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Alternative approaches for GERAN RLC and MAC

1. INTRODUCTION

In GERAN AdHoc #1 different alternatives how to improve R00 GERAN RLC/MAC layer from R99 EGPRS were discussed [3][4][5]. [3] proposed a combination of parallel TBFs and multiple radio bearers per TBF while [4][5] have proposed to have only parallel TBFs. There has also been some discussion on whether the TBFs and associated resources should be released after active periods or the TBFs should be kept reserved also during idle period and physical resources reallocated to other users. In this paper the advantages and disadvantages of the two alternatives are presented.

2. CHARACTERISTICS OF INTERNET TRAFFIC

GPRS is designed to support several quality of services levels in order to allow e.g. intermittent and bursty data transfers and occasional transmission of large volumes of data [1]. Applications like telnet, numerous chat applications and even web browsing traffic in uplink generate frequently short bursts. E-mail client, web browsing traffic in downlink direction generate large volumes of data. However even in the latter case the traffic nature is very bursty due to transmission (TCP) and application layer (SMTP, IMAP) protocol characteristics [2].

3. HOLDING TBF VS RELEASING IT

It has been proposed that TBF is released after inactive periods. As was shown in chapter 2 Internet applications send small packets often, especially during session setup. For this reason when TBFs are released after active periods the number of TBF establishments and releases is large. Therefore, a lot of signaling capacity must be reserved if TBFs are set up separately for each active period. If there is not sufficient signaling capacity available (e.g. when the service is deployed on a narrow spectrum) user perceived delays might be very long. In order to avoid excessive signaling and to provide acceptable delay it should be possible hold TBF during temporary, short inactive periods and reallocate only the physical resources.

4. MULTIPLE TBFS VS MULTIPLE RADIO BEARERS PER TBF

4.1 Multiple RBs per TBF

When having e.g. web browsing and email transfer, it would be beneficial to allocate multiple flows on the same TBF because each TBF requires separate setup and especially if TBFs are released immediately after active period the number of setups will be high. Multiple RBs per TBF could be used also for OS2 (conversational + best effort during silence). Having one single TBF allows for using in an optimal way the silent periods because there is no need for any extra signaling before being able to send data. The MS would just change Rbid so that the block can be identified correctly. The new RB may have even different RLC mode (unack or ack) than the other RB because the RLC mode is known based on the Rbid. In case only one RB is carried per TBF Rbid need not be included.

5. FAST ACCESS

General target in RLC/MAC design should be to avoid unnecessary signaling. However, for some services, mainly real-time interactive like chat, fast access might be useful. In order fast access to be fast sufficient signaling capacity must be reserved. Especially for services with tight delay requirements there must be significant amount of capacity reserved, otherwise users will experience unpleasant delay and jitter in the service. For operator deploying on limited bandwidth (e.g. initial COMPACT deployments) or having only limited amount of services that can benefit from fast access it does not make sense to reserve a lot of signaling capacity. The same services can be provided also by other means namely dedicated channels or holding the TBF during temporary inactive periods and reallocating only physical resources to other users. Consequently, fast access should be optional. In order not to decrease PRACH performance and to provide sufficient number space of access identifiers (ARI) fast access should be carried out on a separate dedicated fast access channel.

6. CONCLUSIONS

Both multiple TBFs and multiple flows (RBs) per TBF can be included in the same standard. Those are complementary, not mutually exclusive and are needed in order to minimize signaling and be able to provide QoS support efficiently. In order to avoid allocating excessive amount of signaling capacity it should be possible to hold TBFs on also during temporary inactive periods. Fast access can be used to improve the performance of interactive traffic but it should be possible to provide the same services without fast access if the required signaling capacity is considered too high.

7. REFERENCES

[1] 3G TS 23.060

[2] W. Stevens. TCP/IP Illustrated, Volume 1. Addison-Wesley. 1994

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