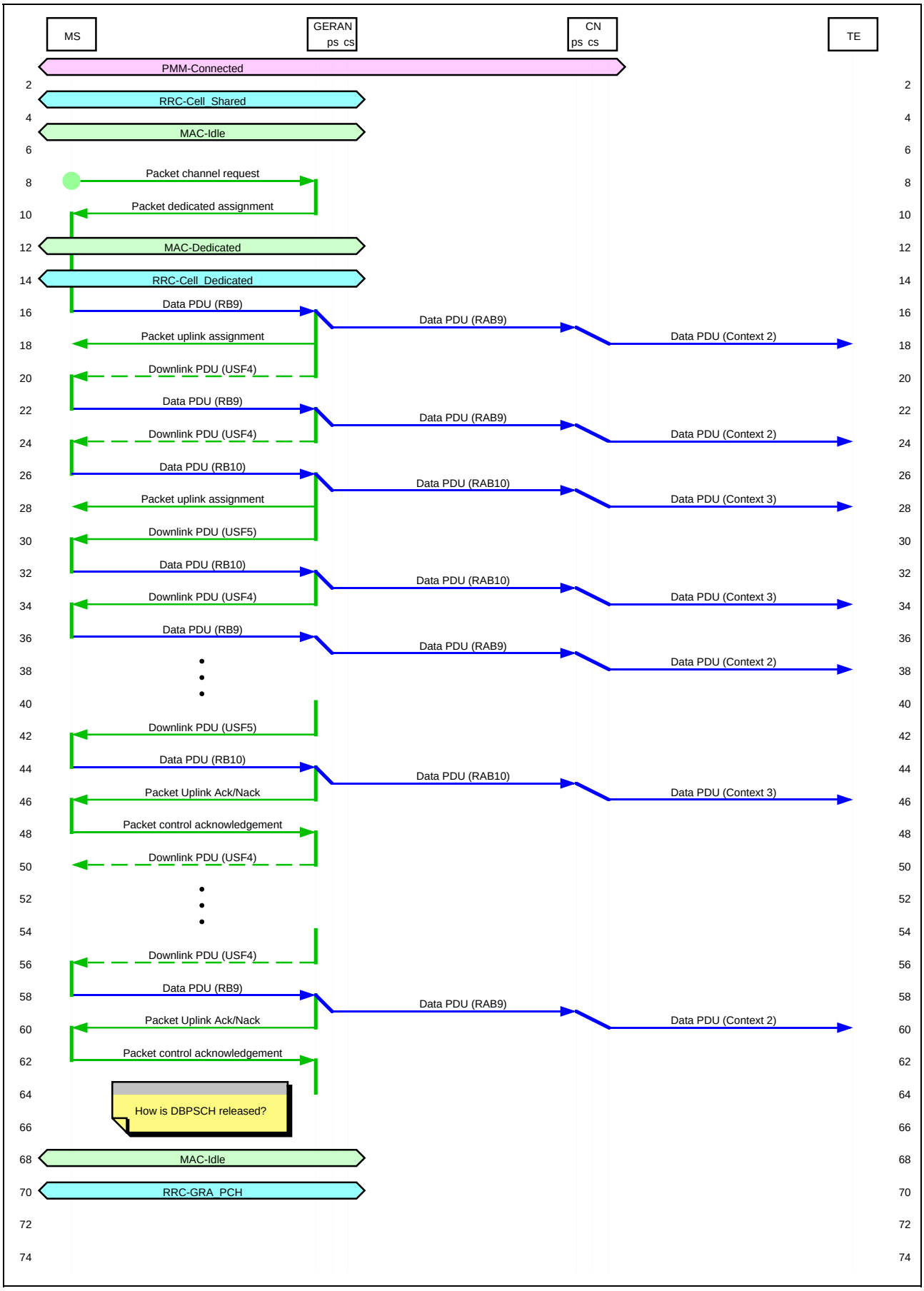
3. Uplink TBFs using MAC signalling

Figure 1 shows how MAC signalling could be used to establish, schedule, and release the TBFs. This option supports the following:

- Up to 32 RBs on a DBPSCH.
- Up to 8 simultaneous TBFs on a DBPSCH.

Note that the figure shows GERAN-CN and CN-TE messages, but the accompanying table provides no descriptions of these messages.

Figure 1: Uplink TBFs using MAC signalling



Line	Description	Direction Protocol Channel
1	This sequence assumes that the following initial conditions apply: • PMM is in *PMM-Connected state*. • RRC is in *RRC-Cell_Shared state*. • MAC is in *MAC-Idle state*; the mobile station monitors a PCCCH. • 6 RABs (radio access bearers) exist and 10 RBs (radio bearers) exist. The 10 RBs comprise 6 URBs (user radio bearers) and 4 SRBs (signaling radio bearers). None of the RBs are active.	
8	Packet channel request *{establishment cause, random reference}* An application in the mobile station initiates a streaming service using RB9. Under control of RRC, the MS MAC requests a channel. • *Establishment cause* should indicate an access for which GERAN should assign a DBPSCH.	MS→GERAN MAC PCCCH (PRACH)
10	Packet dedicated assignment *{page mode, persistence level, packet request reference, channel description}* The GERAN RRC has MAC assign a DBPSCH. • *Packet request reference* comprises the contents of the *packet channel request* and the frame number in which the GERAN MAC received the *packet channel request*. It is used to address the mobile station. • *Channel description* specifies the attributes of the assigned channel.	MS←GERAN MAC PCCCH (PAGCH)
12	MAC-Dedicated The MS and GERAN MACs enter *MAC-Dedicated state.*	
14	RRC-Cell_Dedicated The MS and GERAN RRCs enter *RRC-Cell_Dedicated state.*	
16	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* The MS initiates a TBF (temporary block flow) by sending streaming data. • *Payload type* indicates *data*. • *Temporary flow identity* indicates 9 for RB9. • *TLLI indicator* indicates TLLI included. • *TLLI* is the mobile station's G-RNTI. • *RLC data* is the streaming data.	MS→GERAN RLC/MAC RB9 (PDTCH)
18	Packet uplink assignment *{page mode, persistence level, TLLI, channel-coding command, TLLI-block channel coding, packet timing advance, frequency parameters, dynamic allocation}* Under control of the GERAN RRC, the GERAN MAC allocates a USF for the uplink TBF. At this point, the first uplink TBF is established. • *TLLI* is the mobile station's G-RNTI. If this G-RNTI matches the G-RNTI in line 16, contention has been resolved. • *Dynamic allocation* assigns USF value 4 on one timeslot. Any other of the eight possible values could also have been assigned.	MS←GERAN MAC PACCH
20	Downlink PDU *{USF}* The GERAN MAC schedules uplink traffic by sending USF in a downlink PDU. If GERAN has no downlink data or control to send, it may send nothing. Since this is the only established TBF, the mobile station may ignore the USF. These rules allow GERAN to reduce downlink interference by not transmitting if there is no downlink traffic. • *USF* indicates 4, the value assigned to RB9.	MS←GERAN MAC DBPSCH

22	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* The MS sends data for the TBF scheduled by the USF value in the previous line. • *Payload type* indicates *data*. • *Temporary flow identity* indicates 9 for RB9. • *TLLI indicator* indicates TLLI not included. • *RLC data* is the streaming data.	MS→GERAN RLC/MAC RB9 (PDTCH)
24	Downlink PDU *{USF}* Same as line 20.	MS←GERAN MAC DBPSCH
26	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* An application in the mobile station initiates a background service using RB10. The MS initiates another TBF (temporary block flow) by sending data for that TBF, ignoring the USF value in the previous line. • *Payload type* indicates *data*. • *Temporary flow identity* indicates 10 for RB10. • *TLLI indicator* indicates TLLI not included. • *RLC data* is user data.	MS→GERAN RLC/MAC RB10 (PDTCH)
28	Packet uplink assignment *{page mode, persistence level, global TFI, channel-coding command, TLLI-block channel coding, packet timing advance, frequency parameters, dynamic allocation}* Under control of the GERAN RRC, the GERAN MAC allocates a USF for the uplink TBF. At this point, the second uplink TBF is established. • *Global TFI* indicates uplink RB10. • *Dynamic allocation* assigns USF value 5 on one timeslot.	MS←GERAN MAC PACCH
30	Downlink PDU *{USF}* The GERAN MAC schedules uplink traffic by sending USF in a downlink PDU. Since more than one TBF is now established, GERAN shall now send USF on the downlink and the mobile station shall not ignore the USF unless it wants to establish another TBF. • *USF* indicates 5, the value assigned to RB10.	MS←GERAN MAC DBPSCH
32	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22.	MS→GERAN RLC/MAC RB10 (PDTCH)
34	Downlink PDU *{USF}* Same as line 30 with the following exceptions: • *USF* indicates 4, the value assigned to RB9.	MS←GERAN MAC DBPSCH
36	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22.	MS→GERAN RLC/MAC RB9 (PDTCH)
42	Downlink PDU *{USF}* Same as line 30.	MS←GERAN MAC DBPSCH
44	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22 with the following exceptions: • *Countdown value* indicates 0 (last block).	MS→GERAN RLC/MAC RB10 (PDTCH)

46	Packet uplink ack/nack *{page mode, uplink TFI, channel-coding command, ack/nack description}* GERAN acknowledges receipt of all RLC data for this TBF, which signals the mobile station to release the TBF. • *Uplink TFI* indicates 10 for RB10. • *Ack/nack description* indicates acknowledgement of all RLC data for the TBF.	MS←GERAN MAC PACCH
48	Packet control acknowledgement *{TLLI, control ack}* The mobile station acknowledges release of the TBF. At this point, the TBF for RB10 is released. • *TLLI* contains the mobile station's G-RNTI. <Not needed, but TFI should be included.> • *Control ack* indicates successful receipt of the *packet uplink ack/nack.*	MS→GERAN MAC PACCH
50	Downlink PDU *{USF}* Same as line 20.	MS←GERAN MAC DBPSCH
56	Downlink PDU *{USF}* Same as line 20.	MS←GERAN MAC DBPSCH
58	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22 with the following exceptions: • *Countdown value* indicates 0 (last block).	MS→GERAN RLC/MAC RB9 (PDTCH)
60	Packet uplink ack/nack *{page mode, uplink TFI, channel-coding command, ack/nack description}* Same as line 46 with the following exceptions: • *Uplink TFI* indicates 9 for RB9.	MS←GERAN MAC PACCH
62	Packet control acknowledgement *{TLLI, control ack}* The mobile station acknowledges release of the TBF. At this point, the TBF for RB9 is released. • *TLLI* contains the mobile station's G-RNTI. <Not needed, but TFI should be included.> • *Control ack* indicates successful receipt of the *packet uplink ack/nack.*	MS→GERAN MAC PACCH
68	MAC-Idle The MS and GERAN MACs enter *MAC-Idle state.*	
70	RRC-GRA_PCH The MS and GERAN RRCs enter *RRC-GRA_PCH state*.	

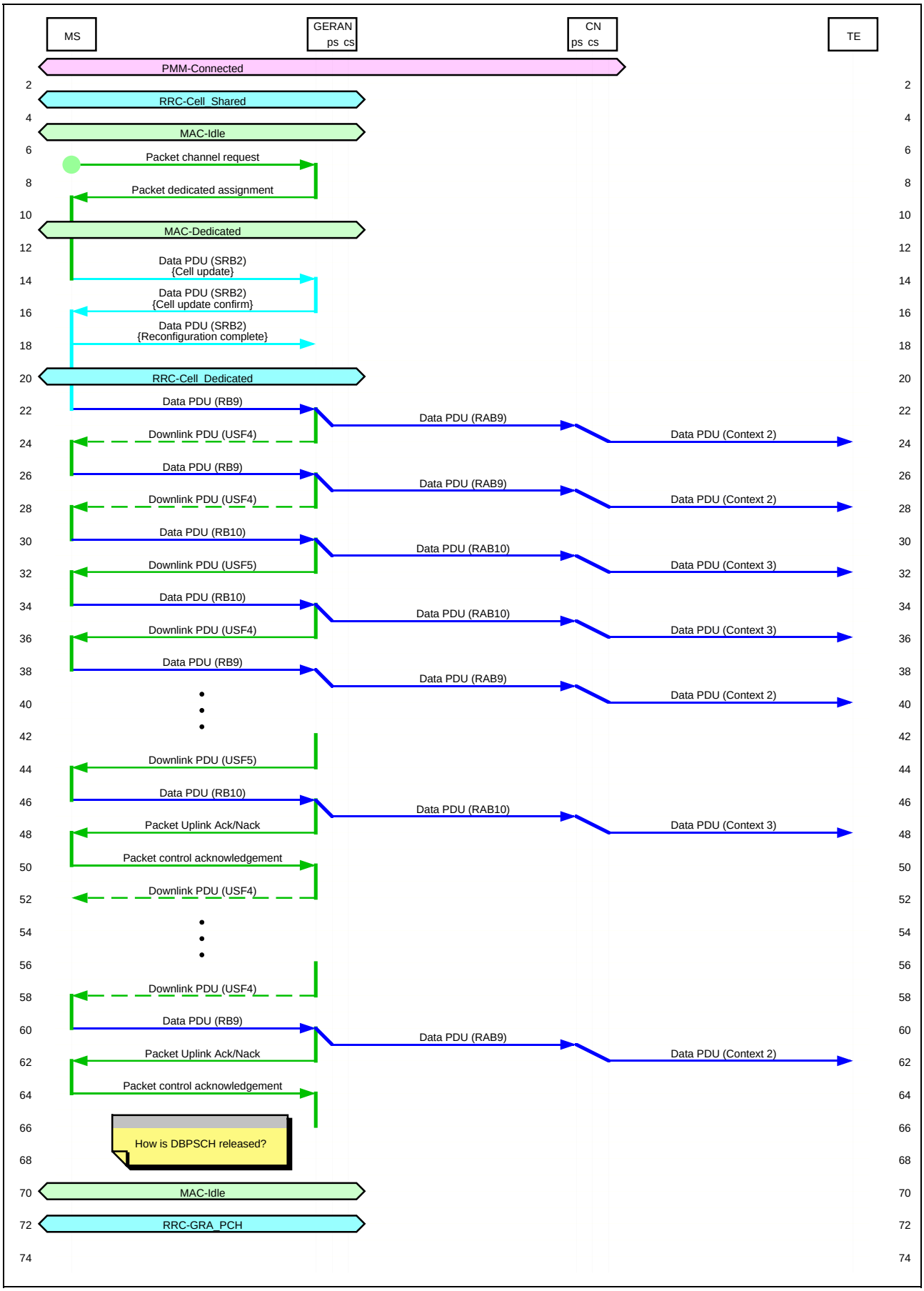
4. Uplink TBFs using RRC signalling

Figure 2 shows how RRC signalling could be used to establish, schedule, and release the TBFs. This option supports the following:

- Up to 8 RBs on a DBPSCH.
- Up to 8 simultaneous TBFs on a DBPSCH.

Note that the figure shows GERAN-CN and CN-TE messages, but the accompanying table provides no descriptions of these messages.

Figure 2: Uplink TBFs using RRC signalling



Line	Description	Direction Protocol Channel
1	This sequence assumes that the following initial conditions apply: • PMM is in *PMM-Connected state*. • RRC is in *RRC-Cell_Shared state*. • MAC is in *MAC-Idle state*; the mobile station monitors a PCCCH. • 6 RABs (radio access bearers) exist and 10 RBs (radio bearers) exist. The 10 RBs comprise 6 URBs (user radio bearers) and 4 SRBs (signaling radio bearers). None of the RBs are active.	
7	Packet channel request *{establishment cause, random reference}* An application in the mobile station initiates a streaming service using RB9. Under control of RRC, the MS MAC requests a channel. • *Establishment cause* should indicate an access for which GERAN should assign a DBPSCH.	MS→GERAN MAC PCCCH (PRACH)
9	Packet dedicated assignment *{page mode, persistence level, packet request reference, channel description}* The GERAN RRC has MAC assign a DBPSCH. • *Packet request reference* comprises the contents of the *packet channel request* and the frame number in which the GERAN MAC received the *packet channel request*. It is used to address the mobile station. • *Channel description* specifies the attributes of the assigned channel.	MS←GERAN MAC PCCCH (PAGCH)
11	MAC-Dedicated The MS and GERAN MACs enter *MAC-Dedicated state.*	
14	Cell update *{G-RNTI, START list, AM_RLC error indication (RB2 or RB3), AM_RLC error indication (RB4 and upwards), cell-update cause, RB-timer indicator}* The mobile-station RRC sends a cell update on SRB2 to request activation of radio bearers. RLC/MAC PDUs carry this RRC message. Because it is the only radio bearer active, GERAN doesn't need to send a downlink USF and the mobile station doesn't need to receive a USF to transmit. • *G-RNTI* identifies the mobile station. <Why do we need G-RNTI? Until contention is resolved, this should be in the RLC/MAC PDU. After contention is resolved, G-RNTI doesn't matter.> • *START list* identifies the CN domain and initializes the 20 most-significant bits of the hyperframe numbers. • *AM_RLC error indication (RB2 or RB3)* indicates *no error.* • *AM_RLC error indication (RB4 and upwards)* indicates *no error.* • *Cell-update cause* indicates *uplink data transmission.* • *RB-timer indicator* indicates if T314 or T315 have expired. These timers relate to radio-link failure. The *cell update* should request a list of RBs to be activated. This scenario assumes at least 6 RBs will be activated: four signaling radio bearers (RB1 to RB4) and two user radio bearers (RB9 and RB10).	MS←GERAN RRC SRB2 (PDTCH)

16	Cell update confirm *{RRC transaction identifier, activation time, RRC state indicator, GERAN DRX cycle length coefficient, RLC re-establish indicator (RB2 and RB3), RLC re-establish indicator (RB4 and upwards), RB info, transport-channel info, physical-layer info}* The GERAN RRC confirms the cell update and assigns radio bearers to appropriate channels. • *RRC transaction identifier* identifies the transaction. Subsequent messages in the transaction use this identifier. • *Activation time* indicates when changes signaled by the message take effect. If not included, the default is *now*. • *RRC state indicator* specifies that the mobile station enter *RRC-Cell_Dedicated state*. • *GERAN DRX cycle-length coefficient* is used to calculate when the mobile station may be paged while connected to this GERAN. • *RLC re-establish indicator (RB2 and RB3)* indicates that RB2 and RB3 should be re-established. • *RLC re-establish indicator (RB4 and upwards)* indicates that RB4 and higher radio bearers should be re-established. The cell update confirm needs to signal which RBs are being activated on which basic physical-layer subchannels. For each RB assigned to a DBPSCH, the following applies: • An uplink and a downlink TBF will be implicitly established. • Each TBF will have a TFI set equal to the radio bearer's RBid. • A USF will be assigned.	MS→GERAN RRC SRB2 (PDTCH)
18	Reconfiguration complete *{<information elements to be specified>}* The mobile station confirms reconfiguration of the radio resources that will carry the radio bearers. This message is similar to UTRAN *radio-bearer reconfiguration complete, transport channel reconfiguration complete,* or *physical channel reconfiguration complete.* At this point, the TBFs on the DBPSCH are established, but none are active.	MS←GERAN RRC SRB2 (PDTCH)
20	RRC-Cell_Dedicated The MS and GERAN RRCs enter *RRC-Cell_Dedicated state.*	
22	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* The MS sends streaming data on the TBF established for RB9. • *Payload type* indicates *data*. • *Temporary flow identity* indicates 9 for RB9. • *TLLI indicator* indicates TLLI not included. • *RLC data* is the streaming data.	MS→GERAN RLC/MAC RB9 (PDTCH)
24	Downlink PDU *{USF}* The GERAN MAC schedules uplink traffic by sending USF in a downlink PDU. If GERAN has no downlink data or control to send, it may send nothing. Since this is the only active TBF, the mobile station may ignore the USF. These rules allow GERAN to reduce downlink interference by not transmitting if there is no downlink traffic. • *USF* indicates 4, the value assigned to RB9.	MS←GERAN MAC DBPSCH
26	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22.	MS→GERAN RLC/MAC RB9 (PDTCH)
28	Downlink PDU *{USF}* Same as line 24.	MS←GERAN MAC DBPSCH

30	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* An application in the mobile station initiates a background service using RB10. The MS sends data on the TBF established for RB10, ignoring the USF value in the previous line. • *Payload type* indicates *data*. • *Temporary flow identity* indicates 10 for RB10. • *TLLI indicator* indicates TLLI not included. • *RLC data* is user data.	MS→GERAN RLC/MAC RB10 (PDTCH)
32	Downlink PDU *{USF}* The GERAN MAC schedules uplink traffic by sending USF in a downlink PDU. Since more than one TBF is now active, GERAN shall now send USF on the downlink and the mobile station shall not ignore the USF unless it wants to establish another TBF. • *USF* indicates 5, the value assigned to RB10.	MS←GERAN MAC DBPSCH
34	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22.	MS→GERAN RLC/MAC RB10 (PDTCH)
36	Downlink PDU *{USF}* Same as line 32 with the following exceptions: • *USF* indicates 4, the value assigned to RB9.	MS←GERAN MAC DBPSCH
38	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22.	MS→GERAN RLC/MAC RB9 (PDTCH)
44	Downlink PDU *{USF}* Same as line 32.	MS←GERAN MAC DBPSCH
46	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22 with the following exceptions: • *Countdown value* indicates 0 (last block).	MS→GERAN RLC/MAC RB10 (PDTCH)
48	Packet uplink ack/nack *{page mode, uplink TFI, channel-coding command, ack/nack description}* GERAN acknowledges receipt of all RLC data for this TBF, indicating that the TBF is now inactive. • *Uplink TFI* indicates 10 for RB10. • *Ack/nack description* indicates acknowledgement of all RLC data for the TBF.	MS←GERAN MAC PACCH
50	Packet control acknowledgement *{TLLI, control ack}* The mobile station acknowledges that the TBF is inactive. • *TLLI* contains the mobile station's G-RNTI. <Not needed, but TFI should be included.> • *Control ack* indicates successful receipt of the *packet uplink ack/nack.*	MS→GERAN MAC PACCH
52	Downlink PDU *{USF}* Same as line 24.	MS←GERAN MAC DBPSCH
58	Downlink PDU *{USF}* Same as line 24.	MS←GERAN MAC DBPSCH

60	Data PDU *{payload type, countdown value, stall indicator, retry, packet-flow identifier, temporary flow identity, TLLI indicator, block sequence number, TLLI, RLC data}* Same as line 22 with the following exceptions: • *Countdown value* indicates 0 (last block).	MS→GERAN RLC/MAC RB9 (PDTCH)
62	Packet uplink ack/nack *{page mode, uplink TFI, channel-coding command, ack/nack description}* Same as line 48 with the following exceptions: • *Uplink TFI* indicates 9 for RB9.	MS←GERAN MAC PACCH
64	Packet control acknowledgement *{TLLI, control ack}* Same as line 50.	MS→GERAN MAC PACCH
70	MAC-Idle The MS and GERAN MACs enter *MAC-Idle state*.	
72	RRC-GRA_PCH The MS and GERAN RRCs enter *RRC-GRA_PCH state*. At this point the TBFs on the DBPSCH are released.	

5. References

1. 3GPP TS 25.331. *3rd Generation Partnership Project; Technical Specification Group Radio Access Network; RRC Protocol Specification.*

2. 3GPP TS 44.060. *3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; General Packet Radio Service (GPRS); Mobile Station (MS) – Base Station System (BSS) interface; Radio Link Control / Medium Access Control (RLC/MAC) protocol.*

3. 3GPP TS 44.118. *3rd Generation Partnership Project; Technical Specification Group GSM EDGE Radio Access Network; Mobile radio interface layer 3 specification; Radio Resource Control Protocol; Iu mode.*