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Agenda item: UE Capability

Source: Nokia

Title: Upper Limit on DRx cycle in UE Capability

Document for: Decision

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1 Abstract

This document examines the need to place an upper limit for discontinuous reception within Layer 1, and suggests a change to the UE capability document [1] in order to reflect this.

2 Introduction

In idle mode and in some connected modes (URA_PCH) the UE enters a discontinuous reception mode in order to conserve battery life. Currently the network decides on the DRx cycle to be used by the UE (the number of frames between the consecutive reception instances) and it has a 'free hand' to choose any 'power of 2' frames from 20ms to 40.96s.

In practice such long DRx cycles will not be used (for the reasons outlined in this paper), but as the specifications stand at the moment there is no limit on this DRx cycle. This will force the UE manufactures to implement unnecessary DRx cycles that will in practice never be used. So the purpose of this paper is to propose that the UE capabilities contains an entry which allows the UE to tell the network what the maximum DRx cycle it can support.

3 Upper Limit on DRx cycle

The following subsections outline the reasons for wanting to place an upper limit on the DRx cycle.

3.1 UE complexity:

Typically in idle mode the UE attempts to conserve current by 'sleeping' between idle periods during which time the UE does not receive anything from the air interface. With this in mind it is clear that the mobile must use an internal clock to maintain its chip, symbol and slot timing during this sleep period. The longer the sleep period the larger the 'wake-up' time uncertainty which impacts the complexity of the procedure required to re-establish synchronisation prior to reception of the PICH channel. (Basically the search window is increased).

3.2 Response time:

In a typical mobile phone it is not acceptable for the mobile to take 40.96sec to respond to a page, this would be obviously be seen as a very bad feature from the customer's point of view.

3.3 Idle Handoff Rate (= increased missed message rate):

It is reasonable to expect that a UE will perform its neighbour measurements every DRx cycle. So if the DRx cycle is very long then these measurements may not be frequent enough to guarantee that the UE is always on the best cell. This effect is most noticeable in a pilot polluted area.

If the UE is not always on the best cell then it can start to get PCH message errors.

4 Conclusion

There should exist the possibility for the UE to indicate to the network what the maximum DRx cycle it can support is. The UE capabilities would be a suitable place to convey this information to the network.

The proposal here is therefore to include a ‘Max DRx cycle supported’ entry into the list of UE capabilities. The range of this should be 1.28s to 40.96s. Note that this ensures that all UE are capable of supporting all DRx cycles less than and equal to 1.28s which should be enough flexibility for operators.

5 Text proposal for UE Capabilities [1]

4.10 DRx cycle

Max DRx cycle supported

Defines the maximum DRx cycle the UE can support

5 Possible UE radio access capability parameter settings

5.1 Value ranges

The value ranges are, depending on the particular parameter, specified according to either on of the following alternatives.

1. Value range: Yes/No (support or not support)
2. Value range: MIN, GRANULARITY, MAX

   minimum value for providing the baseline capability

   granularity

   maximum value should be defined so that a wide variety of UE's (with different capabilities) can exist in the future.

3. Some distinctive values between **minimum value** and **maximum value**, not necessarily with a linear granularity.

NOTE: It has been suggested to leave the maximum value open whenever possible (number of bits in the information element of UE Radio Access Capability message could set the upper bound)

Table 1: UE radio access capability parameter value ranges

		UE radio access capability parameter	Value range
PDCP parameters		Header compression algorithm supported	Yes/No
RLC parameters		Total RLC AM buffer size	2,10,50,100,150,500,1000 kBytes
		Maximum number of AM entities	2,3,4,8,16,32
PHY parameters	Transport channel parameters in downlink	Maximum sum of number of bits of all transport blocks received in TTIs that end at the same time	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum sum of number of sustainedly processable bits of all transport blocks received in TTIs that end at the same time, normalized with the respective TTI lengths in number of radio frames.	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum number of simultaneous transport channels	4, 8, 16, 32
		Maximum number of simultaneous CCTrCH (of DCH type	1, 2, 3, 4, 5, 6, 7, 8
		Maximum total number of transport blocks received within TTIs that end at the same time	4, 8, 16, 32, 48, 64, 96, 128, 256, 512
		Maximum number of TFC in the TFCS	16, 32, 48, 64, 96, 128, 256, 512, 1024
		Support for turbo decoding	Yes/No
		Support of 24 bits CRC	Yes/No
		Support of blind transport format detection (FFS) This should be first specified fully. Then a LS should be sent by WG1 to WG2 about what needs to be the UE capability.	Yes/No
	Transport channel parameters in uplink	Maximum sum of number of bits of all transport blocks transmitted in TTIs that start at the same time	, 640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum sum of number of sustainedly processable bits of all transport blocks received in TTIs that end at the same time, normalized with the respective TTI lengths in number of radio frames.	640, 1280, 2560, 3840, 5120, 6400, 7680, 8960, 10240, 20480, 40960, 81920, 163840
		Maximum number of simultaneous transport channels	2, 4, 8, 16, 32
		Maximum number of simultaneous CCTrCH of DCH type (TDD only)	1, 2, 3, 4, 5, 6, 7, 8
		Maximum total number of transport blocks transmitted within TTIs that start at the same time	2, 4, 8, 16, 32, 48, 64, 96, 128, 256, 512
		Maximum number of TFC in the TFCS	4, 8, 16, 32, 48, 64, 96, 128, 256, 512, 1024
		Support for turbo encoding	Yes/No
		Support of 24 bits CRC	Yes/No
	FDD Physical channel parameters in downlink	Maximum number of DPCH per RL	1, 2, 3, 4, 5, 6, 7, 8
		Maximum number of DPCH bits received per 10 ms	300, 600, 1200, 2400, 4800, 9600, 19200, 28800, 38400, 48000, 57600, 67200
		Support for SF 512	Yes/No
		Support of PDSCH	Yes/No

		Maximum number of simultaneous S-CCPCH	FFS
		Simultaneous reception of SCCPCH and DPCH	Yes/No
	FDD Physical channel parameters in uplink		
		Maximum number of DPDCH bits transmitted per 10 ms	150, 300, 600, 1200, 2400, 4800. 9600. 19200. 28800, 38400, 48000, 57600
		Support of PCPCH	FFS
	TDD physical channel parameters in downlink	Maximum number of timeslots per frame	1..14
		Maximum number of physical channels per frame	1,2,3..,224
		Minimum SF	16, 1
		Support of PDSCH	Yes/No
	TDD physical channel parameters in uplink	Maximum Number of timeslots per frame	1..14
		Maximum number of physical channels per timeslot	1, 2
		Minimum SF	16,8,4,2,1
		Support of PUSCH	Yes/No
RF parameters	FDD RF parameters	UE power class (25.101 section 6.2.1)	1, 2, 3, 4
		Radio frequency bands (25.101 section 5.2)	a), b), a+b)
		Tx/Rx frequency separation FFS for frequency band b (25.101 section 5.3)	190 MHz 174.8-205.2 MHz 134.8-245.2 MHZ
		Chip rate capability	N/A for FDD
RF parameters	TDD RF parameters	UE power class (25.102)	1,2,3,4,
		Radio frequency bands (25.102)	a), b), c), a+b), a+c), a+b+c)
		Tx/Rx frequency separation	N/A for TDD
		Chip rate capability (25.102)	3.84,1.28
Multi-mode related parameters		Support of UTRA FDD/TDD	FDD, TDD, FDD+TDD
Multi-RAT related parameters		Support of GSM	Yes/No
		Support of multi-carrier	Yes/No
LCS related parameters		LCS support	FFS
Measurement related capabilities (FFS)		Need for compressed mode	Yes/No
DRx cycle		Max DRx cycle supported	1.28, 2.56, 5.12, 10.24, 20.48, 40.96 seconds

6 References

[1] TSG RAN, “TR 25.296 UE Radio Access Capabilities”