Status Report for SI to TSG

Study Item Name: Uplink Enhancements for Dedicated Transport Channels

SOURCE: Rapporteur (Karri Ranta-aho, Nokia) **TSG:** RAN **WG:** 1

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Ref. to SI sheet: RAN_Study_Items.doc

Progress Report since the last TSG (for all involved WGs):

The work focus was in completing the open issues of the SI, i.e. simulation results, complexity and interactions of the enhancements, RAN2&RAN3 issues and finally on feasibility study conclusions and recommendations. This was also achieved and the RAN1 considers the SI is ready for closing and recommends a creation of a WI. See Appendix for the RAN1 conclusions and recommendations.

RAN WG1
RAN WG1 had an Ad hoc meeting and one regular meeting between RAN#22 and RAN#23:
RAN1 Ad hoc: ~50 documents were submitted, 42 treated, 6 agreed for inclusion to the TR.
RAN1#36: ~60 documents were submitted ~40 treated, 16 agreed to be included to the TR. As agreed in the meeting, one additional document was email reviewed and included in the TR after the meeting.

Main RAN1 focus was on concluding the feasibility study, i.e. new schemes or additional details were not extensively discussed but the meeting time was spent on completing the work, link and system simulation results mainly indicating that the enhancements can provide gain were taking majority of the time. Main disputes were related to how the potential benefits of the shorter TTI should be evaluated and its complexity assessed.

RAN WG2
RAN WG2 had two meetings between RAN#22 and RAN#23:
RAN2#40: 8 documents were submitted for the SI, but the meeting did not allocate any time for the SI
RAN2#41: 11 documents were submitted for the SI and the topic was discussed in the joint RAN1/RAN2/RAN3 session.

RAN WG3
RAN WG3 had two meetings between RAN#22 and RAN#23:
RAN3#40: 5 documents were submitted for the SI, mainly related to UTRAN architectural impacts and what to include to the TR from RAN3 perspective.
RAN3#41: 2 documents were submitted for the SI, but no specific discussion took place in the meeting, as the topic was discussed in the joint RAN1/RAN2/RAN3 session.

RAN WG4
RAN WG4 had one meeting between RAN#22 and RAN#23:
RAN4#30: 2 documents were submitted for the SI, LS to RAN1 was produced.
The discussion was on selecting such multiplexing solutions, TFC selection procedures and radio frame lengths that negative impacts to the system could be avoided in the design phase.

Joint RAN WG1/WG2/WG3 session, February in Malaga
14 documents in total were submitted to this session, 9 of which were treated and 3 documents were agreed for inclusion to the TR.
The session focused on filling the chapters 10 and 11 of the SI TR25.896 containing RAN2 and RAN3 related parts. The session identified possible protocol architectures for the E-DCH as well as different parts of the UTRAN that could be affected by the features under study. This level of RAN2 and RAN3 involvement was considered to be sufficient for completing the feasibility study.

Liaison Statements
RAN3 to RAN1 (R1-040036): Asking to consider whether the shorter TTI provides any delay gain if introduced to the air interface, but not introduced to the Iub. Also asking to consider possible RNC complexity impact if assuming shorter TTI to Iub.

RAN4 to RAN1&RAN2 (R1-040332): Asking to consider TFC selection impact as well as PAR and radio interference impacts when making design choises. RAN4 also offered assistance to RAN1 in identifying suitable simulation cases.

List of Completed elements (for complex work items):
- Simulation assumptions
- Traffic model descriptions
- Reference technique descriptions
- Overview of techniques to be studied
- Detailed descriptions of the techniques to be studied
- Compatibility of the enhancements with the existing system
- Interaction of the enhancement techniques
- Simulation results of the enhancement techniques
- Complexity analysis of the enhancements
- Feasibility study conclusion and recommendations for work item

List of open issues:
None

Estimates of the level of completion (when possible):
Estimated level of completion is 90%

SI completion date review resulting from the discussion at the working group:
The latest estimate for the SI completion date is RAN#23 (March 2004).

References to WG's internal documentation and/or TRs:
[1] RP-040046, TR25.896, Feasibility Study for Enhanced Uplink for UTRA FDD, v2.0.0

Appendix: Conclusions and Recommendations of TR25.896 [1]

12.1 Conclusions

In the study of "Uplink Enhancements for Dedicated Transport Channels", the following techniques have been considered:

- *Node B controlled scheduling*
- *Hybrid ARQ*
- *Shorter TTI*
- *Higher order modulation*
- *Fast DCH setup*

Simulation results presented to RAN1 has shown a significant improvement compared to Rel5, in the order of 50%-70% increase in system capacity, 20%-55% reduction in end-user packet call delay and around 50% increase in user packet call throughput, when simultaneously applying Node B scheduling, hybrid ARQ with soft combining, and a shortened TTI. Hence, significant technical benefits have been found for a system using these techniques in conjunction.

Higher order modulation, of which only 8PSK has been studied, has been found to cause a loss in link performance compared to multi-code transmission with BPSK, but may enable peak data rates exceeding 5.76 Mbit/s or may provide implementation benefits in terms of a reduced PAR. The other enhancements studied are not dependent on whether higher order modulation is introduced or not. Thus, from a principal point of view, higher order modulation is independent of the other enhancements studied.

Complexity has been studied in terms of buffering and timing requirements due to hybrid ARQ, PAR impact due to additional physical channels, and power requirements for the associated control signaling. Comments from RAN2 and RAN3 on their respective areas have also been taken into account in the TR. The enhancements can be introduced into the FDD specifications without impacting the backwards compatibility with Rel5 and earlier releases.

All these enhancements, Node B controlled scheduling, hybrid ARQ, shorter TTI, and higher order modulation, have been found to be technically feasible. At least one company has expressed concerns on the benefits of a shorter TTI in comparison with the potential implementation impacts. Some companies have questioned whether the benefit with 8PSK from a PAR perspective outweighs the loss in link performance.

Fast DCH setup has been partially investigated. Methods for reducing the synchronization time when going from CELL_FACH to CELL_DCH have been described but not evaluated in detail in this report. Other aspects of fast DCH setup, e.g., architectural changes and signaling protocols, have not been covered.

12.2 Recommendations

Based on the findings documented in this report, RAN1 recommends to create a work item on uplink enhancements where:

- *Node B controlled scheduling, hybrid ARQ, and shorter TTI are parts of the work item;*
- *Higher order modulation (8PSK and higher) is not part of the work item;*
- *Fast DCH setup is not part of the work item.*