

3GPP TSG RAN Meeting #69

Phoenix, USA, 14 -16 September 2015

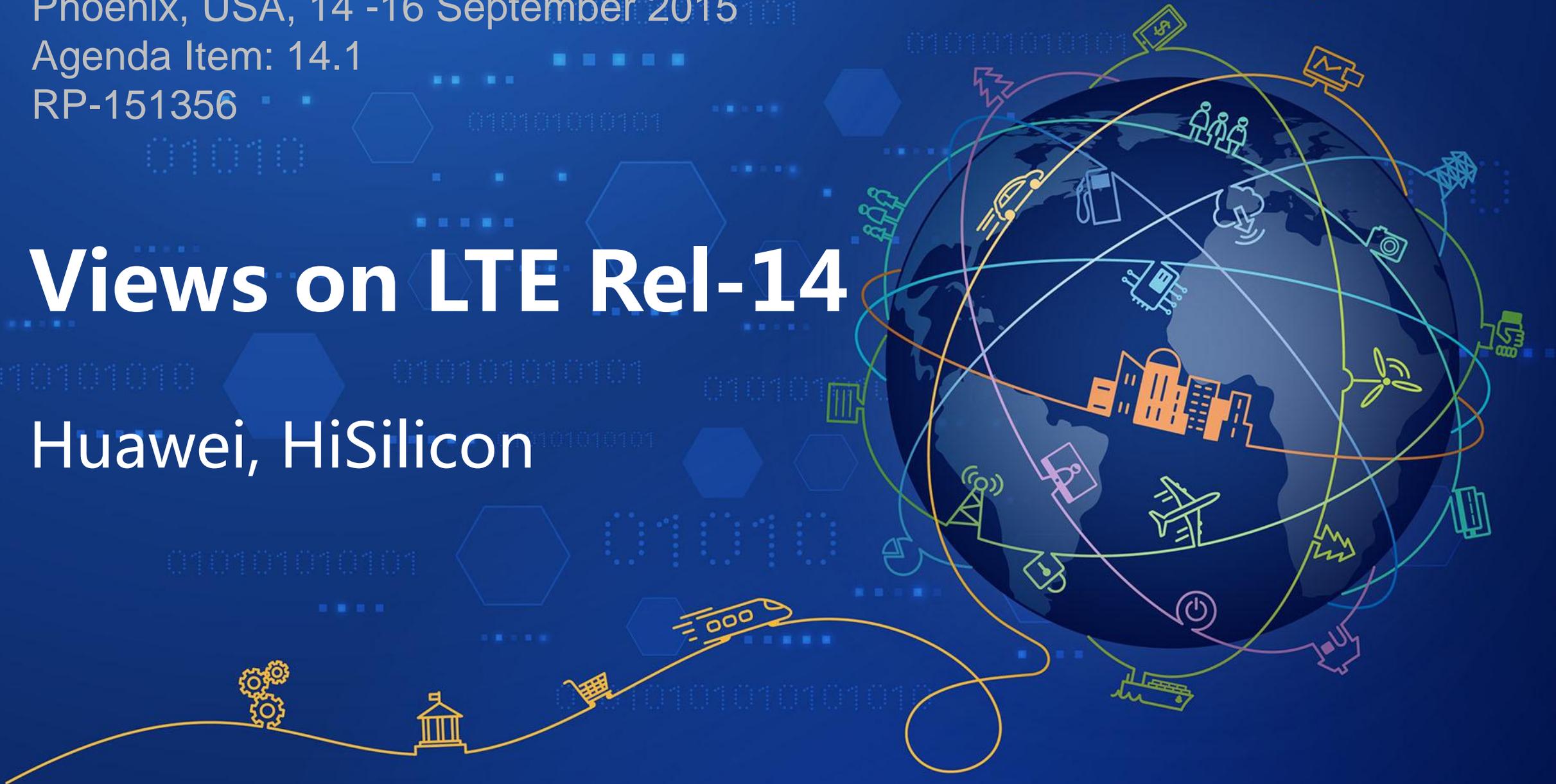
Agenda Item: 14.1

RP-151356



Views on LTE Rel-14

Huawei, HiSilicon



Standard Roadmap: (Rel-14 and onwards)



Notes:

R14 (18 months), R15 (12 months), R16 (15 months)



LTE Evolution is Important!

- LTE Rel-13 and onwards provides an opportunity for further expansion for operators before 2020:
 - To efficiently address the request of increasing capacity for Mobile Broad Band
 - To enhance the end-user experience
 - To accommodate the well identified valuable vertical markets over cellular network
- LTE Rel-14 is the second release of LTE new branding
- A few LTE Rel-13 topics will continue in Rel-14

Note: PCG decision on LTE new marker will be in October

Continuation of a few Rel-13 Topics



Note: CIoT is discussed in other presentation

Overview of LTE Rel-14 Key Features

Flexible Spectrum Utilization

LAA UL and Wider Carrier

Flexible Duplex

Fast Carrier Switching

Bandwidth Flexibility

Continuous Network Optimization

Advanced MIMO Technologies

Latency Reduction

DL MUST

TDD-Universal

Ultra Dense Networks

Signaling Reduction

Diverse Service Support

LTE based V2X

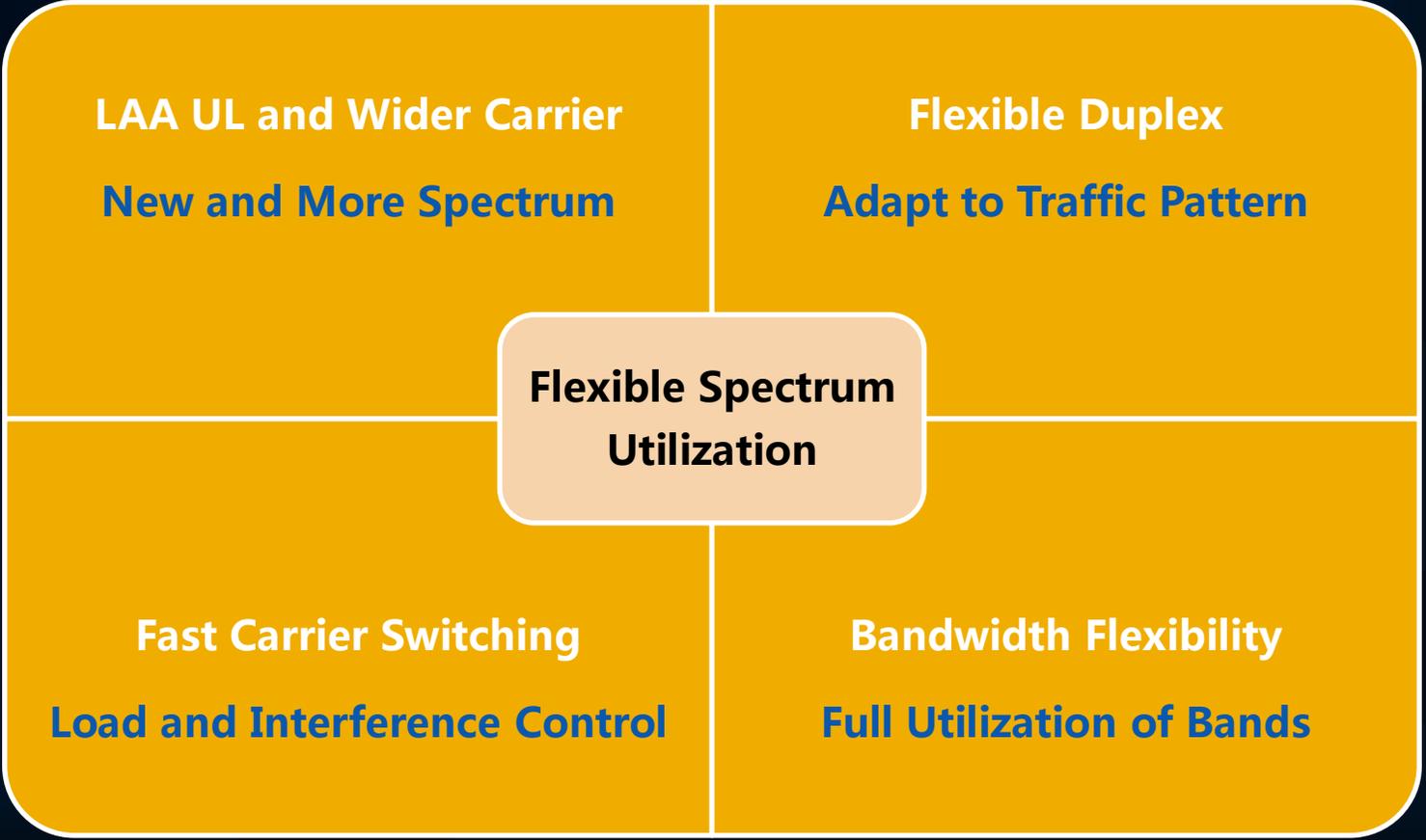
SC-PTM Enhancements

High Speed Train

VoLTE+

D2D for M2M

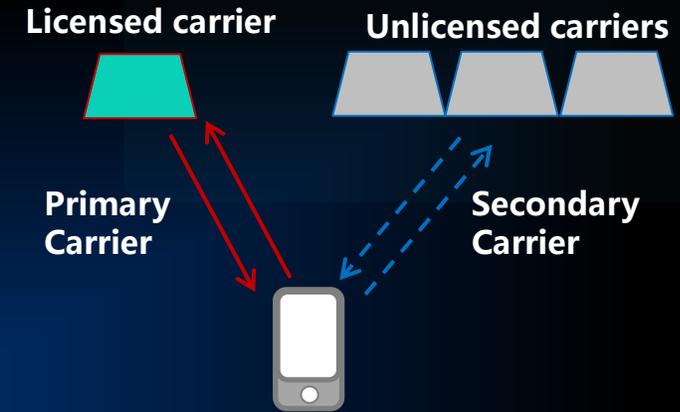
Rel-13
Continuations



LAA Enhancements

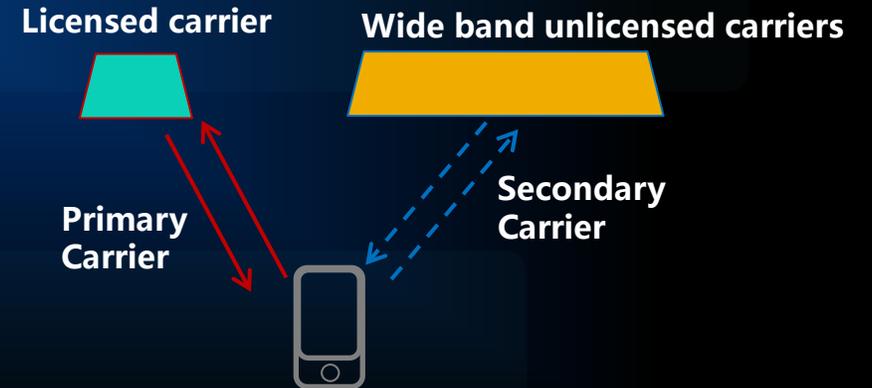
● Support of Uplink

- DL LAA is approved for Rel-13 and uplink traffic offloading can be planned for R14
- UL traffic will take an important portion in future MBB application
- Both TDD and Supplemental Uplink modes can be considered



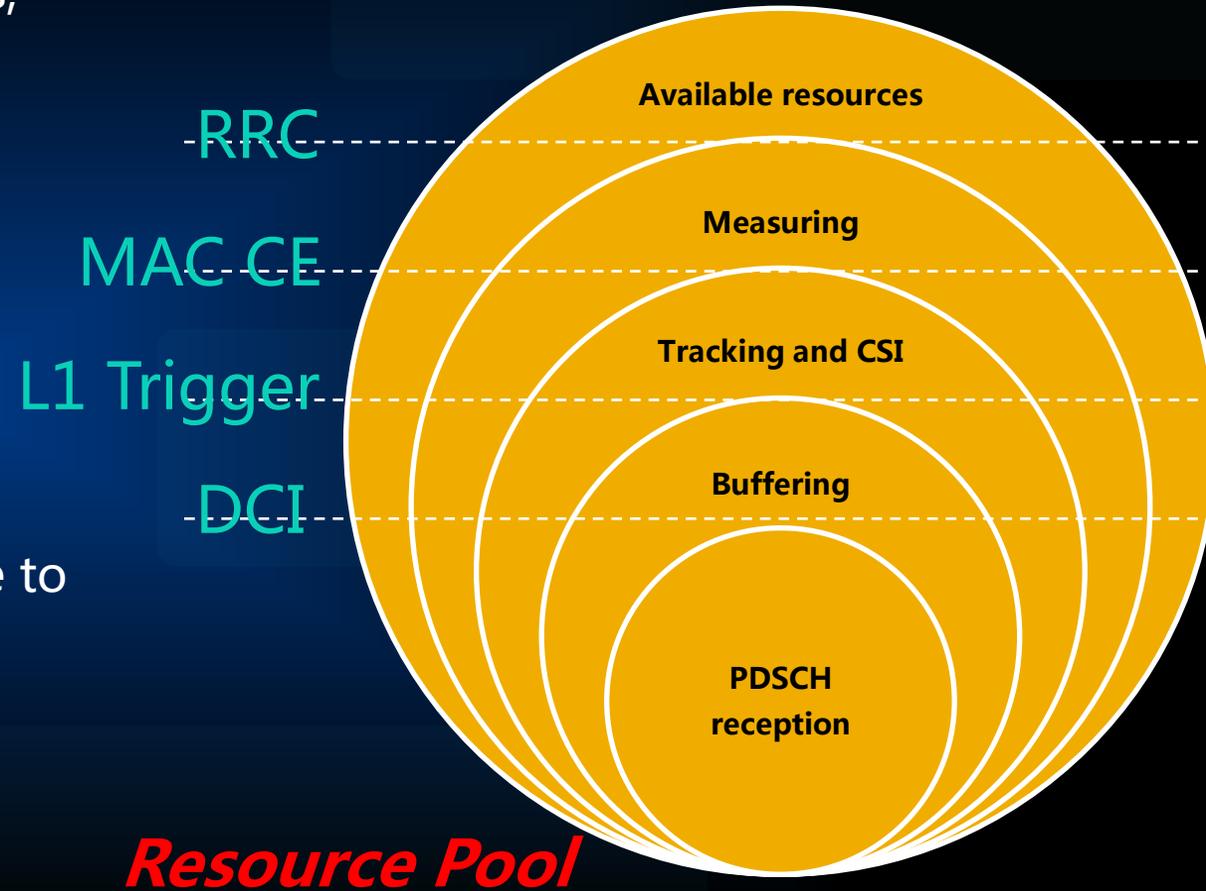
● Wider bandwidth (40M, 80M or larger) per carrier, increased sub-carrier spacing, and shorter TTI

- Adapt carrier bandwidth to match accessible band
- Improve channel use efficiency and reduce implementation complexity
- Better PAPR (3 dB and more)
- Enable scalable bandwidth and reduce power consumption



Fast Carrier Switching

- Even with massive carrier aggregation of up to 32 CCs, most of the UEs in the near future will only support CA with a small number of CCs, especially for UL
- Fast Carrier switching
 - Enable utilization of the available spectrum over time without significantly increased UE complexity
 - Improve network interference coordination and load balancing
- UL SRS transmission on a large number CCs over time to improve DL beamforming performance
- Take full advantage of multi-carrier LBT for LAA



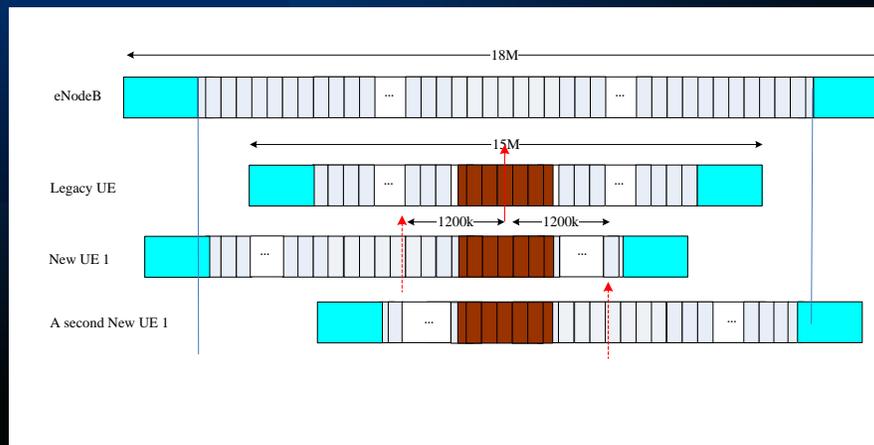
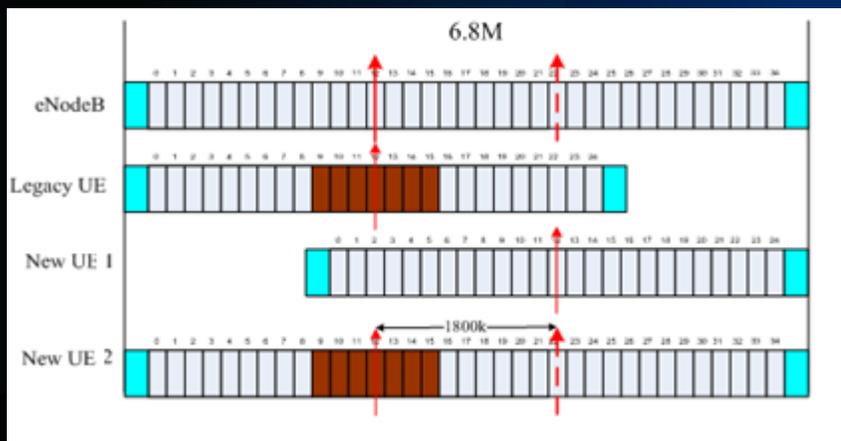
Bandwidth Flexibility

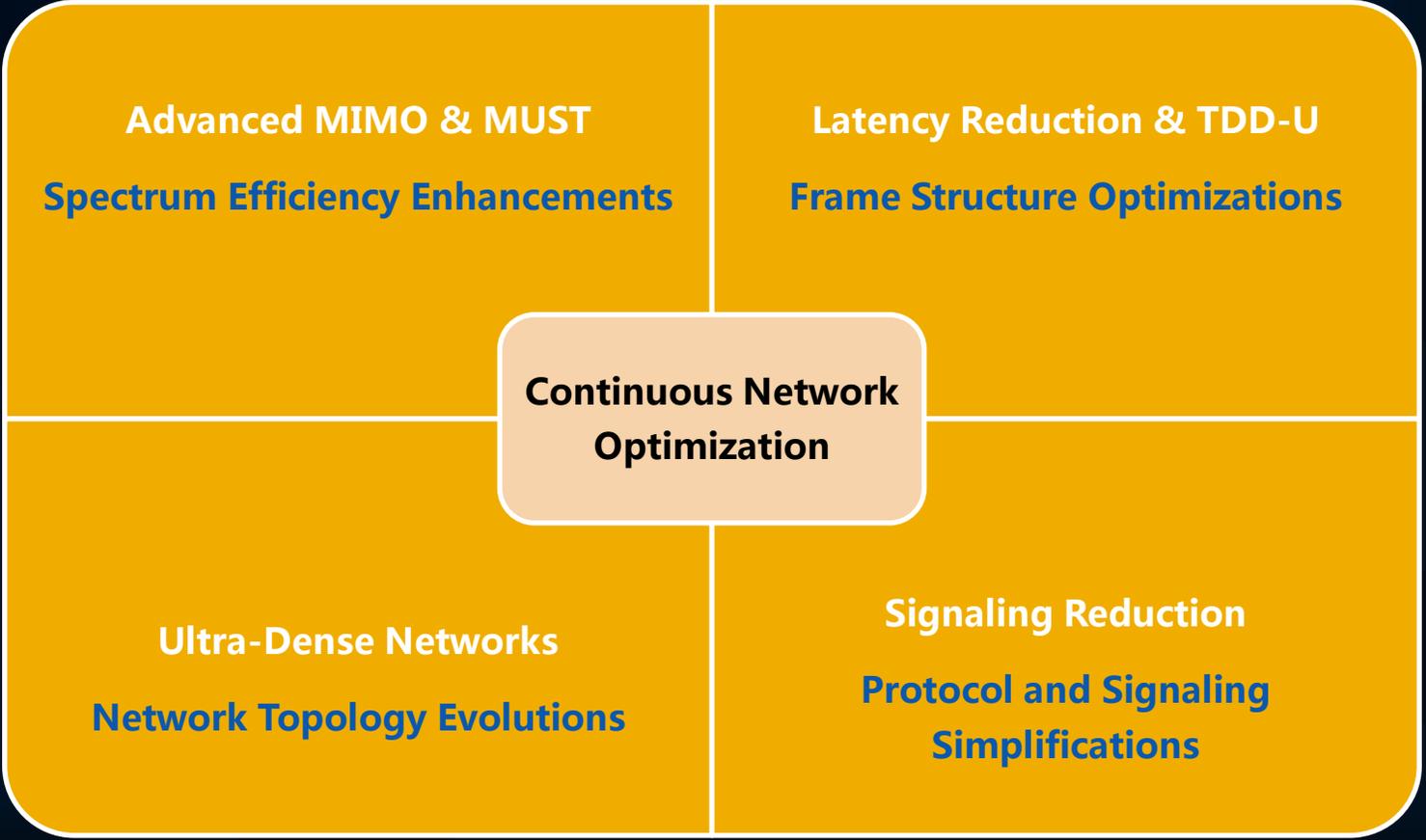
● Motivation

- Parts of the spectrum identified for IMT-advanced are not efficiently utilized by LTE in licensed bands because of non-standardized bandwidth sizes
- Enhancements to LTE should be specified such that the entire licensed spectrum block can be used by the network with the possibility to schedule different UEs in different parts of the spectrum block

● Solution for maximizing bandwidth utilization (examples for 6.8 MHz and 18 MHz)

- Legacy UE: access 5 MHz of a legacy carrier with a fixed center frequency
- New UE 1 : 5 MHz bandwidth with a single RF chain (no hardware impact compared to a legacy UE)
- New UE 2: Full bandwidth but potentially with CA-like solution, and peak data rate can be achieved
- OFDM mapping and resource allocation to ensure baseband orthogonality with legacy UEs





R14 Advanced MIMO technologies



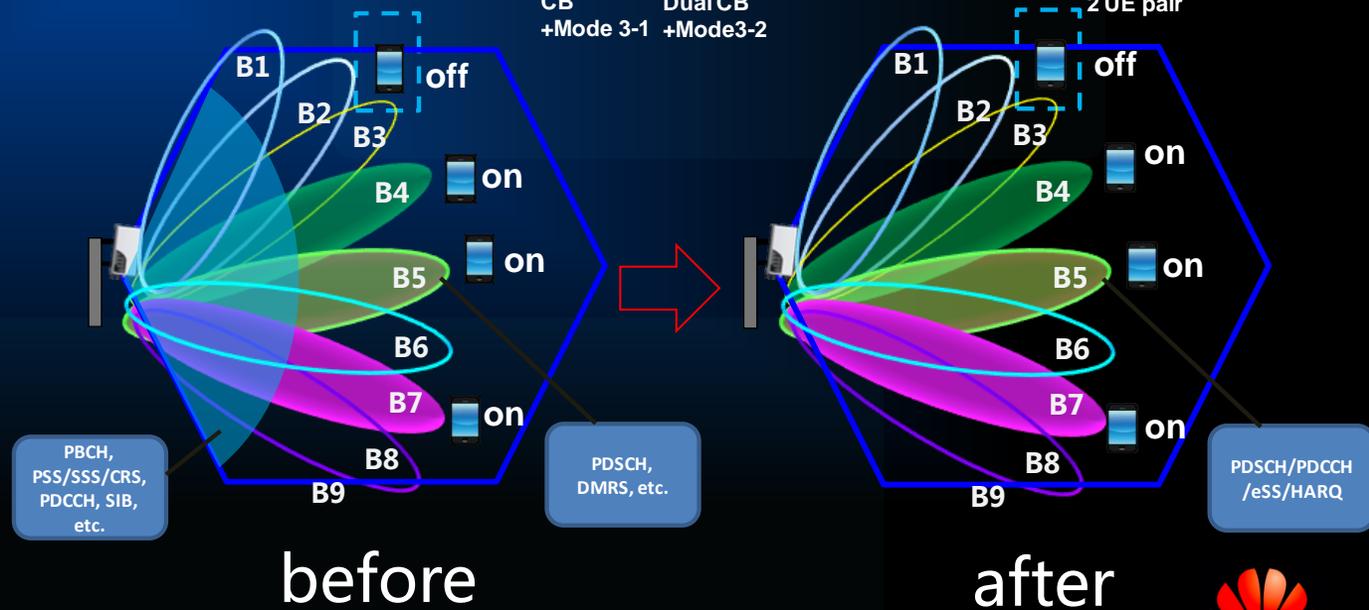
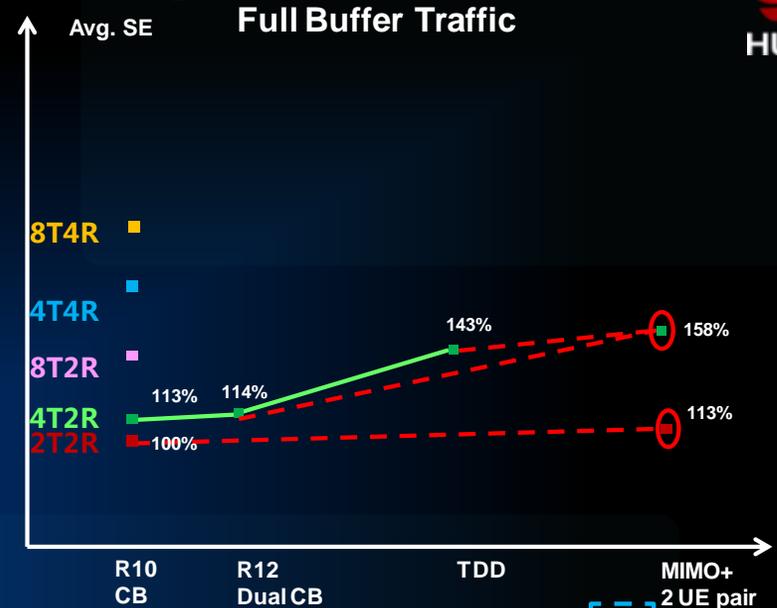
- MIMO+/Probing: new CSI/CQI measurement/feedback mechanism

- Post CQI definition for "perfect" link adaptation
- Faster CQI feedback
- Analog CSI feedback

- MBC: Massive beamforming for coverage/SDMA

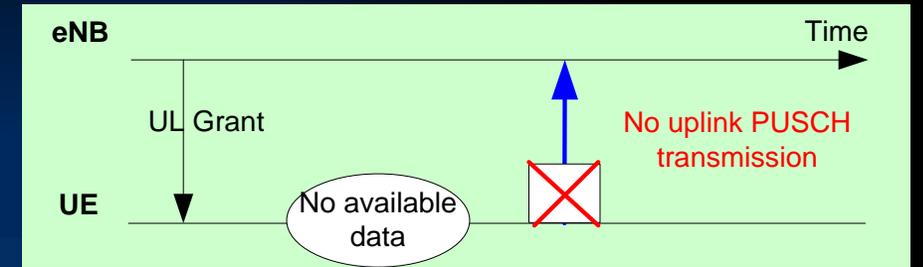
- Self contained beam with pilot, control and data
- Minimization of common system overhead
- Dynamic beam on/off

- Expect to see other company proposals for support of up to 64 ports



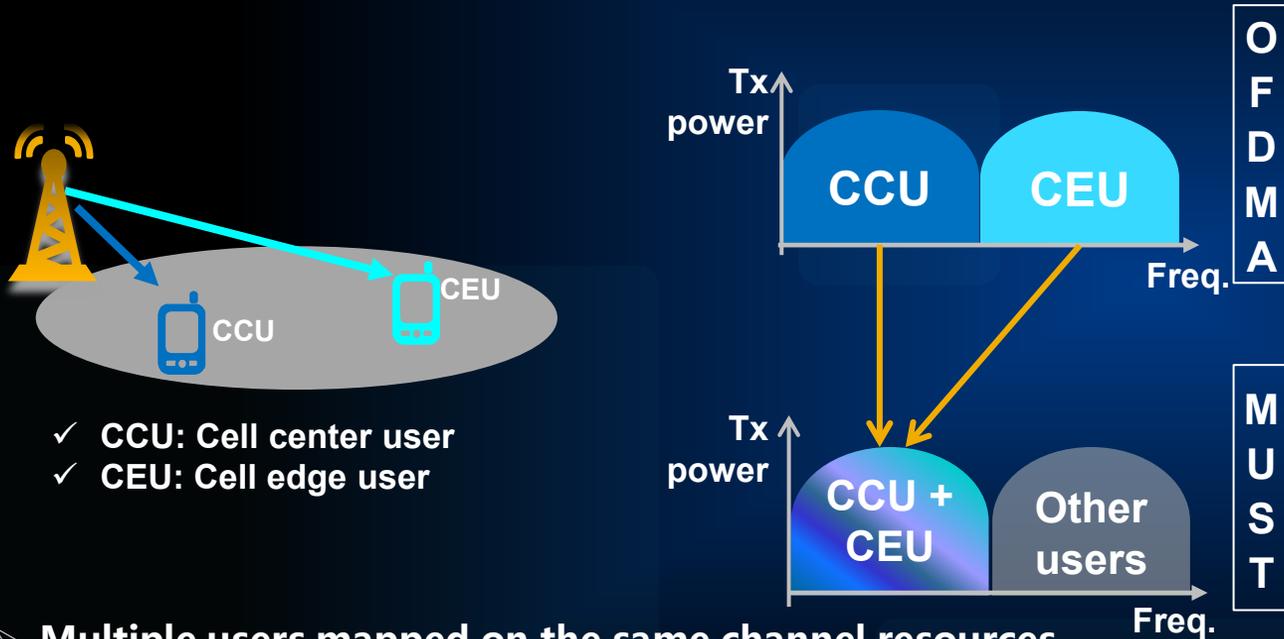
Latency reduction

- Latency reduction will improve the user experience and system capacity:
 - The follow up Work Item is expected to be in R14.
- Fast uplink access solutions by improving the existing pre-scheduling scheme, e.g.
 - Skipping UL transmission when no available data
 - Contention based UL transmission
- Shorter TTI
 - Between 7 OFDM symbols and 1 OFDM symbol
 - **Focus on FDD**



DL Multi-User Superposition Transmission (MUST)

MUST: Multiuser Superposition Transmission → improving the MU system capacity for networks without spatial separation



- **Multiple users mapped on the same channel resources**
- CEU receives its own signal by treating superposed CCU signal as noise.
- CCU receives its own signal using a Maximum Likelihood (ML) receiver or performing Successive interference cancellation (SIC) of CEU signal.
- With gray mapping in MUST, applying ML can achieve same performance as applying SIC, while simpler UE implementation is required.

➤ SI on track in Rel-13

- MUST can provide ~20% throughput gain and UPT gain for PDSCH transmission, depending on the evaluation scenarios
- MUST on PMCH can provide many valuable configurations and billing possibilities

PMCH	Basic layer throughput for 95% coverage (Mbps)	Additional throughput for 70% coverage (Mbps)
w/o MUST	4	0
with MUST (with different power allocations to the two layers)	4	1.8
	2.7	6

TDD Universal Frame Structure

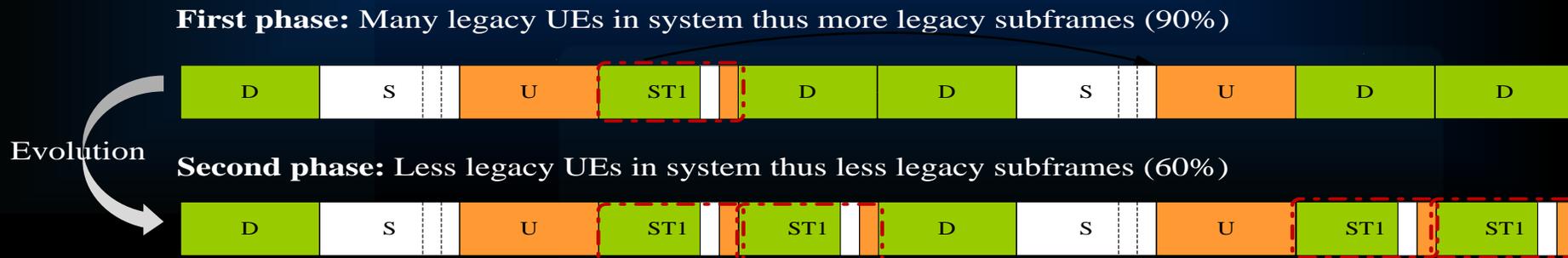


TDD Universal Frame Structure

- ▣ DL/UL control channels in one SF as FDD
- ▣ Uniform HARQ Timing as FDD
- ▣ LTE numerologies and backward compatible

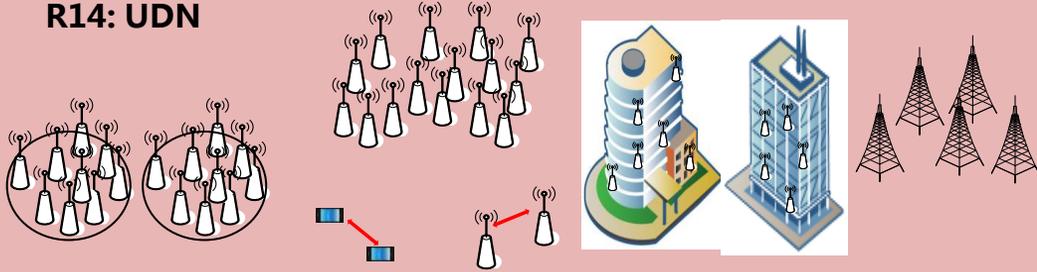
Benefits

- ▣ Fast SRS/CQI for Massive MIMO
 - ✓ More beam-forming gains
 - ✓ More gains for small packets and high speed users
- ▣ Short HARQ RTT
- ▣ Control channel alignment across cells
- ▣ Dedicated A/N to reduce bundling



Ultra Dense Network (UDN)

R14: UDN



• Dense network scenarios

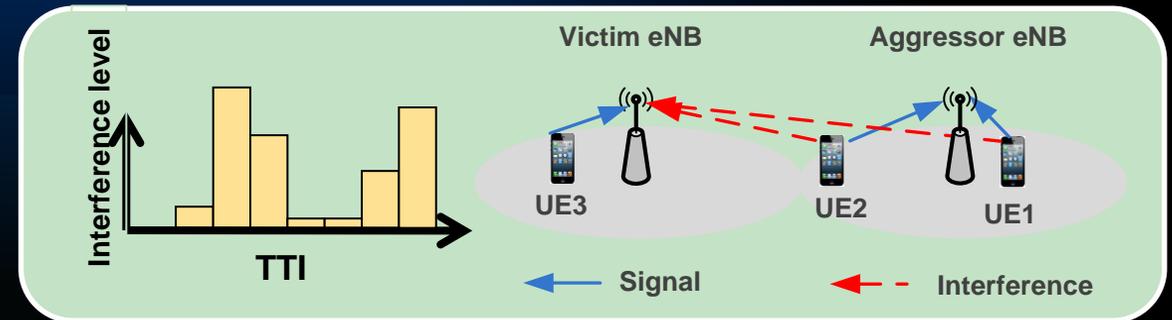
- Dense macro
- Ultra-dense small cell
- 3-dimensional dense urban network
- Dense D2D

• Key issues

- Severe interference conditions
- Mobility and load balancing issues
- Backhaul availability

• Proposals

- Fast, mutual, & reliable discovery and measurements
- Virtual cell
 - → UE-centric resource utilization
- Coordination & adaptation over multi-carriers
- UL 256 QAM
- Mobility Enhancements
- UL and DL Link adaptation enhancement



Signaling overhead reduction

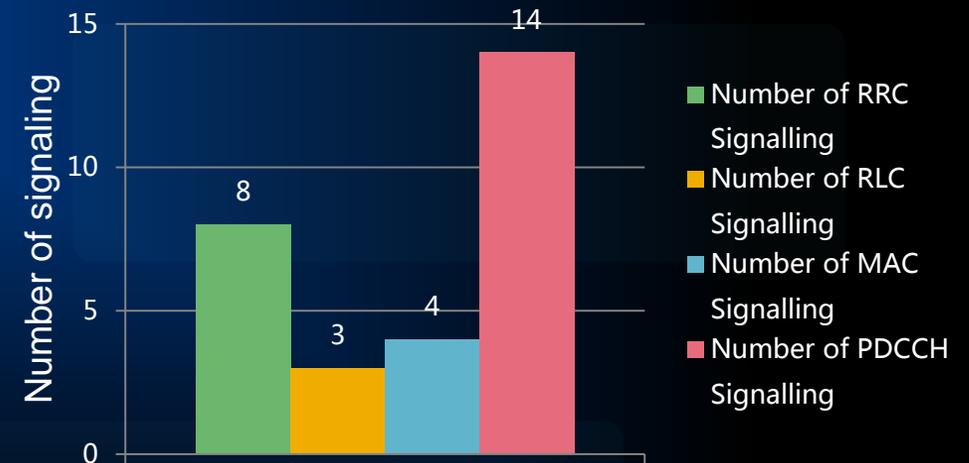
- Motivation:

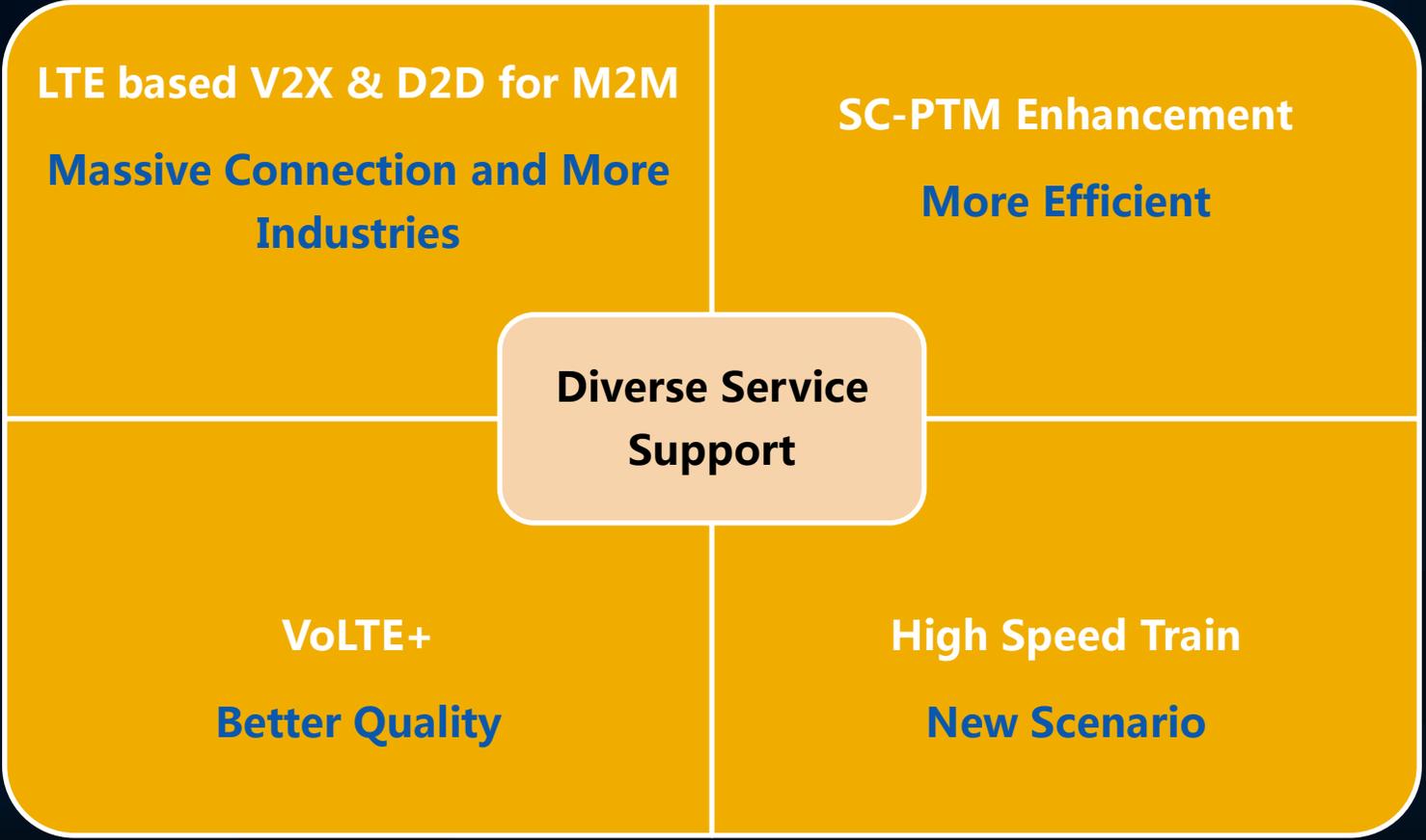
- The signalling overhead is considerable for small data delivery, if each small data transmission requires RRC connection setup/release.
- Signalling overhead reduction will enable the system to support a larger number of connections (both for MTC devices and smart phones).

- Proposal:

- Small data delivery with reduced signalling overhead:
 - Fast RRC connection (re-)establishment
 - RRC connection less

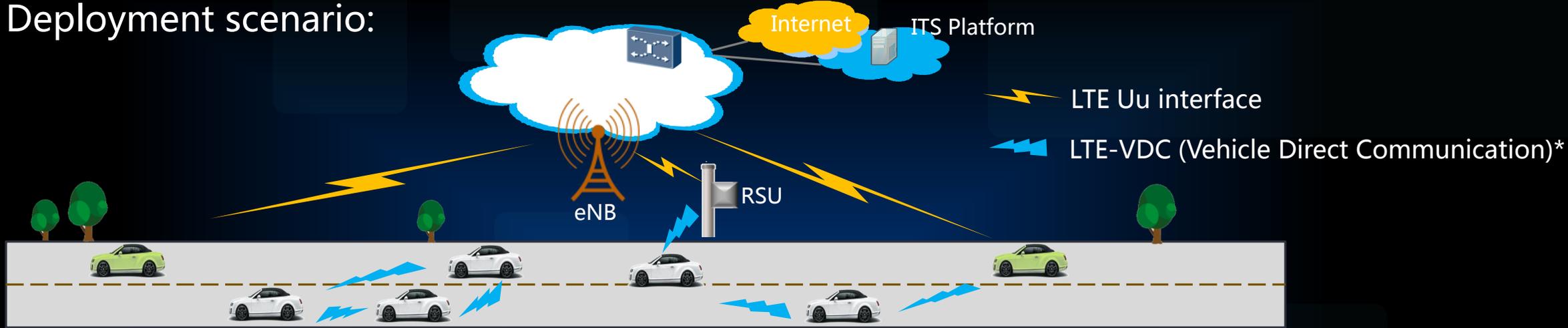
Overhead of RRC connection establishment procedure





LTE-Based V2X

- Deployment scenario:



- Feasibility Study on LTE-based V2X Services

- SI on track in Rel-13

- Plan for WI

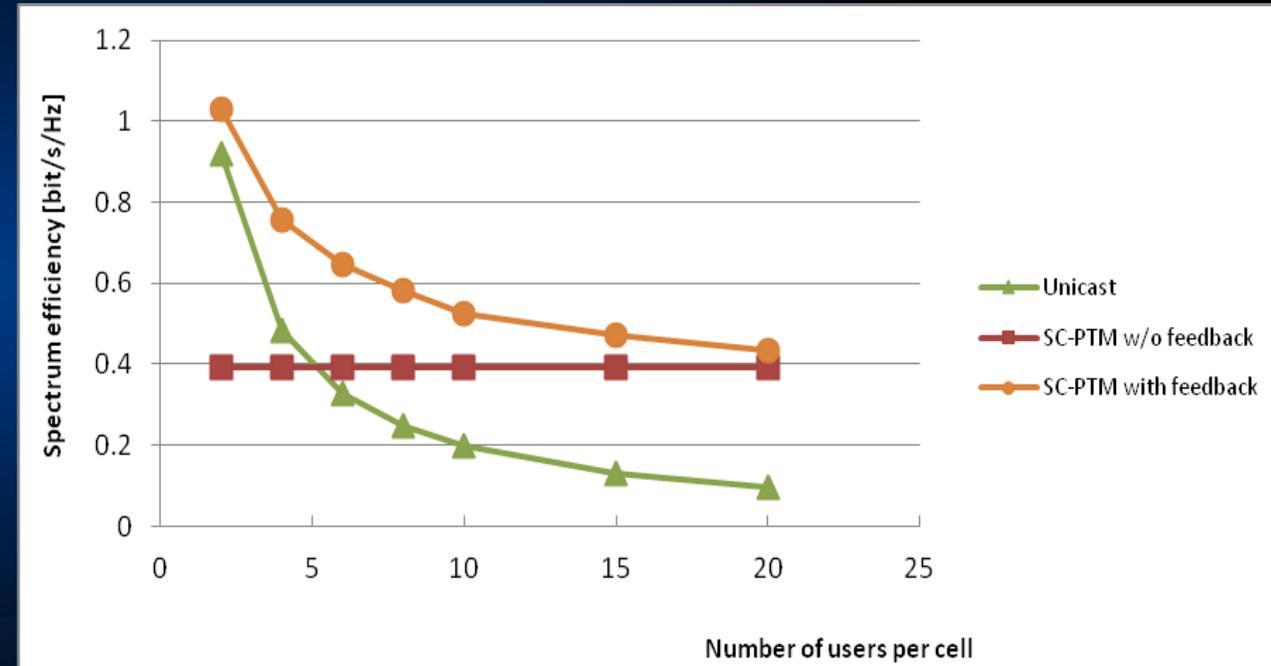
- V2V WI (December 2015 – June 2016)
 - V2X WI (June 2016 – June 2017)
 - V2I
 - V2P
 - Compatible V2V enhancements

Name	Value
Maximum relative velocity	280 km/h
Typical message size	50 - 400 bytes
Maximum message size	1200 bytes
Maximum message frequency	10 Hz
Maximum latency	100ms (and 20ms) **
Communication range	4s response time

* Tentative naming, while final naming is up to SA WG(s)
 Page 18**20ms applies to pre-crash sensing warning

SC-PTM Enhancements

- Uplink feedback for SC-PTM transmission
 - Uplink CSI/HARQ feedback can bring significant gain when the number of UE is limited (i.e. <15)
- SC-PTM for Low cost MTC
 - Scenarios: e.g. software update, group triggering
 - SC-PTM scheduling over narrowband and repetitions for coverage enhancement
- Licensed-assisted SC-PTM transmission
 - Offload group services to unlicensed spectrum



Enhancements in High Speed Scenarios

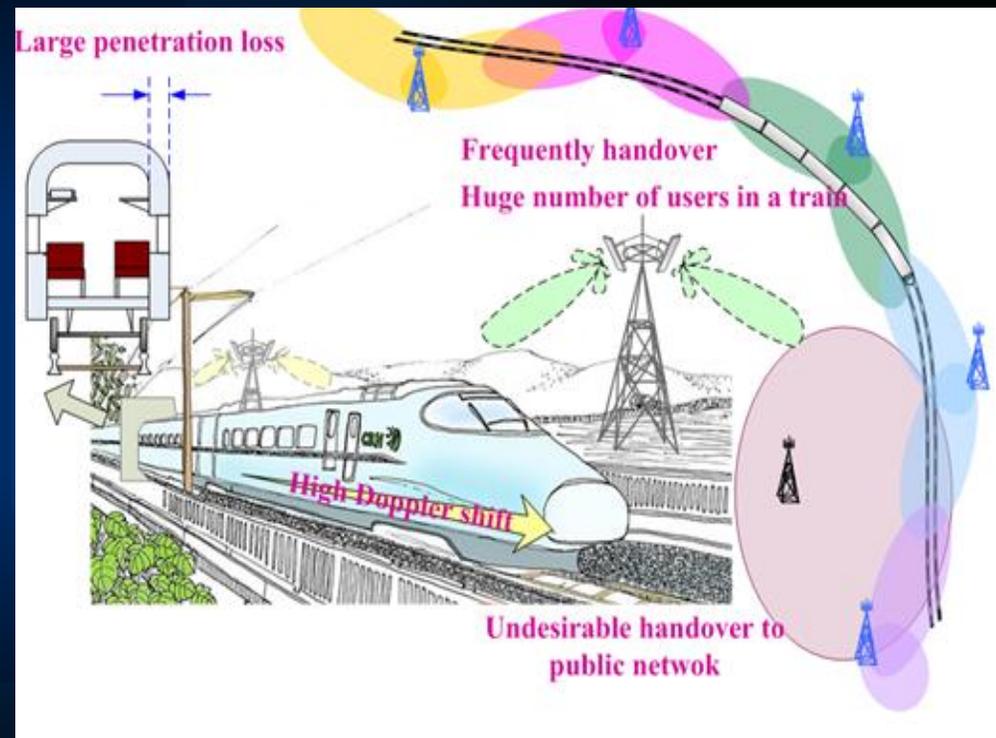
- **SI on track in Rel-13**

- Problems:

- RRM performance degradation
- DL demodulation performance degradation
- PRACH performance degradation
- Undesirable handover to public network
- Signaling storm due to group mobility

- Proposals:

- Enhance the RRM performance:
 - Reduce the cell identification and RRM measurement latency
 - Support of robust Radio Link Monitoring
- Enhance the demodulation performance e.g., DL
- PRACH enhancements
- Mobility enhancements:
 - Increase the robustness of handover
 - Enhancements for group mobility, e.g. group handover, RACH-less handover



VoLTE+

• Key technologies

• Codec rate adaptation

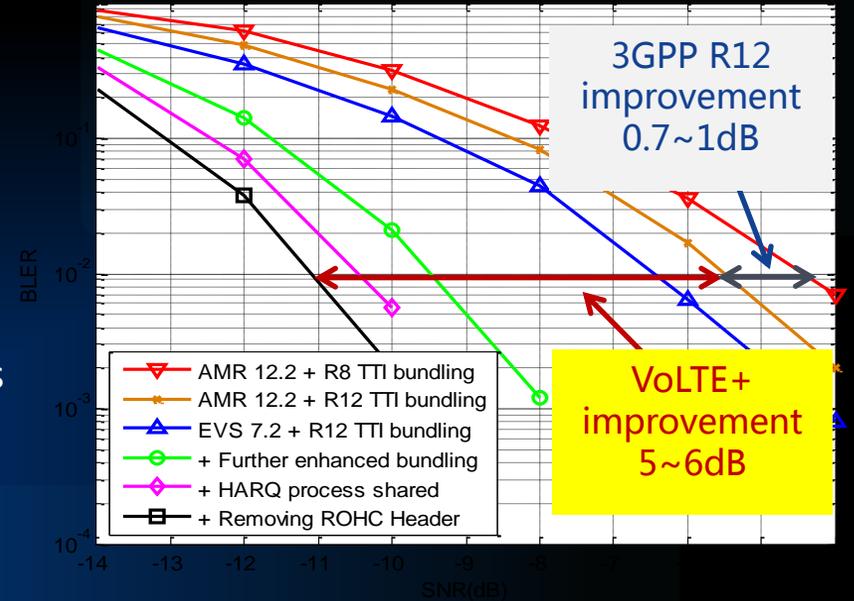
- to enable EVS codec rate adaptation in 3GPP and ensure quality EVS voice
- among AMR-NB/AMR-WB/EVS and interworking of VoLTE with GSM/UMTS

• Refining TBS support of new voice packet sizes for new EVS rates

- to improve the VoLTE spectrum and power efficiency with EVS voice packets

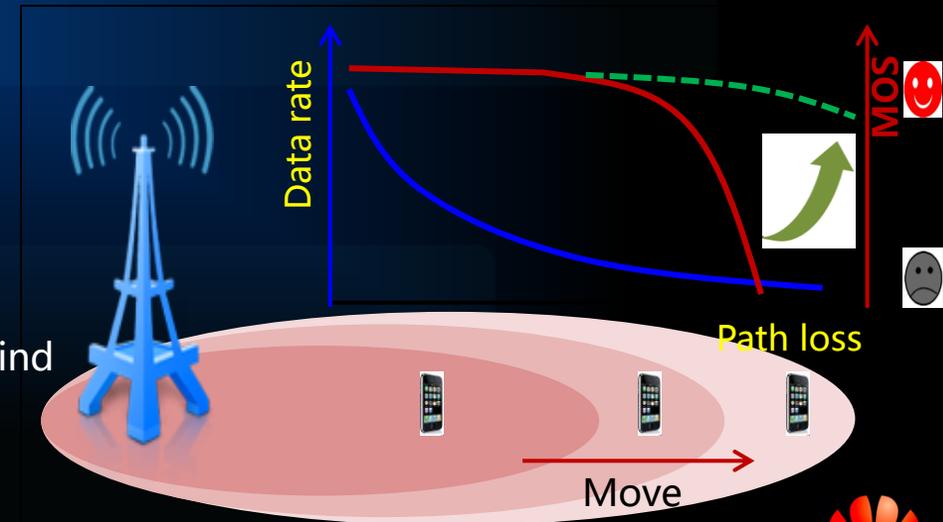
• other coverage enhancements, e.g. TTI Bundling enhancement, HARQ process sharing and overhead reduction

- to provide reliability and quality enhancements for HD voice



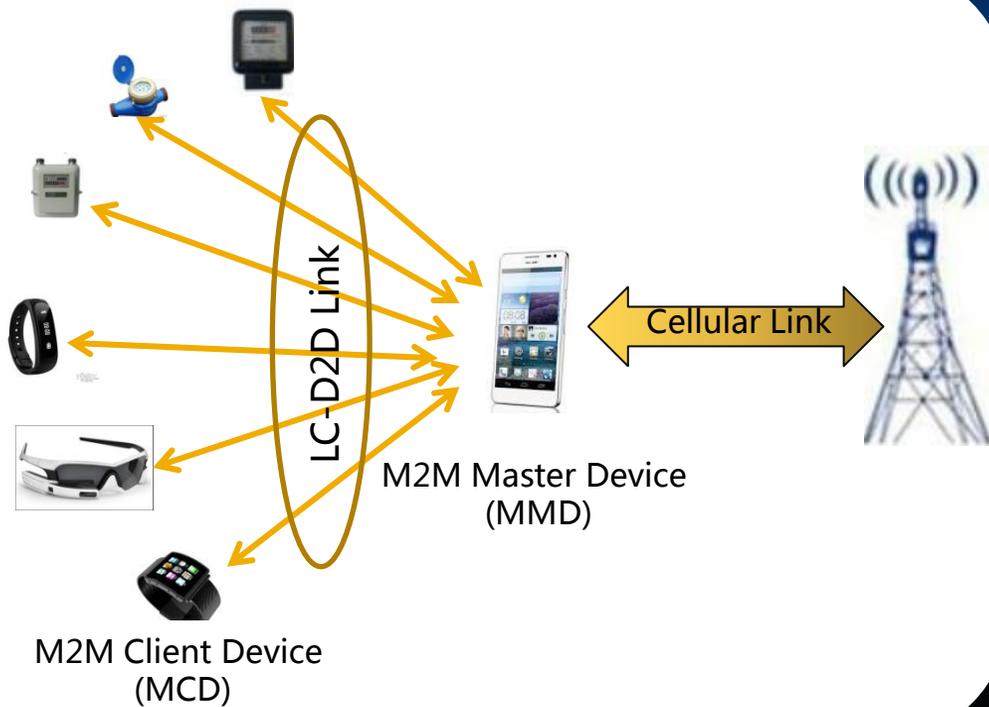
Values

- Inherent high flexibility and robustness of voice codec adaptation from GSM/UMTS to VoLTE, enhance the operators' confidence in VoLTE quality.
- Improve spectrum efficiency and energy efficiency for EVS HD voice traffic support in VoLTE.
- Extreme voice quality and performance improvements, to clean up voice blind spots thoroughly.



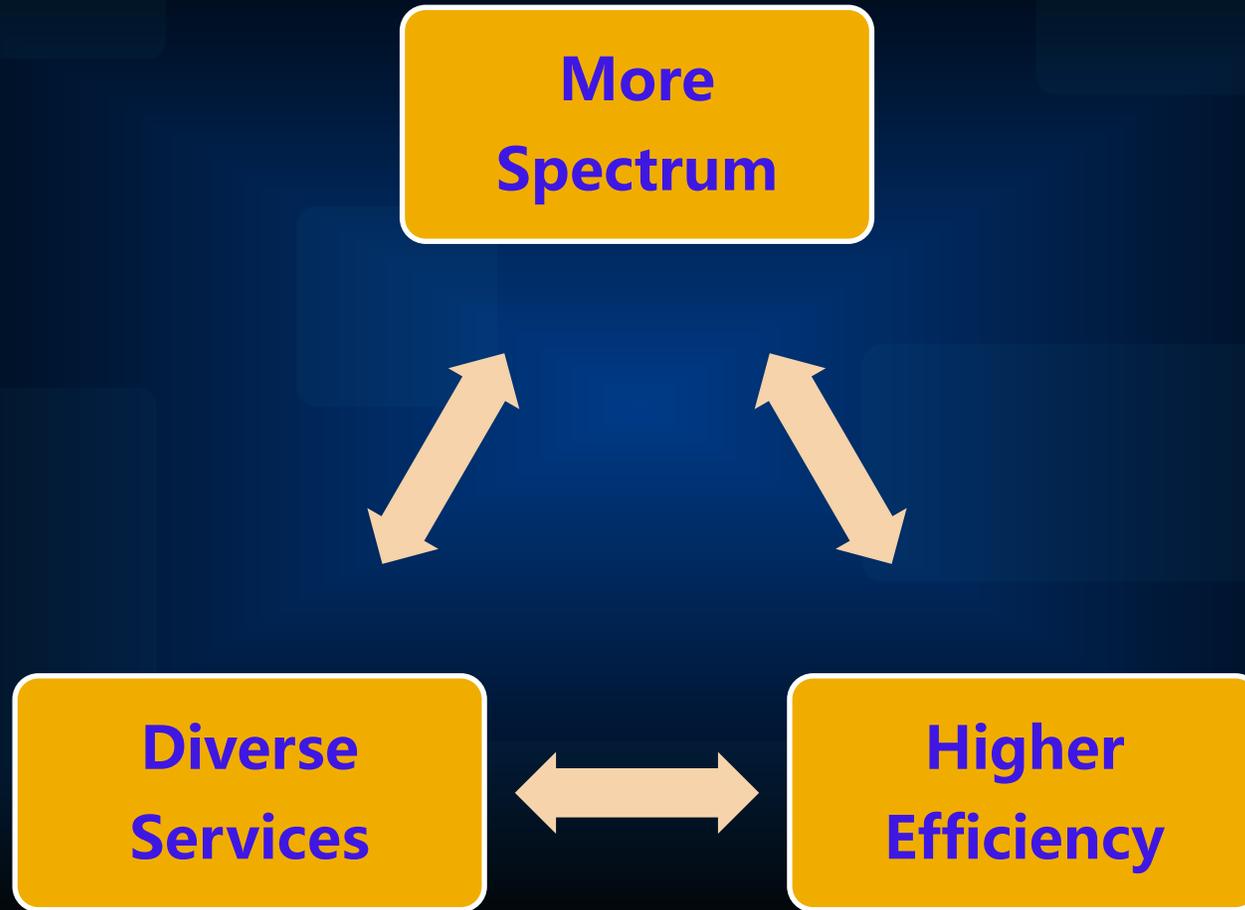
D2D for M2M

Use a master device to relay the data for the machine type communication.



- Benefits
 - Reduces the network load by reducing the number of devices accessing the network
 - Enhances the coverage
 - High efficiency
 - Reduces the power consumption
 - Network manageable
- Standard efforts
 - D2D evolution to support low complexity/power M2M access and handle hierarchical M2M access

LTE Evolution is Important!



Thank you