

Agenda Item: 14

Source: Samsung Electronics

Title: Upper layer aspect of DPCCH gated transmission

Document for: Discussion and Decision

1. Introduction

There have been previous contributions treating the gated transmission of DPCCH aspect. Those contributions contained the concept and abstract physical layer operation [1], related RRC messages [2], and over the air performance [3]. However, most of those discussions were focused on the physical layer aspects and didn't present a general overview of gated transmission from the upper layers point of view. Therefore, we would like to demonstrate the impact of gated transmission of DPCCH from the perspective of the upper layers including MAC, RLC, and RRC.

2. Discussion

2.1 Operation in control only substate with gated transmission.

Upward Direction (Control only → User data active), UTRAN initiated

- 1) If UTRAN-MAC detects the arrival of user data, then reports it to RRC.
- 2) UTRAN-RRC determines proper transport & physical channel.
- 3) UTRAN-RRC sends RRC message that contains the information about assigned resources to UE-RRC.
: **(Gated transmission rate = Full)**
- 4) Change configuration of MAC and L1.
 - ♦ UTRAN-RRC sends control primitive to MAC and L1 **(DPCCH gate rate = Full)**.
 - ♦ UE-RRC sends control primitive to MAC and L1 **(DPCCH gate rate = Full)**.
- 5) UTRAN and UE make state transition to User data active substate and start transmission of user data.

Downward Direction (User data active → Control only), UTRAN initiated

- 1) If UTRAN-MAC detects that there has been no user traffic for a given duration, then reports it to RRC.
- 2) UTRAN-RRC sends RRC message that indicates the release of resources to UE-RRC
: **(Gated transmission rate = 1/3, 1/5, 0)**.
- 3) Change configuration of MAC and L1.
 - ♦ UTRAN-RRC sends control primitive to MAC and L1. **(DPCCH gate rate = 1/3, 1/5, 0)**
 - ♦ UE-RRC sends control primitive to MAC and L1. **(DPCCH gate rate = 1/3, 1/5, 0)**

- 4) UTRAN and UE make state transition to control only substate and activate the gated transmission of DPCH if it was specified.

2.2 The Impacts of DPCH gated transmission on upper layer operation.

Comparing the operation scenario of gated transmission in control only substate with the conventional case, we find that no additional procedure is required at upper layer. The impacts induced by support of gated transmission DPCH are only the appending of gated transmission related field on the interface between RRC and Physical layer and some RRC messages. Therefore, we concluded that there is no performance degradation and increase of overhead on upper layer operation.

Interface between RRC and Physical layer.

- a) "gate rate" field is appended on uplink/downlink DPCH parameter.

Related RRC Procedures

- a) Transport channel reconfiguration procedure
- ◆ Applicable situation: initiates/terminates gated transmission while performing state transition between control only and user data active substate which is induced by Transport channel reconfiguration.
 - ◆ Related RRC message: Transport Channel Reconfiguration.
- b) RAB Setup procedure
- ◆ Applicable situation: Terminates gated transmission while performing state transition from control only to user data active substate, which is induced by RAB setup.
 - ◆ Related RRC message: RAB Setup.
- c) RAB Release procedure
- ◆ Applicable situation: Initiates gated transmission while performing state transition from user data active to control only substate, which is induced by RAB release.
 - ◆ Related RRC message : RAB Release
- d) RAB reconfiguration procedure
- ◆ Applicable situation: Initiates/terminates gated transmission while performing state transition between user data active and control only substate which is induced by RAB reconfiguration.
 - ◆ Related RRC message : RAB Reconfiguration
- e) RRC Connection establishment procedure
- ◆ Applicable situation: Initiates gated transmission while performing state transition from Idle mode to control only substate, which is induced by RRC connection setup procedure.
 - ◆ Related RRC message: RRC Connection Setup.
- f) Active set update procedure
- ◆ Applicable situation: changes gated transmission rate while roaming to adjacent cell.
 - ◆ Back ground: According to the channel status of each cell, the required proper gated transmission rate can be changed. For example, if an UE with 1/3 gated transmission rate roams to the adjacent heavily loaded cell, then the target cell may want to change the gated transmission rate of this UE from 1/3 to 1/5 in order to reduce air interference.
 - ◆ Related RRC message: Active Set Update.

3. Conclusion

On the upper layers, no additional RRC procedure is required and no performance degradation is produced by support of the gated transmission of DPCCH since this operation utilises already existing upper layer procedures.

The impacts on upper layer protocols are appending of the gated transmission control IE on some existing RRC messages and appending the gated transmission rate field on interface between RRC and physical layer as an optional field.

4. References

- [1] R2-99299 "RRC procedures and parameters for gated transmission of uplink/downlink DPCCH in control only substate", Samsung
- [2] R2-99629 "RRC messages relevant to control only substate", Samsung
- [3] R2-99665 "A performance evaluation on uplink/downlink DPCCH gated transmission in control only substate", Samsung