

Agenda item: 6.3
Source: Lucent
Title: Scheduling Schemes for EDCH
Document for: Decision

1 Introduction

In this contribution, we compared the two scheduling modes available: Rate/Time and Rate scheduling and discuss the different options of operations when consider together with the different modes of retransmissions. As many issues have been raised in previous meetings on the schemes to be adopted for further studies during this work item phase, this document presents our view on the preferred scheduling mode for enhanced uplink.

2 Rate/Time and Rate Scheduling

As discussed in detail in TR25.896, Rate and Time scheduling mode involves selecting a subset of UEs, based on some scheduling algorithm, that are allowed to send in the uplink for a certain period of time. The UEs would transmit for a time interval using a signaled TFCS that it receives in the downlink scheduling assignment sent by the NodeB. In WG1#37, some simulation performance of Rate/Time over Rate scheduling have been presented and while the results still needs to be further verified, potential gains of Rate/Time scheduling over Rate scheduling were reported. The following lists the benefits of Rate and Time scheduling:

1. Performance Gain over Rate Scheduling: By selecting a subset of UEs scheduled for transmission in the uplink, a better control of the RoT is achieved in addition of the reduced latency as well. The RoT management is improved due to the tighter restriction on which UEs are allowed to send and the duration of transmissions as well. Certain UEs with larger buffer occupancy, higher priority and/or data with less delay tolerance is able to take advantage of this mode since a higher TFC can be assigned, up to the maximum TFC, to these UEs for a limited period of time;
2. Downlink signaling: This depends on the number of UEs that need to be scheduled for simultaneous transmissions. Since the UEs are selected based some criteria to fulfill the system RoT operating point, depending on the scheduling algorithm used, the number of UEs that need to be scheduled to meet the RoT utilization needs to be studied further. In comparison, in Rate scheduling, even though the exact TFCS signaling is not needed, the incremental scheduling signaling needs to be sent to all UEs. Based on the gain versus complexity tradeoffs, the optimum maximum number of UEs that can be scheduled for simultaneous transmission in EDCH needs to be studied further with simulations and a recommendation can then me made.
3. The option of using a Cell wide signaling for scheduling grant is available in Rate scheduling. Such an option would reduce the signaling overhead in the downlink. However, with Rate and Time scheduling, UE specific DL signaling is mandatory as only a subset of UEs are chosen and each

UE's TFC is more likely to be different due to the greater granularity in the TFC adjustments for Rate and Time mode.

3 Autonomous or Scheduled Retransmission

As already currently described in Section 7.1 of the TR [1], there are currently two options for retransmissions:

Autonomous Retransmissions: The UE is allowed to send its retransmissions at any subsequent retransmission timing without the need to be scheduled by the NodeB. This lets the UE to send its retransmission with less latency than in the case of scheduled retransmissions but with the potential disadvantage of undesirable RoT fluctuation at the NodeB. If its TFC subset at the time of retransmission does not include the TFC of the first transmission, the UE has the option of using the TFC of the first transmission with or without transmission power adjustment. This mode is similar to the operation of Rate scheduling since both rate and transmission time is UE controlled;

Scheduled Retransmissions: The UE retransmissions are scheduled. If the assigned TFC subset for the retransmission does not include the TFC of the first transmission, the UE has the option of using the TFC of the first transmission with or without transmission power adjustment. This mode is similar to Rate and Time scheduling but with the possibility of UE needing to adjust its TFC so that the initial transmission TFC is included as part of the TFC subset for retransmissions.

The above two options when combined with the two scheduling modes available would yield the following options:

1. Rate/Time Scheduling for 1st and all retransmissions (Scheduled retransmissions): The newly assigned TFC subset and duration of transmission are both signalled to the UE. As the channel variations may very likely change during the retransmissions, the NodeB would have to rely on transmission power adjustment at the UE if the original TFC for first transmission could not be assigned to the UE. Hence, the objective of more RoT control may be less effective during HARQ retransmissions;
2. Rate/Time Scheduling for 1st transmission and Autonomous retransmissions: Only the first transmission is Rate and Time scheduled. The retransmissions are allowed to be autonomously controlled by the UE. The UE could choose to perform power adjustment on the original TFC or retransmit with the same power level as the first transmission. The retransmission behaviour in the scenario where the UE would need to adjust its transmission power would be very similar to above scenario of scheduled retransmissions. However, with autonomous retransmissions, the signalling for retransmissions is reduced;
3. Rate Scheduling for 1st and all retransmission (Autonomous retransmissions): All transmissions from the UE are autonomous so that the UE transmits at its chosen time within the assigned TFC subset;
4. Rate Scheduling for 1st and Scheduled retransmissions: Only the retransmissions are scheduled. This combination implies that the retransmissions contribute to a significant RoT variation compared to the first transmission and need to be controlled tighter compared to the first transmission. Depending on the usefulness of such a scenario, this combination may be excluded.

4 Summary

In this contribution, the various scheduling combinations for first and retransmissions are discussed. Based on the above discussions, it is proposed that only

Option 2: Rate/Time for 1st transmission and Autonomous retransmission, and

Option 3: Rate for 1st transmission and Autonomous retransmissions

should be for further performance comparisons during the work item phase.