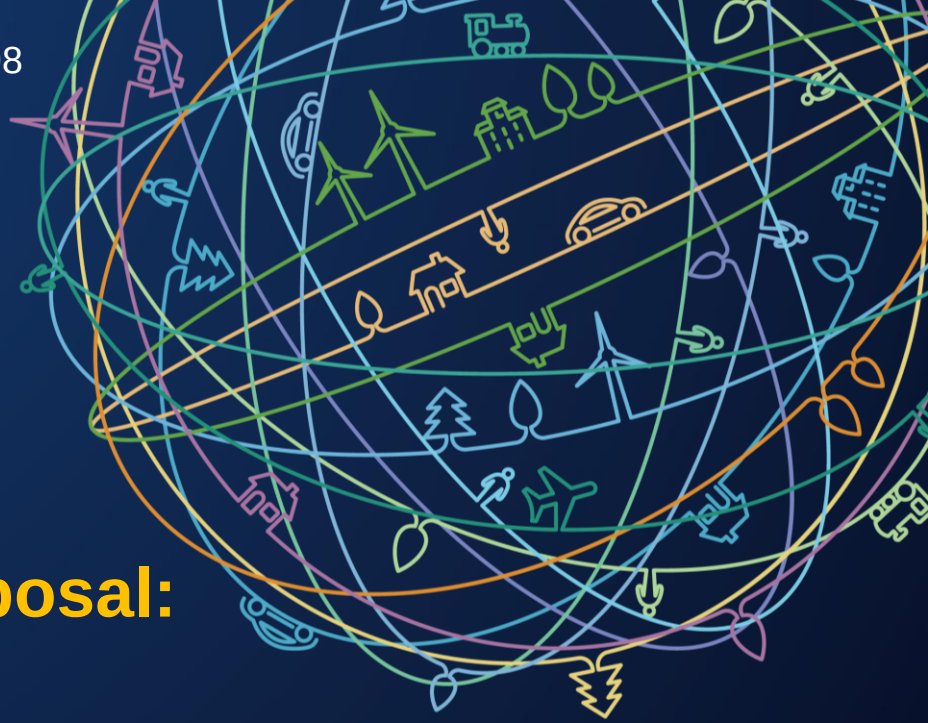
3GPP TSG RAN Meeting #79
Chennai, India, March 19-22, 2018
Agenda Item: 9.1.1
Source: Huawei, HiSilicon

RP-180398



Motivation for a New SI proposal: NR voice enhancements

HUAWEI

Motivation

- For voice, first of all, features used in LTE can be reused in NR for voice performance optimization, e.g. short PDCP SN. However, VoLTE still exhibits worse performance than OTT service, under certain circumstances.
- Increased jitter causes packet loss at the receiver. For Rel-14 VoLTE, a delay budget reporting framework was introduced, followed by a SI approved by SA4 to further investigate the suitable media handling mechanism. A jitter buffer adjusting mechanism could be studied and introduced, to reduce the packet loss due to increased jitter.
- In both OTT and VoLTE, redundancy is added to the voice streams for error correction. To improve the transmission reliability, additional redundancy or other error correction solution could be studied and introduced for VoNR.
- The performance of VoLTE is deteriorating dramatically with instant high neighboring interference. Enhancement on resource reservation mechanism could be investigated for VoNR.
- We also observe that dedicated PHY layer operations are beneficial to voice, e.g. Polar code, shorter RTT and specific HARQ configurations. Specific or dedicated PHY enhancements for voice can be studied and introduced.
- For video, two aspects were considered in LTE: critical data prioritization and TCP enhancement (e.g. for TCP ACK). Both can be reconsidered in NR, given the benefits which were already observed.
- In conclusion, we think that it is useful to study mechanisms to improve the user experience for both the voice and video services in NR.

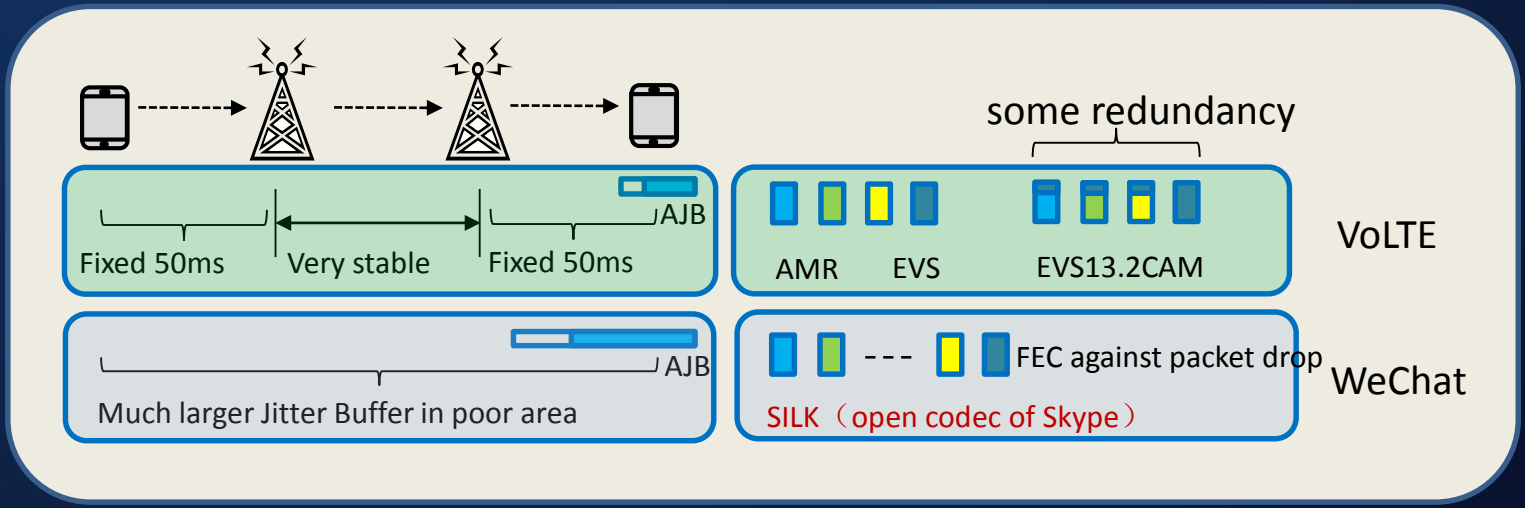
HUAWEI

VoLTE vs. OTT

Field test in underground parking lots：Wechat has much higher delay, but less low MOS points than VoLTE

	Tested hours	MOS<3.0	Low MOS#	E2E delay
VoLTE	1 hour	1.45%	0.33%	**151**
Wechat	1 hour	0.32%	0.16%	**724**

- VoLTE vs. OTT (drawback of VoLTE)
  - Fixed delay restriction, leading to high packet drop rate
  - Semi-static jitter buffer size, not adaptive to real air condition
  - Without flexible codec selection

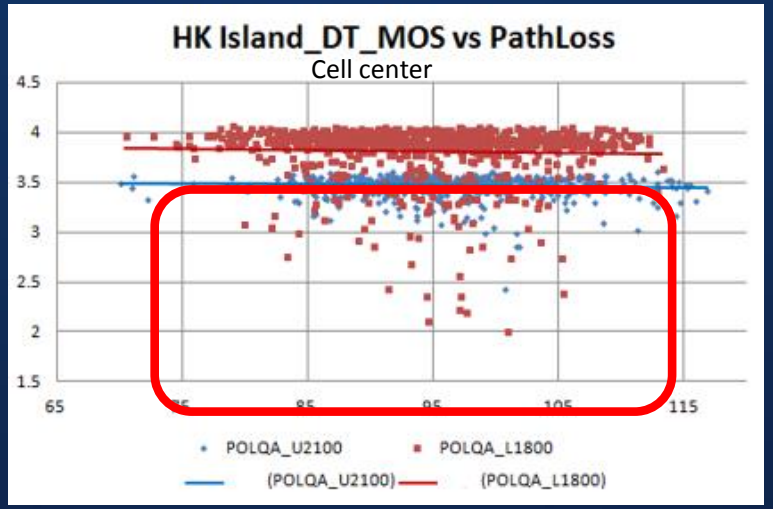


HUAWEI

VoLTE vs. UMTS

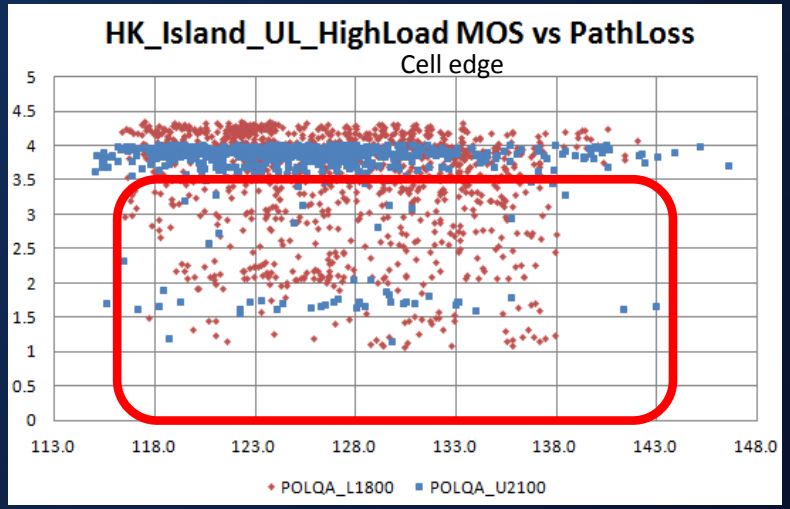
VoLTE is sensitive to packet drop

Low loaded



More low MOS points than UMTS in low loaded case

High loaded

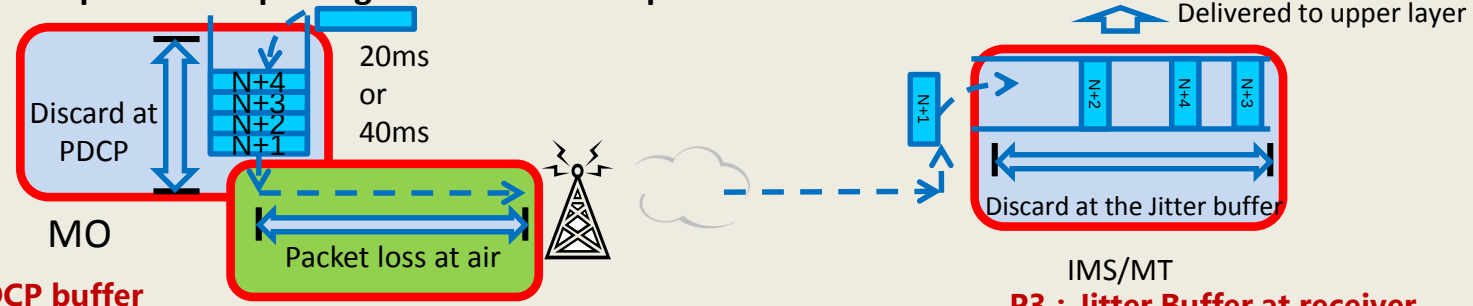


The number of low MOS points increases greatly in high loaded case

HUAWEI

Analysis on packet drop for voice

Scenarios for packets drop along the transmission path:

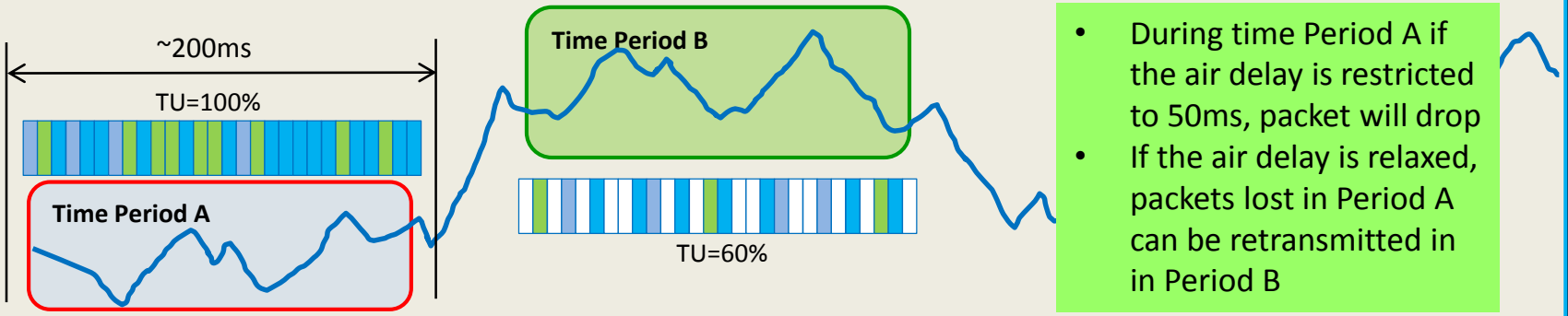


P1 : PDCP buffer
PDCP timer expires

P2 : Air interface
Upon maximum number of HARQ retransmissions reached

P3 : Jitter Buffer at receiver
When the jitter is longer than Jitter Buffer size, packets drop can occur

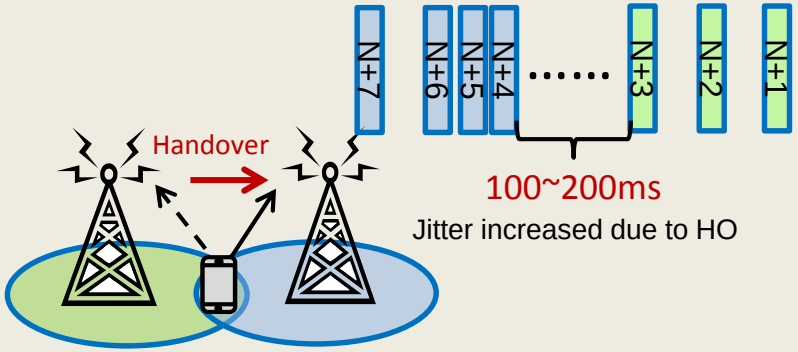
Detailed analysis for P2: Air interface

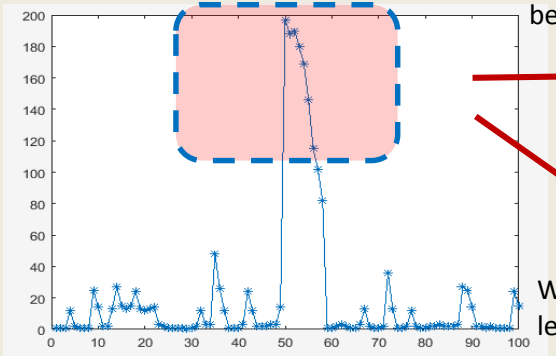


- During time Period A if the air delay is restricted to 50ms, packet will drop
- If the air delay is relaxed, packets lost in Period A can be retransmitted in in Period B

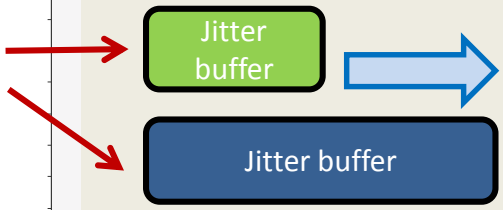
HUAWEI

Adaptive Delay Enhancement





Without jitter buffer enhancement: packets will be discarded



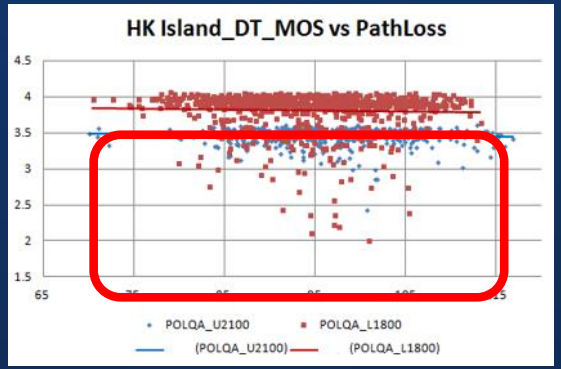
With jitter buffer enhancement: less packet discarded

- Poor/extreme poor coverage: delay increased at the originator mobile would increases the jitter at the terminator mobile
- Handover or UE movement from outdoor to indoor will cause sudden channel quality degradation.
- Packets are discarded if the delay variation is so large to cause packets to be received out of the jitter buffer
- Study dynamic adaptation of jitter buffer size which might be useful to reduce the possibility of package drop at the terminator mobile

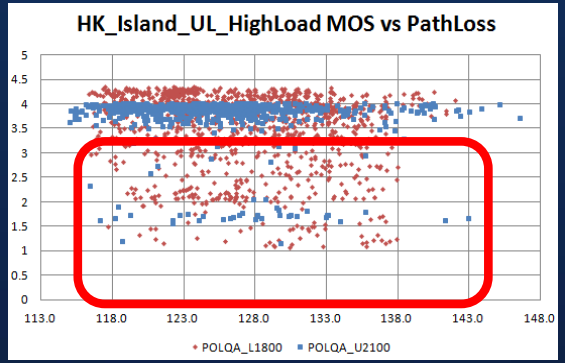
HUAWEI

Resource Reservation Enhancements

Cell center



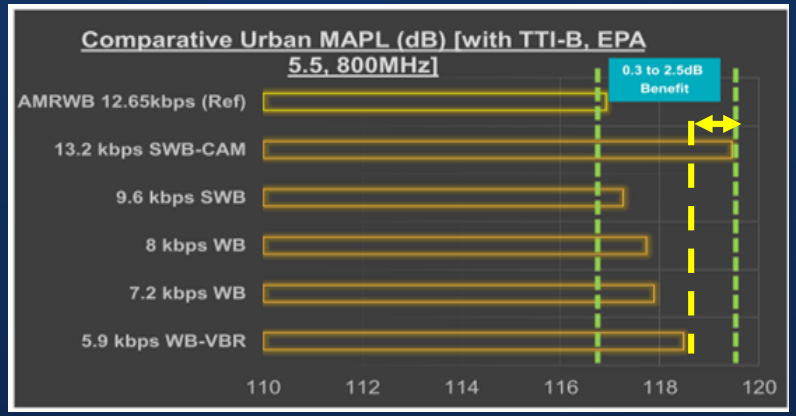
Cell edge



- Frequent consecutive packets errors occur within a certain period of time in current VoLTE networks
  - The FLR of the cell-edge UEs can be maintained well, as long as neighbor cells are lightly loaded
  - For center UEs, FLR can be minimized via AMC; for cell-edge UEs, FLR cannot be minimized, if burst data transmission is performed at the neighbor cells.
- RAN could consider inter-cell resource reservation/negotiation for user experience improvement at the cell edge.

HUAWEI

Redundancy Coding Enhancement

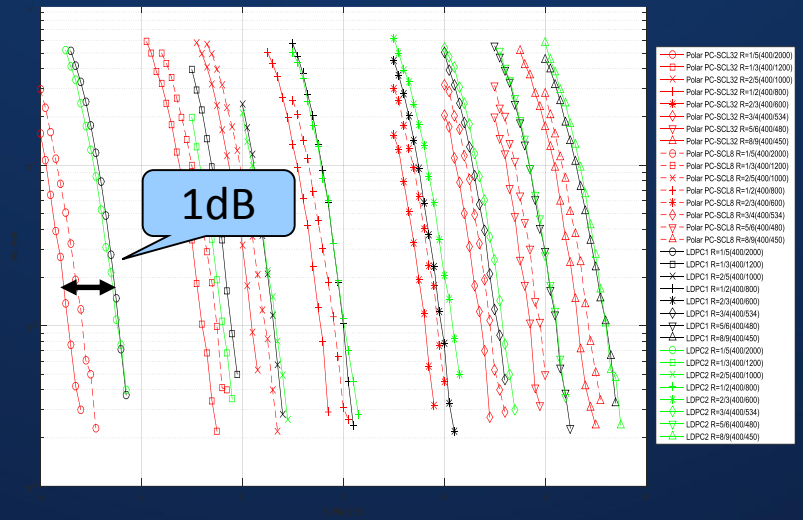


- EVS 13.2 CAM exhibits better error recovery performance than the low-rate 5.9kbps WB-VBR, due to redundancy that is introduced at the source
- We could investigate the introduction of additional redundancy, via coding, to improve transmission reliability
- The additional redundancy coulld be introduced at RTP layer, IP layer, PDCP layer or even at the Codec

HUAWEI

Dedicated PHY Resource Enhancement

BLER performance comparison for decoder of Polar and LDCP, QPSK



Block length=400

- For voice typical block length, e.g. 100 or 400, a Polar decoder outperforms LDPC decoder
- Furthermore, shorter RTT or specific HARQ configuration is beneficial for voice packets
- Therefore, voice specific PHY resource with Polar code and short RTT could be configured to service voice service, e.g. voice specific BWP

HUAWEI

Critical Data Prioritization in video transmission

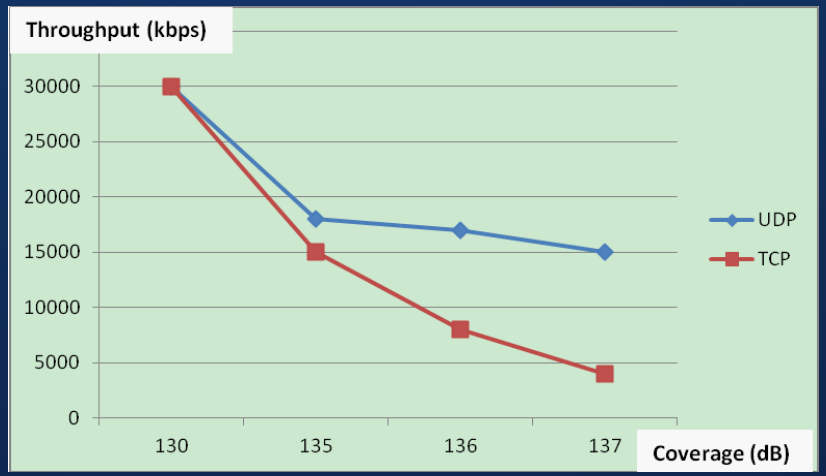
- The importance of different video data parts are quite different. For instance, the I-frames, which do not depend on any other frame for rendering, are usually much more important than other frames(e.g. P-frames), and the loss of these critical data will result in a sequence of damaged images.

- Currently both important and non-important data packets are transmitted on the same video bearer, experiencing similar L2 and L1 handling.

- When the video bearer queue is highly loaded (e.g. in case of UL radio congestion or in poor radio coverage) , these critical packets may be dropped as other normal packets, which will cause serious video quality degradation.

HUAWEI

TCP Performance Optimization



TCP throughput reduction in weak coverage area

- When a TCP packet is sent over in LTE, it requires to be acknowledged with HARQ ACK, RLC ACK and TCP ACK by the receiver.
- Failures to receive any of the ACKs containing acknowledgements of the TCP packet in transmit side will result in retransmission.
- These redundant ACKs and redundant retransmission significantly increase the TCP RTT which reduces the TCP throughput.

HUAWEI

Objectives of Study Item

This study item will study the following enhancements for VoNR:

1. Enhancements that improve the VoNR quality perceived, focusing on:
   - Support coverage optimization based on short PDCP SN (RAN2).
   - Investigate the mechanism to adjust UE jitter buffer size for reducing packet loss (RAN2, RAN3).
   - Investigate the mechanism to introduce additional redundancy for voice reliability improvement (RAN2).
   - Investigate the mechanism to provide specific PHY resource tailored to the requirements and characteristic of voice (RAN1, RAN2).

2. Enhancements to avoid continuous packet loss by inter-cell resource reservation/negotiation (RAN1, RAN3).

3. Enhancements to improve the video quality perceived, focusing on:
   - Investigate the critical data awareness and handling differentiation mechanism (RAN1, RAN2).
   - Investigate the TCP throughput optimization mechanism (RAN2).

HUAWEI

THANK YOU

Copyright©2015 Huawei Technologies Co., Ltd. All Rights Reserved.

The information in this document may contain predictive statements including, without limitation, statements regarding the future financial and operating results, future product portfolio, new technology, etc. There are a number of factors that could cause actual results and developments to differ materially from those expressed or implied in the predictive statements. Therefore, such information is provided for reference purpose only and constitutes neither an offer nor an acceptance. Huawei may change the information at any time without notice.