TSG-RAN Working Group 3 Meeting #6 ***TSGR3#6(99)906***
Sophia Antipolis, France
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Agenda Item: 16.3

Source: InterDigital Comm. Corp.

Title: TDD Support of NRT Data Services with Dedicated Channels

Document for: Approval

Introduction

In TDD low data occupancy on dedicated channels supporting NRT services must be avoided. Since only a small number of physical channels share common air resources in TDD (i.e. within a time slot), other physical channels can not absorb unused spectrum within specific time slots. Therefore it is important to have the ability to allocate dedicated channels only for the specific period required for user data transmission.

Discussion

For NRT data services RLC buffer measurements in the UE and RNC are used to determine physical channel allocations. UE measurements are reported to the S-RNC with the RRC Measurement Report. Based on measurement reports the RNC can establish and release dedicated physical channels (DPCH).

The worst case scenario exists when a cell is saturated by DPCH's that are supporting primarily short bursts of user data. The following example illustrates the expected efficiency within one set of resource units supporting 2000 octet average transmissions (two UE's – for simplicity):

1. Assuming high data transfer rate allocations (to reduce serialization delays on the physical channel) on the order of 200kbs, a 2000 octet transmission will require 80ms (8 frames).

2. The duration from RNC reception of either the UE or RNC RLC measurement to RRC DCH establishment or DCH release is expected to be on the order of 100 to 200ms. (Delay in initial radio link setup)

Air frames 1 - 30

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td></tr>
<tr><td colspan="15">UE #1 DCH establishment</td><td colspan="8">UE #1 Transmitting</td><td colspan="7">UE #1 DCH Release</td></tr>
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Air Frames 31-60

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td></tr>
<tr><td colspan="8">UE #1 DCH Release</td><td colspan="15">UE #2 DCH establishment</td><td colspan="7">UE #2 Transmitting</td></tr>
</table>

Air Frames 61-76

<table>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>0</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td></td><td colspan="15">UE #2 Release</td></tr>
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In this worst case example only 16 of the 76 air frames are used for the respective RU's assigned to the hypothetical two users. This is approximately a 20% utilization of the assigned RU's.

The cause for this inefficient use of RU's is due to the RRC release and Radio Link release signaling procedures having to complete before the next RRC and radio link establishment procedure can be initiated. This is effectively a serial sequence with respect to the air interface resources (establishtransmit-release-establish…). The proposed solution is to allow the RRC and Radio link signaling procedures to be performed asynchronously and in parallel with respect to the user data transmissions.

Therefore to more efficiently allocate RU's for NRT connections, it is proposed that DCH establishments and releases in TDD mode can be coordinated with the air frame number. With this capability the release of a particular UE's RU's can be coordinated on an air frame boundary with another UE's establishment. It is suggested that this can be accomplished by adding parameters to existing RADIO LINK procedures, without any change in existing Radio Link procedures.

The proposal is to add activation CFN and deactivation CFN to RADIO LINK SETUP, and RADIO LINK RECONFIGURATION (Synchronized) (the reconfiguration process already contains activation CFN). In NBAP these two parameters are added to the RADIO LINK SETUP REQUEST and the RADIO LINK RECONFIGURATION COMMIT messages. In RNSAP a duration request travels from the SRNC to the CRNC in the RADIO LINK SETUP REQUEST or RADIO LINK RECONFIGURATION PREPARE. The actual allocated activation time and deactivation times are returned by the CRNC in the RADIO LINK SETUP RESPONSE or RADIO LINK RECONFIGURATION READY. This will allow the resource management to schedule the use of a physical resource unit to the frame number.

1 Proposals

1.1 Modify the following sections of NBAP 25.433

9.1.2 RADIO LINK SETUP REQUEST

This message is sent from CRNC to Node B in order to start radio link setup for the UE in the Node B.

Information Element	**Reference**	**Type**
Message Discriminator		M
Message Type		M
CRNC Communication Context ID		M
Transaction ID		M
UL Scrambling Code		M
UL Channelization Code		**M**
Length of UL Channelization Code		M
DCH Information		**M**
DCH ID		M
DCH Combination Ind		O
DCH Priority		FFS
UL Transport Format Set		M
DL Transport Format Set		M
UL Transport Format Combination Set		M
UL TFCI used flag		*(FFS)*
DL Transport Format Combination Set		M

DL TFCI used Flag		*(FFS)*
RL Information		**M**
RL ID		M
Cell ID		M
OFF		M
Chip Offset		M
Diversity Control Field		C[1]
DL Scrambling Code		M
DL Channelization Code		**M**
DL Channelization Code Number		M
(initial) DL transmission power		M
Maximum DL power		M
Minimum DL power		M
Activation CFN		O
Deactivation CFN		O
UL Eb/No Target		M
DL Reference Power		M

9.1.12 RADIO LINK RECONFIGURATION COMMIT

Information element	**Reference**	**Type**
Message Discriminator		M
Message type		M
Node B Communication Context ID		M
Transaction ID		M
Activation CFN		M
Deactivation CFN		O

1.2 Add the following sections in NBAP 25.433

9.2.39 Activation CFN

The CFN of the frame in which the physical layer stops transmitting.

9.2.40 Deactivation CFN

The CFN of the frame in which the physical layer stops transmitting.

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[1] This Information Element is present for all the radio links except the first radio link in the Node B.