

Agenda Item: 7.6.2
Source: Ericsson
Title: Handover between UMTS and GPRS
Document for: Decision

1 Introduction

This contribution identifies and describes UE RRC states and state transitions supporting Inter-System handover between UMTS and GSM/GPRS for IP domain services. Examples of procedures that are required for Inter-System handover are also included. Information regarding GPRS RR operating modes is collected from [2], [3], [4] and [5].

2 Discussion

2.1 Description of UE states and state transitions

Figure 2 shows the main UE RRC states (Cell Connected State and URA Connected State) in Connected Mode for the IP domain services. It also shows the transitions between Idle Mode and Connected Mode and further the transitions between Cell Connected and URA Connected States. The different states are further clarified in the following subsections.

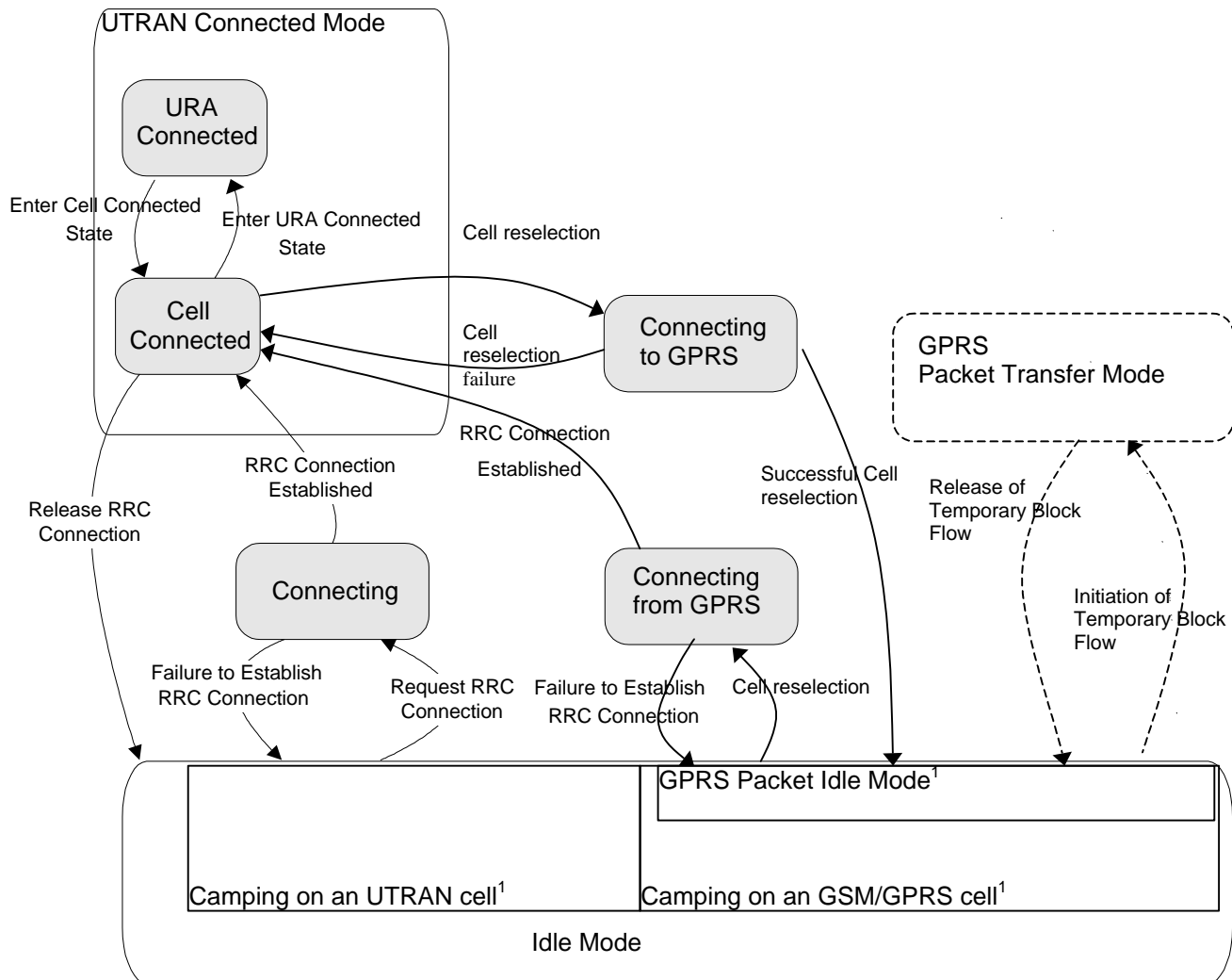


Figure 2: UE RRC states and State Transitions including GSM/GPRS (IP only)

[Note 1: The indicated “Radio access modes” in Idle Mode are only included for clarification and shall not be interpreted as states.]

The UE states “Connecting to GPRS” and “Connecting from GPRS” indicated in figure 2 between UTRAN Connected Mode and Idle mode (GPRS Packet Idle Mode) are transition states where the UE, in case of failure, has the possibility to re-establish the connection in the mode it originated from.

When using IP domain services, The UE initiate cell reselection from GSM/GPRS to change from Idle Mode to “Connecting from GPRS” state, from that state the UE is using the RRC Connection Establishment procedure for the transition from “Connecting from GPRS” to Cell Connected state.

When the RRC Connection is established from “Connecting from GPRS” state the RRC Connection request message contains an indication, that UTRAN needs to continue an already established GPRS UE context from the CN. This indication allows UTRAN to e.g. priorities the RRC Connection request from the UE.

In Cell Connected State UTRAN is using UE or Network initiated cell reselection to change from Cell Connected state to “Connecting to GPRS” state. If the cell reselection was successful the UE enters Idle Mode (GPRS Packet Idle mode). The UE sends Packet channel request from Idle Mode (GPRS Packet Idle mode) to establish a Temporary Block flow and enter GPRS Packet Transfer Mode. In the GPRS Packet Transfer Mode the UE sends a RA Update request message. The RA Update Request message sent from the UE contains an indication that GSM/GPRS need to continue an already established UTRAN UE context from the CN. This means that the RA Update request is always sent for the transition from UTRAN Connected Mode to GSM/GPRS regardless if the RA is changed or not.

[Note: The reason for using RA update instead of a new message is to reduce the impact on the existing GSM/GPRS specification.]

3 Example of procedures

Below follows some examples of procedures that illustrates the applicability of the above-described UE state model. Only the non-error cases are described. The error cases are for further study. The examples in the present form are not intended to be included in S2.03 [1].

3.1 Transition from UTRAN Connected Mode to GPRS

When the UE is in Cell Connected State and in one of the substates (RACH/DSCH or RACH+FAUSCH/DSCH), (RACH/FACH or RACH + FAUSCH/FACH), the UE typically initiates the transition i.e. the UE measures, evaluates and initiates the cell reselection. The amount of information the UE have with regards to the channel configuration of the GPRS cell before the cell reselection is FFS.

The UE transition from UTRAN Connected mode starts when the UE triggers the cell reselection. The transition to GPRS is finished when the UE context is connected to GSM/GPRS.

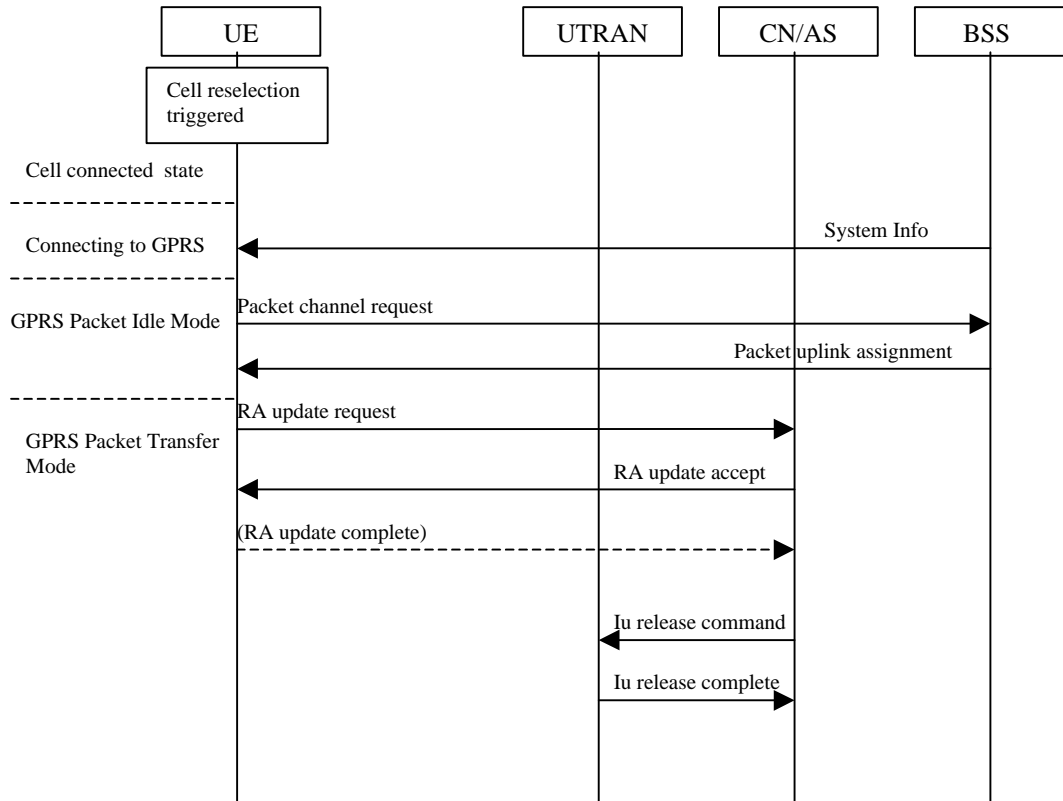


Figure 3: UMTS to GSM/GPRS transition, UE initiated

The UE selects a GSM/GPRS cell. After having switched to CCCH in the GSM cell the UE reads the system info broadcasted in the GSM/GPRS cell. The UE then initiate a temporary block flow by sending PACKET CHANNEL REQUEST.

If the temporary block flow is successfully established the UE enters GPRS PACKET TRANSFER MODE.

The UE sends a RA UPDATE REQUEST message to CN/AS to indicate to NAS that the UTRAN UE context need to be transferred to GPRS. Note that the RA update message is sent regardless if the RA read in the system info is changed or not. The reason for using RA update instead of a new message is to reduce the impact on the existing GPRS system.

CN/AS validates the UE presence in the new RA and if the presence of the UE is allowed the CN/AS responds with a RA UPDATE ACCEPT message that may include a new connection identity.

The UE may confirm the new identity by sending a RA UPDATE COMPLETE depending on the content of the RA UPDATE ACCEPT message.

CN/AS is then able to release the Iu connection and that also releases the UTRAN resources that was used for the UE in UTRAN Connected mode.

When the UE is in the substate DCH/DCH or DCH/DCH+DSCH, UTRAN uses a Network initiated cell reselection. The transition is triggered by an “Cell reselection command” sent from the Network . The transition to GPRS is finished when the UE context is connected to UTRAN.

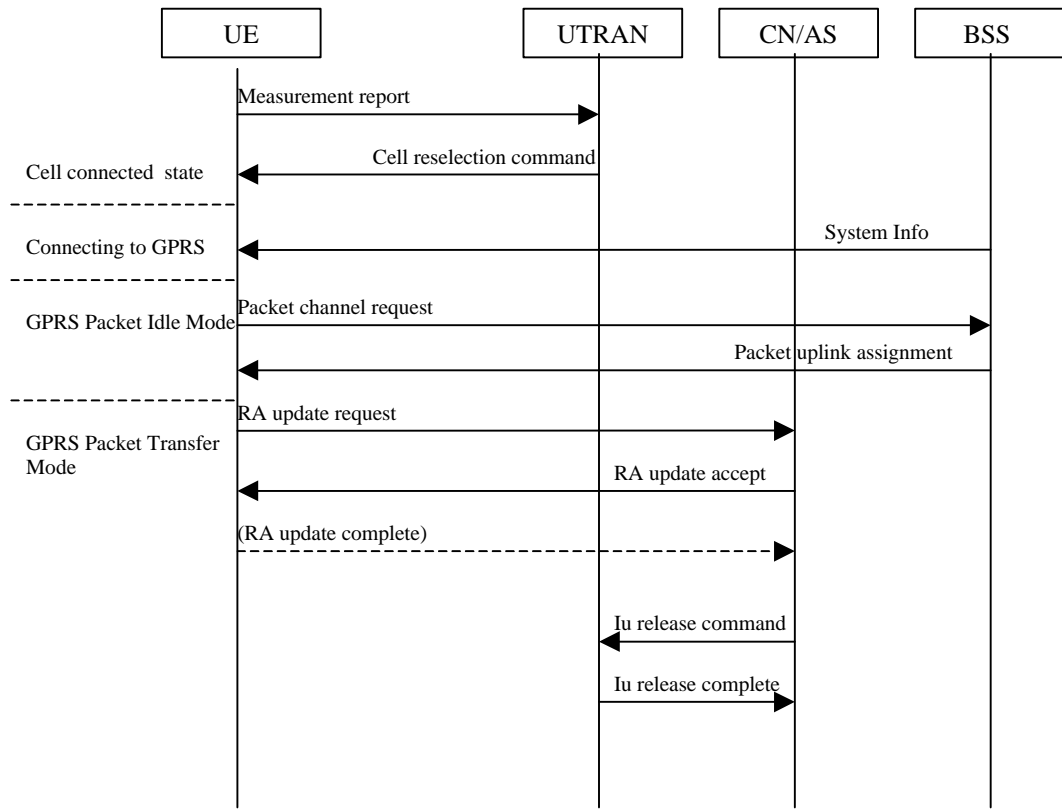


Figure 4; UMTS to GSM/GPRS transition, Network initiated

UTRAN have provided the UE with information regarding how the GSM/GPRS neighboring cell shall be measured and reported by using broadcast information or UE specific information.

The transition is triggered by a “Cell reselection command “ sent from the Network.

This message contains all information for the UE to be able to switch to the CCCH/PCCCH in the indicated GSM/GPRS cell and initiate a temporary block flow.

The rest of the sequence is done according to the UE initiated case described above.

3.2 Transition from GPRS Packet Idle Mode to UTRAN Connected Mode

When the UE selects a new cell the UE leaves the Packet Transfer Mode, enters Packet Idle mode where it switches to the UTRAN cell. The amount of information the UE have with regards to the channel configuration of the UTRAN cell before the cell reselection is FFS.

The UE transition from GPRS Packet Idle Mode to UTRAN Connected mode starts when the UE initiates the cell reselection. The transition to UTRAN Connected Mode is finished when the UE context is connected to UTRAN.

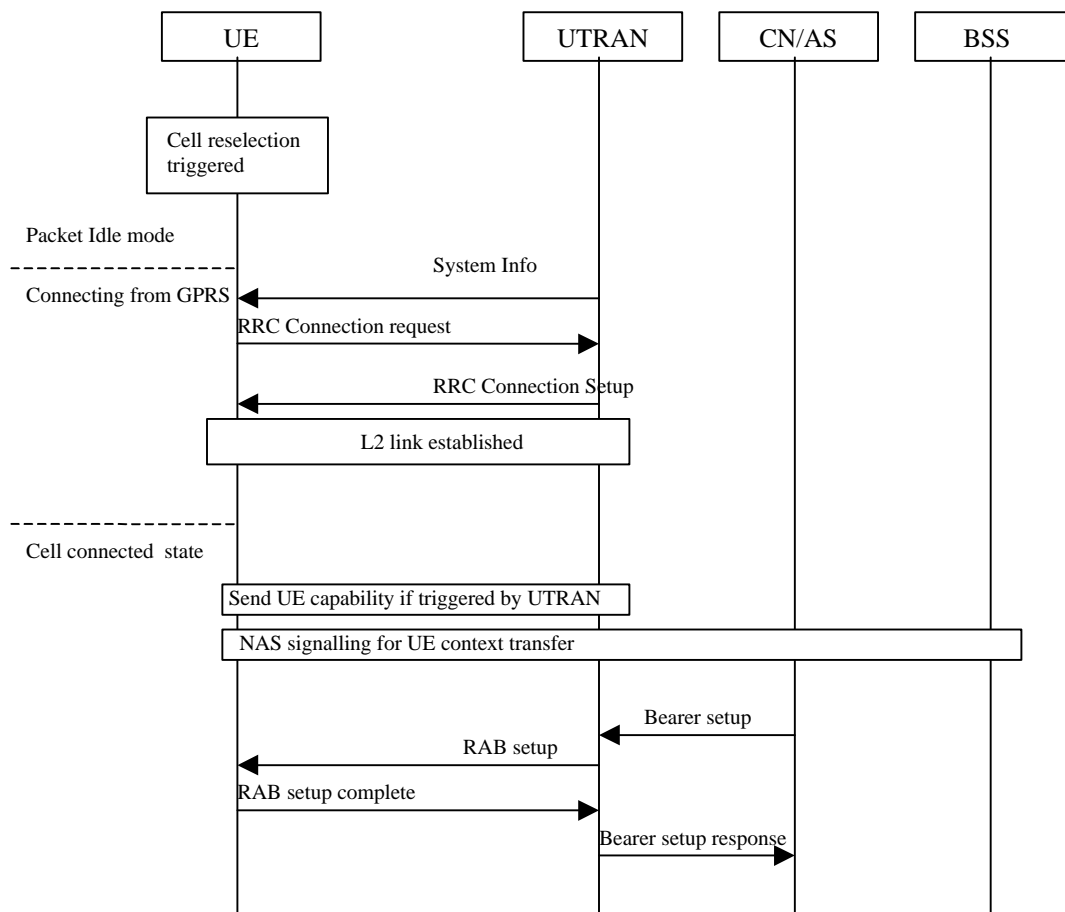


Figure 5: GSM/GPRS to UMTS transition, UE not in the DCH/DCH or DCH/DCH+DSCH substate

The UE selects a UTRAN cell. After having switched to CCCH in the UTRAN cell the UE reads the system info and sends RRC Connection Request to UTRAN. In the RRC Connection Request the UE indicates to UTRAN that there exist an established GPRS UE context that need to be connected to UTRAN.

In cell connected state the UE sets up a signalling connection to NAS and informs NAS that the UE context needs to be transferred from GSM/GPRS to UTRAN.

The NAS then initiate the set up of an appropriate RAB.

4 Proposal

It is proposed that the UE state and state transition for the IP domain services, presented in chap. 2.1 is inserted in chap 5 of S2.03 [1]. It is also proposed that the examples of procedures are discussed and a decision is taken that further work is based on the proposed sequences. If so decided it is proposed that a liaison statement is produced and sent to TSG-RAN Working Group 3 for comments.

5 References

- [1] Tdoc TSGR2#2(99)055, TS RAN S2.03 V0.0.2, "UE Functions and Interlayer Procedures in Connected Mode",
- [2] Source: Temporary editor
- [3]
- [4] GSM 3.60:"Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Service description; stage 2; version 6.2.0.
- [5]

- [6] GSM 3.64: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Overall description of the GPRS radio interface; stage 2; version 6.1.0.
- [7] GSM 4.08: "Digital cellular telecommunication system (Phase 2+); Mobile radio interface layer 3 specification; version 6.2.0.
- [8]
- [9] GSM 4.60: "Digital cellular telecommunication system (Phase 2+); General Packet Radio Service (GPRS); Mobile Station (MS) – Base Station System (BSS) interface; Radio Link Control/Medium Access Control (RLC/MAC) protocol; version 6.2.0.