

RAN workshop on Rel-12 and onwards
Ljubljana, Slovenia, 11th and 12th June 2012

RWS-120006

Views on Rel-12 and onwards for LTE and UMTS

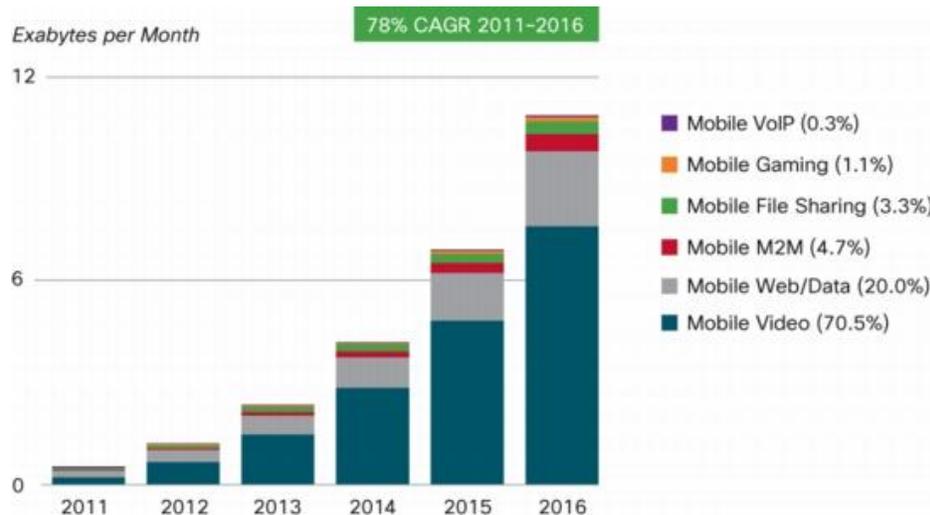
www.huawei.com

Huawei Technologies, HiSilicon

HUAWEI TECHNOLOGIES CO., LTD.

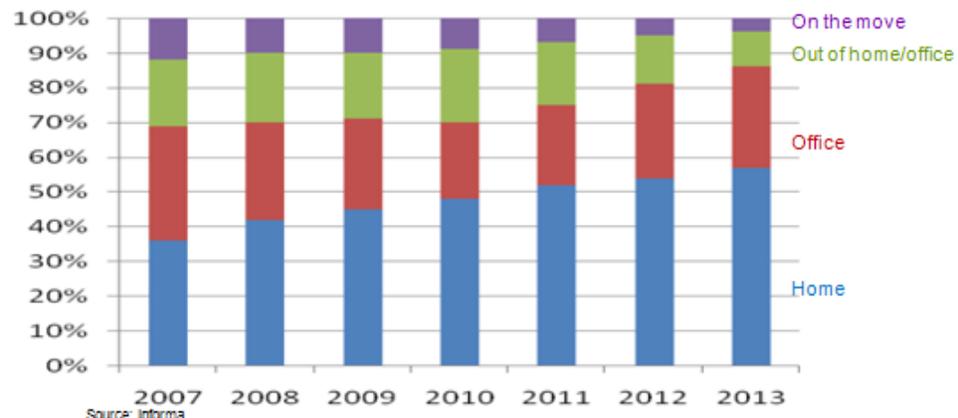


Evolution of Mobile Traffic



Figures in legend refer to traffic share in 2016.
Source: Cisco VNI Mobile, 2012

>80% Traffic in Indoor; >50% Traffic at Home



Rapid traffic growth with mobile video as dominant service

Major part of traffic occurs in Hotspot and Indoor Scenarios

Machine Type Communication (MTC) related traffic will gain in importance

Rel-12 Targets and Requirements

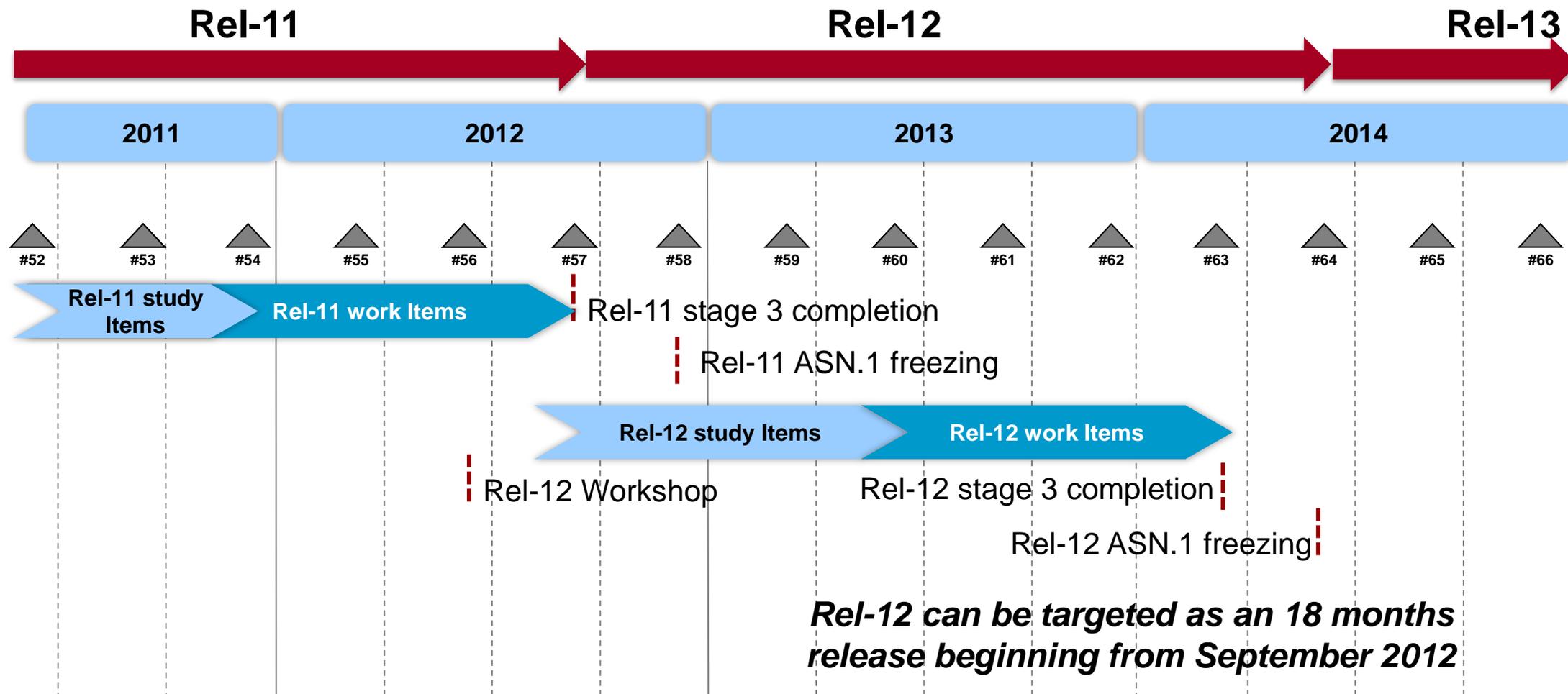
Higher mobile broadband capacity

- Improved spectrum efficiency, in particular for hotspot and indoor scenarios
- Efficient support of Heterogeneous Networks with dense Low Power Node (LPN) deployments
- Improved spectrum usage

General network enhancements

- Easier deployment and system operation
- Energy efficiency improvement with bit/J/km² as generic metric
- Improvements for diverse devices, applications, and services (smartphones, MTC traffic,...)
- Support of efficient backhaul offloading

Proposed Rel-12 Timing

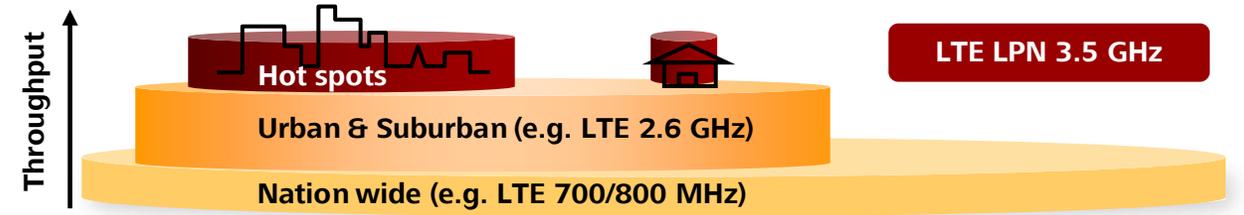


LTE

Hotspot and Indoor Enhancements (LTE-Hi)

Multi-layer network layout with dense low power nodes (LPN)

- Different layers for coverage and capacity
- Efficient capacity layer at higher frequency bands
e.g. strategic spectrum at 3.5GHz for global wideband hotspot and indoor access

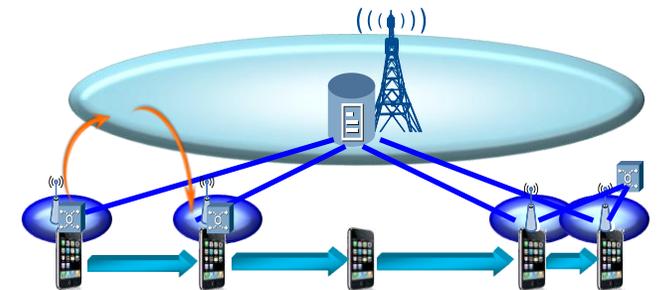


LPNs optimized and simplified for hotspot and indoor scenarios

- Enhanced spectrum efficiency for typical terminal form factors (2 RX antennas):
 - Peak Spectrum Efficiency: 10 bps/Hz (~25% improvement over LTE-Advanced)
 - Average Spectrum Efficiency: Up to 50% improvement
- Adaptation to local traffic with flexible TDD DL/UL configuration
- Interference avoidance in local clusters via synchronized neighbor detection
- Efficient use of larger available bandwidth
- Stand alone support, e.g. for deep indoor scenarios

Coordinated multi-layer operation and management

- Throughput aggregation from multiple layers
- Macro assistance on small cell layer mobility and traffic steering



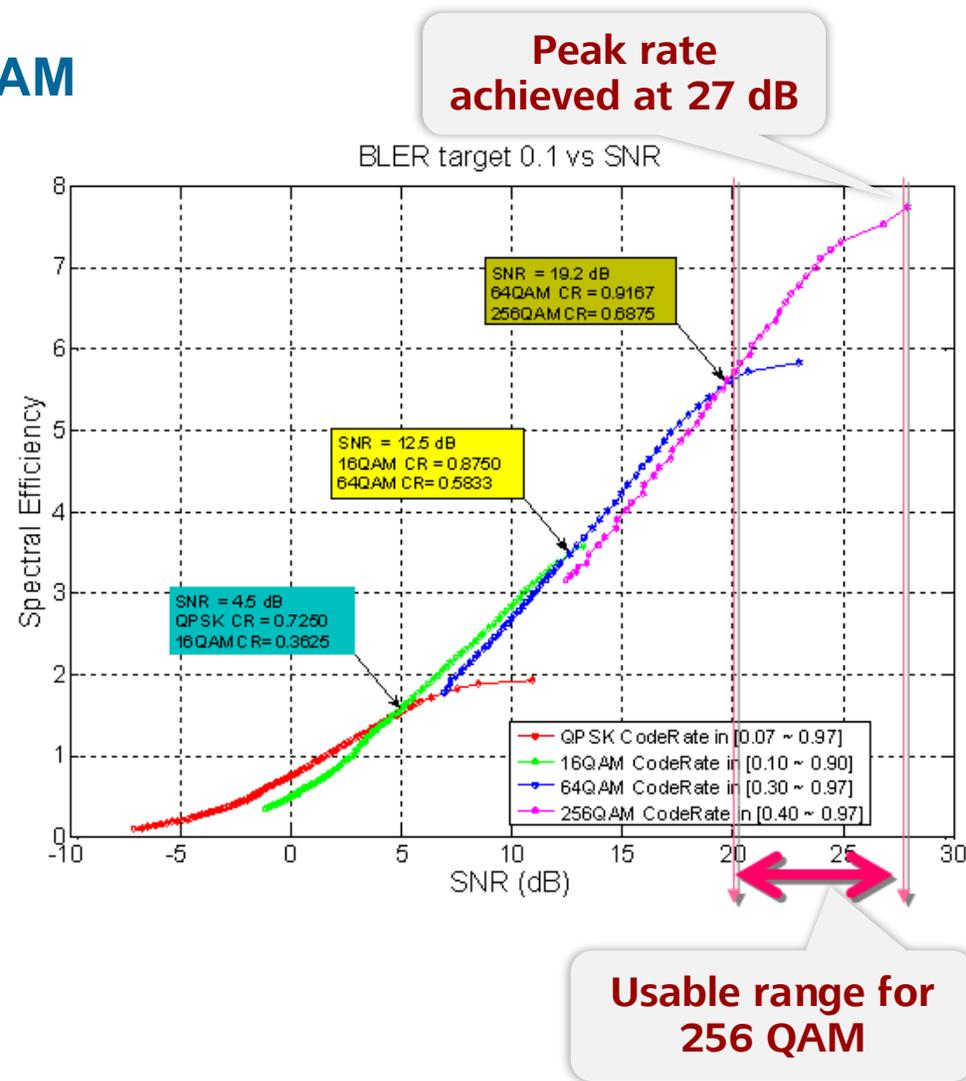
LTE-Hi: Enhanced Spectrum Efficiency

Support of higher order modulation up to 256 QAM

- Usable SINR range is roughly above 20 dB
- Up to 40% of terminals may benefit from 256 QAM in indoor scenarios (ITU InHome scenario)

Overhead reduction

- RS overhead (CRS and DMRS) can be reduced in low mobility and wider coherence bandwidth
- Control channel overhead can be reduced e.g. by scheduling over multiple sub-frames
- Maintain backward compatibility for legacy terminals
- Expected savings are 10-15%



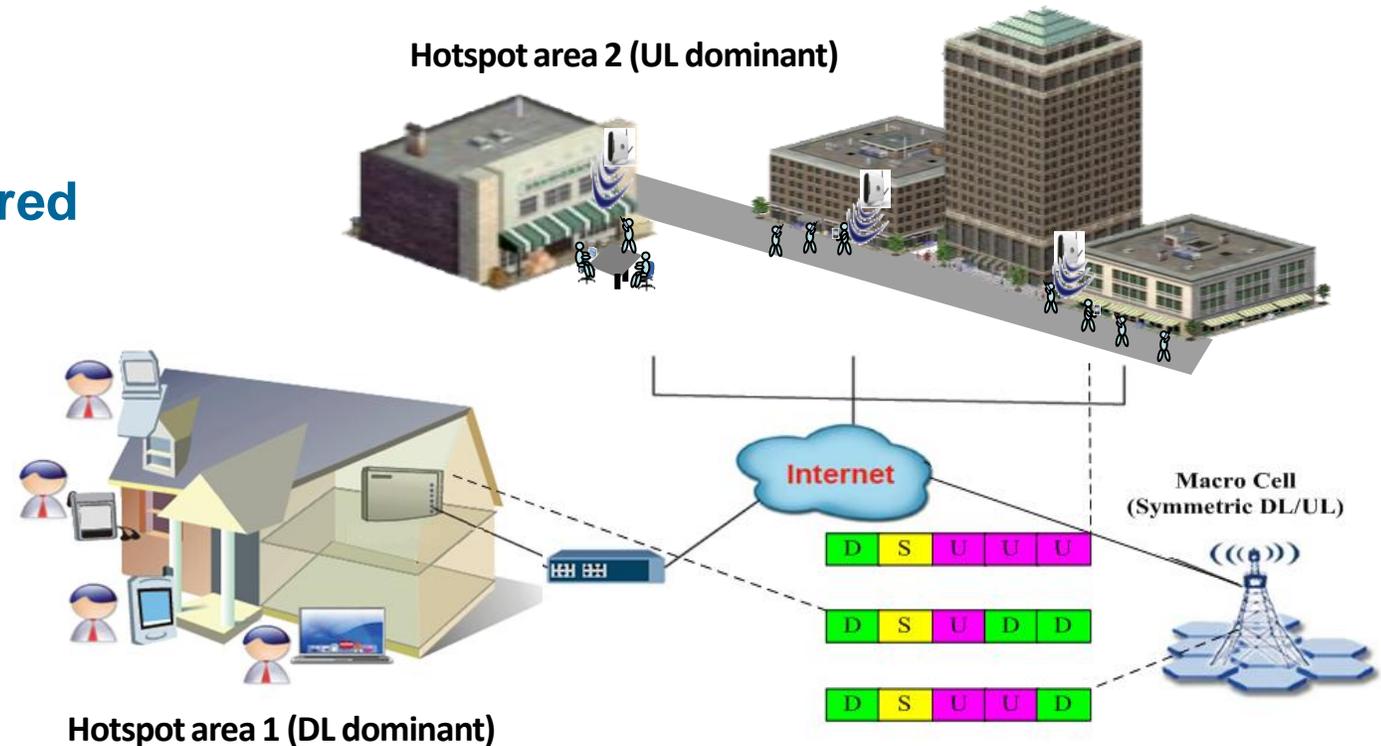
LTE-Hi: TDD Traffic Adaptive DL/UL Configuration

Adaptive DL/UL configurations based on traffic variation

- Isolated cell clusters, e.g. shopping mall, airport, etc.
- Heterogeneous networks
- Continued work from Rel-11 study phase

Inter-cell interference mitigation is required

- Configuration detection of neighbor cells
- Alignment of DL/UL configuration within LPN clusters



LTE-Hi: LPN Configuration Detection

Motivation

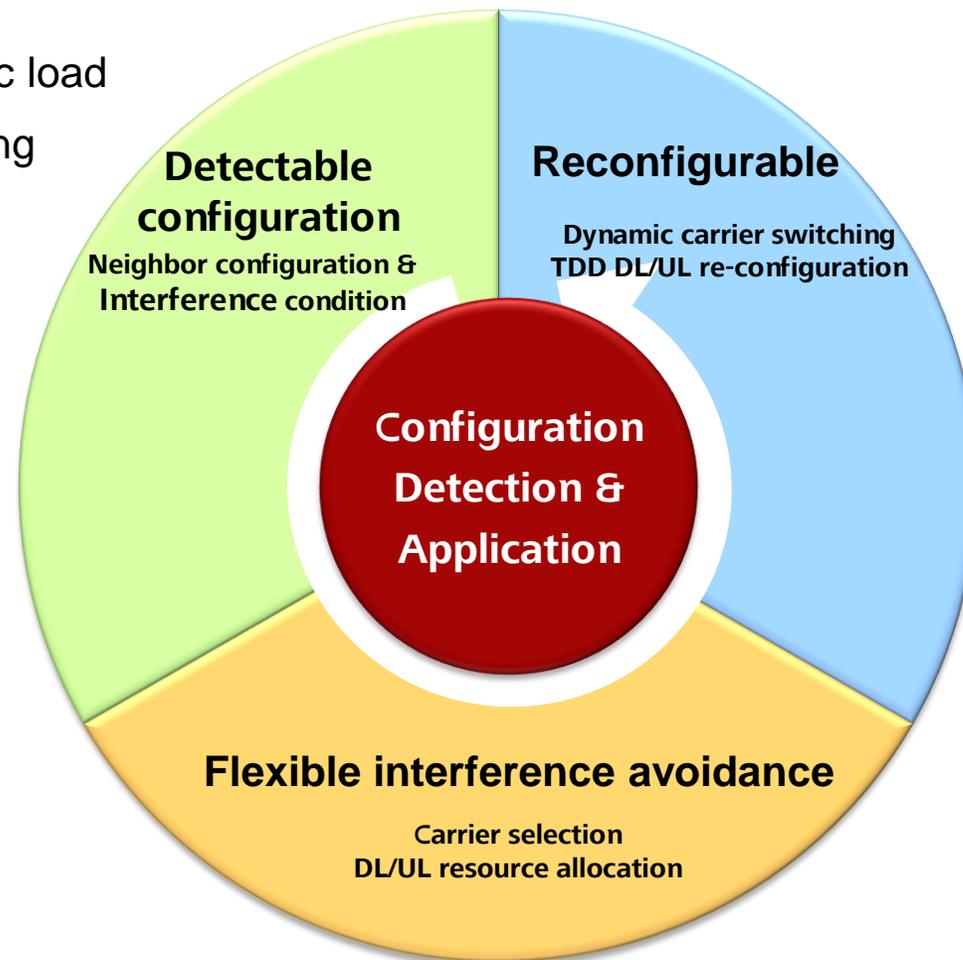
- Dynamic cell re-configurations adapt to time-varying traffic load
- Autonomous detection allows to quickly react to a changing environment and avoid interference between LPNs

Highly efficient detection mechanism

- Support detecting LPN configuration by other LPNs and UEs
- Synchronized detection slot in the frame structure
- Configuration detection RS and procedure

Configuration detection applications

- Flexible carrier selection in larger bands (FDD and TDD)
- Flexible DL/UL resource allocation (TDD)
- Flexible power control (FDD and TDD)



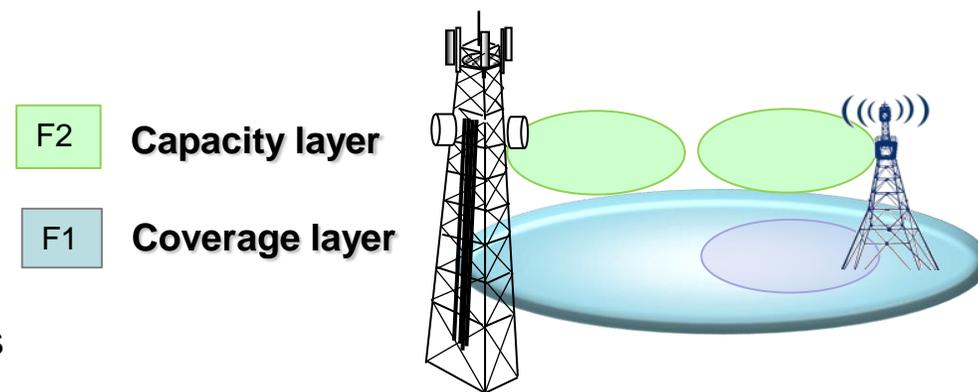
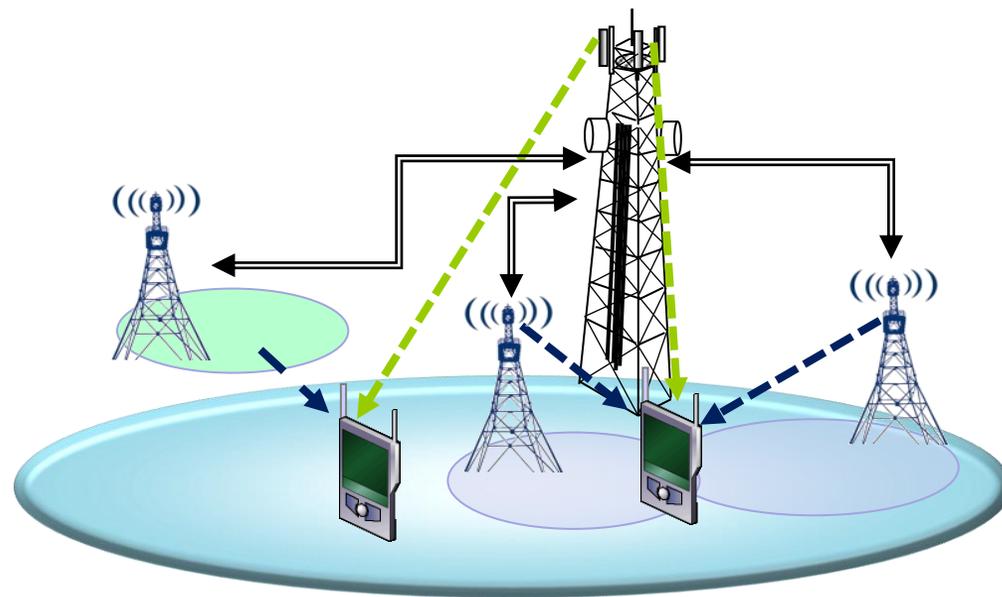
Multi-Stream Aggregation

Throughput aggregation from multiple nodes

- CoMP and CA solutions so far are limited to intra-site and fast backhaul scenarios
- Backhaul with limited bandwidth and higher latency needs to be supported as well
- Possibility of separate frequency and shared frequency

Efficient multi-layer operation for LTE-Hi scenario

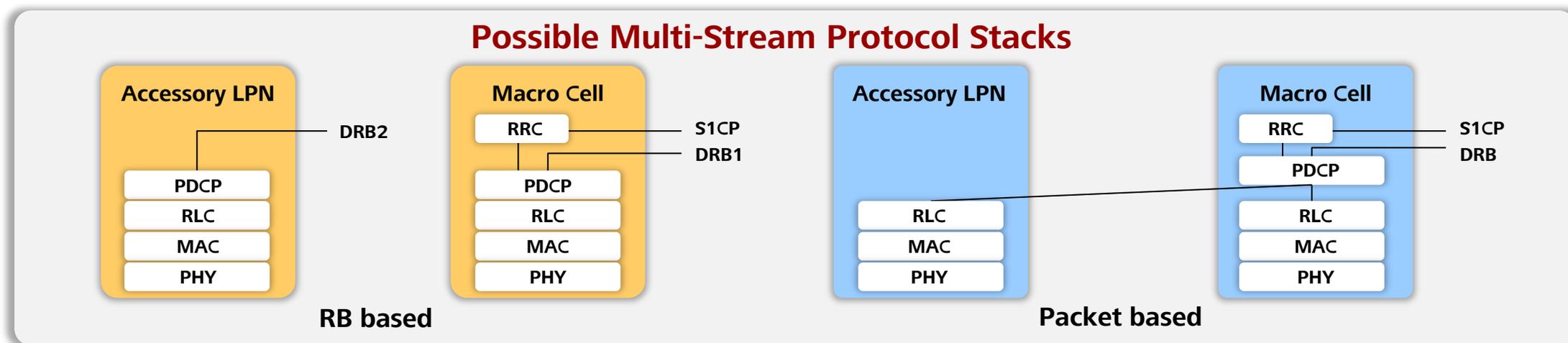
- Coordinated multi-point protocol stack
- Coverage layer with macro-node
 - Handling of mobility and traffic steering
- Capacity layer with LPNs
 - Cluster of LPNs ensuring high data rate
 - Energy efficient topology adapting to load variation
- Fast carrier selection
 - Increased number of carriers in larger bands
 - Handling of New Carrier Type
 - Support of UEs with single RF chain and multiple RF chains



Multi-Stream Aggregation

Protocol stack split over multiple nodes

- Create a local LPN cluster around the UE
- Data splitting above MAC layer supports backhaul with various latencies
- UE aggregates data streams from multiple nearby LPNs
- Radio resources are pooled to form a high speed composite data pipe
- Macro-cell handles traffic steering (e.g. based on QoS) and control plane
- Possibility of slim protocol stack for LPN (User plane only)



Support of Active Antenna Systems

Increased spectrum efficiency

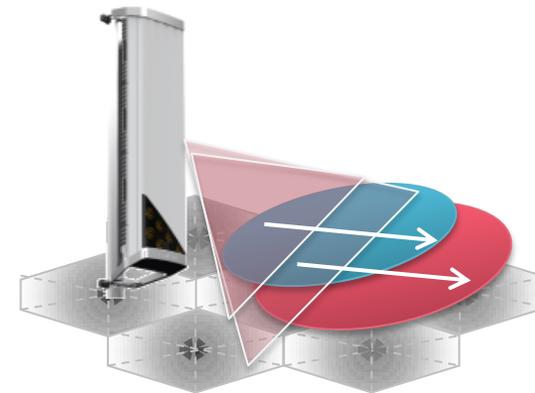
- Vertical beamforming
- Proactive cell shaping
- Vertical cell-splitting

Proposed study areas

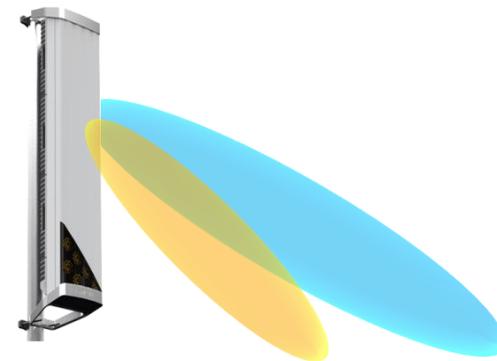
- 3D channel modelling
- Reference signal enhancements
- Codebook and feedback enhancements
- Measurement enhancements for interference coordination in beam domain
- RF requirements (ongoing as SI in RAN4)



Active Antenna System



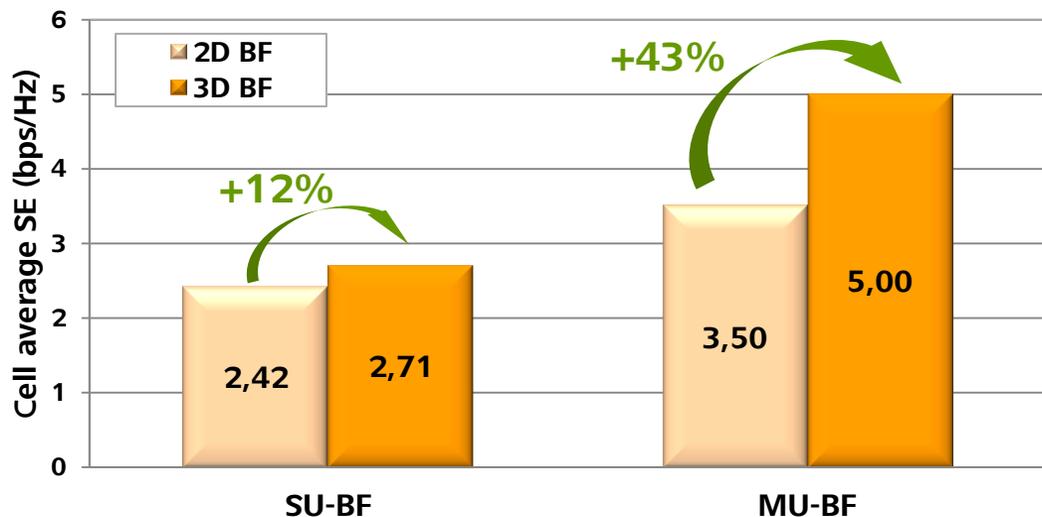
Vertical cell shaping



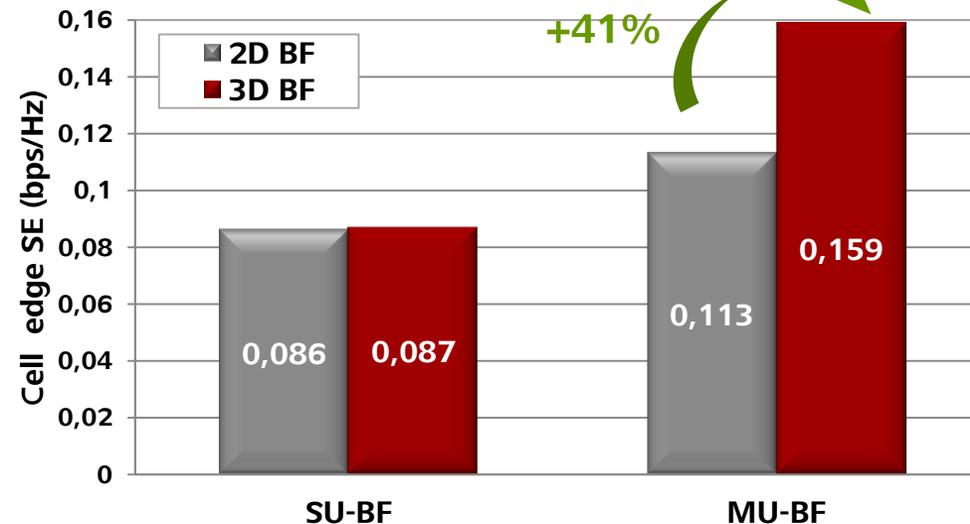
Vertical beamforming

Active Antenna Systems – performance

Cell average SE



Cell edge SE



Assumptions

- 3GPP case 1
- SCM with 6° vertical angle spread
- Ideal beamforming
- 2 column X-polar AAS
- 2D: 4 horizontal ports only at baseband
- 3D: 4 horizontal + 8 vertical ports at baseband

Expected gain:

- SU-BF: 12% gain @cell average
limited gain @cell edge
- MU-BF: 43% gain @cell average
41% gain @cell edge

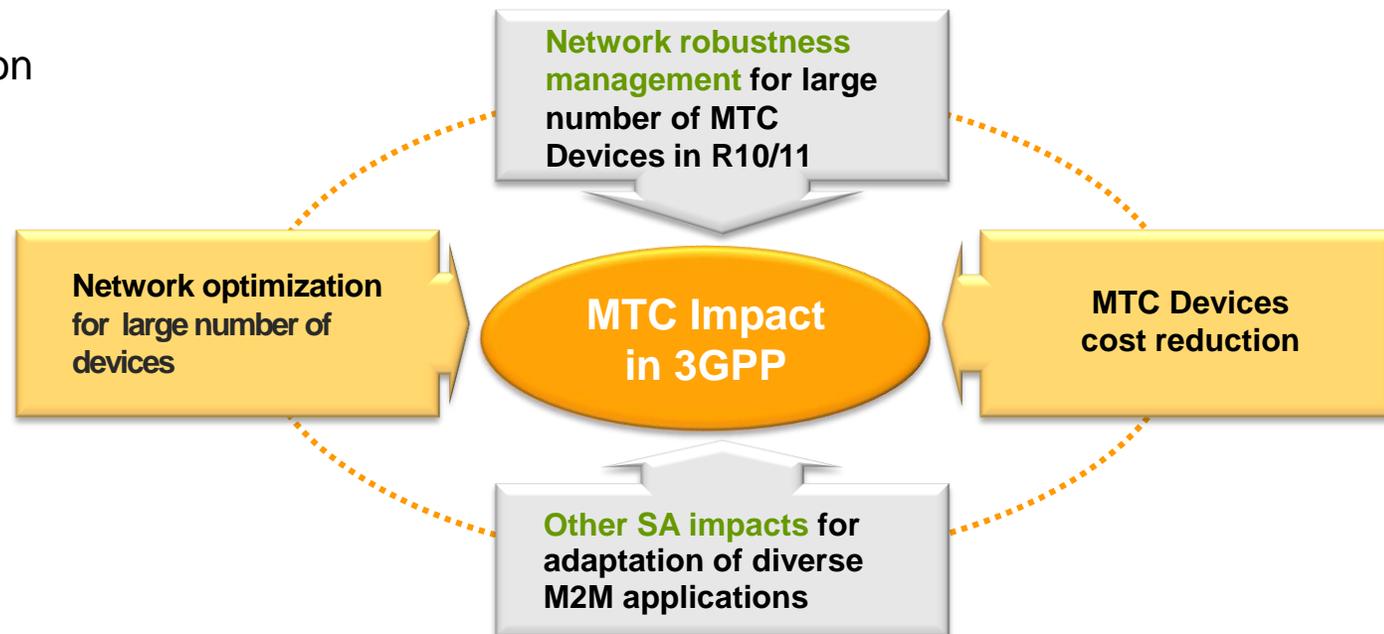
Improved Support for MTC

Low cost devices

- Continuation of Rel-11 study on cost reduction
- Low bit-rate UE category for MTC

Network optimization for MTC in R12

- Efficient support of large amount of MTC devices with small data transmission
 - RRC signalling reduction
 - Efficient physical layer resource usage (e.g. PDCCH/PUCCH/SRS)
- Low power consumption for MTC devices
- Co-work with SA2 for MTC enhancements



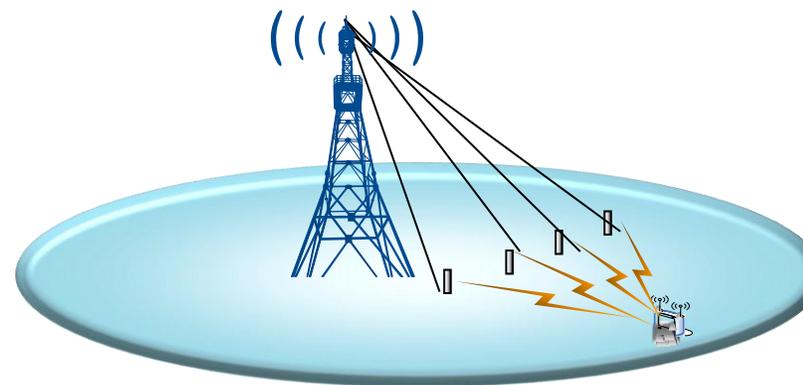
Positioning Enhancements

Support new scenarios for OTDOA

- Distributed RRUs in heterogeneous networks
- Vertical positioning
- Higher terminal speeds
- High SNR difference of reference signals

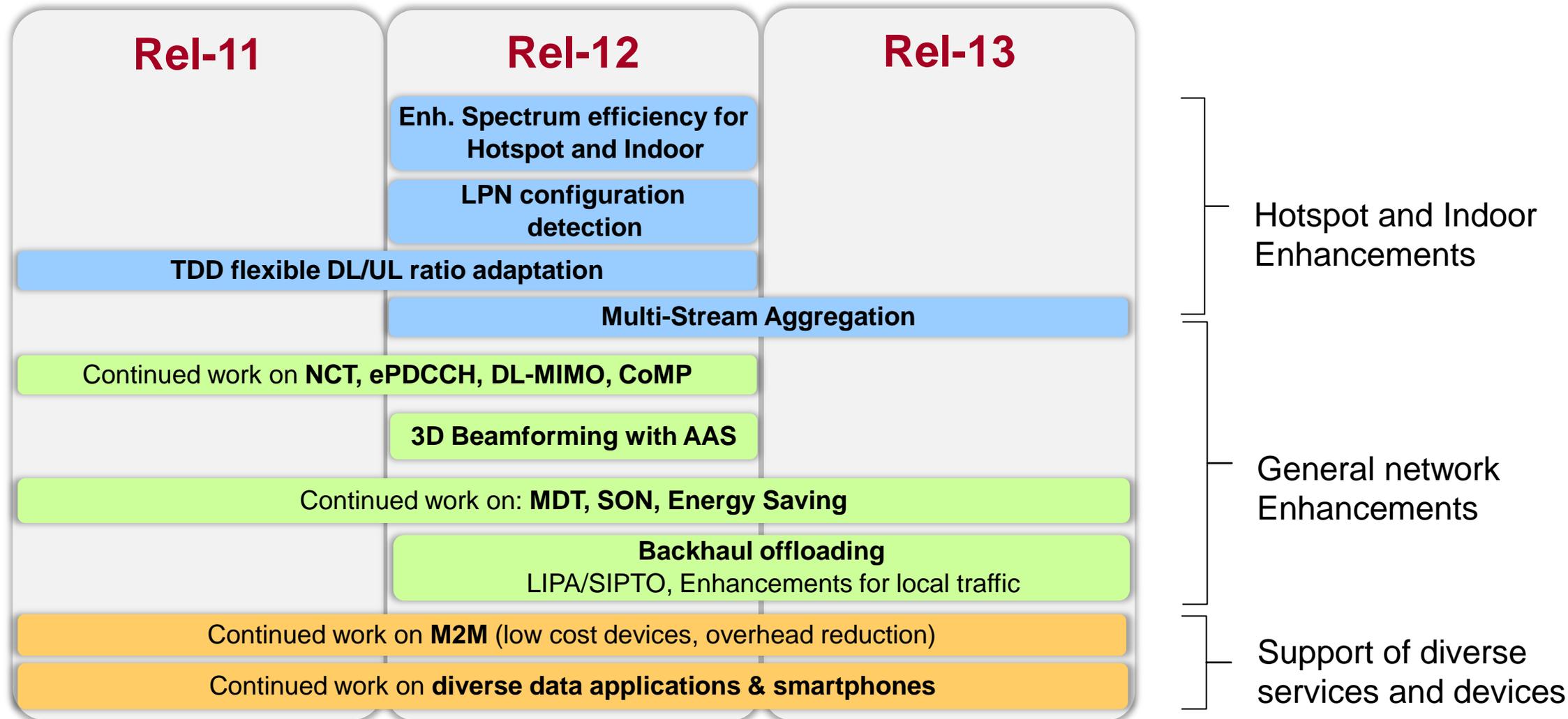
Enhanced OTDOA accuracy

- Specific system bandwidths
 - Small bandwidth 1.4 MHz / 3 MHz
 - Larger bandwidth 15 MHz / 20 MHz



Positioning for distributed RRU scenario

LTE Standardisation Roadmap



UMTS

Continued Improvement of UMTS

UMTS networks and devices will still dominate in medium term

- Continued improvement of UMTS is essential

Peak rate enhancements introduced in Rel-11

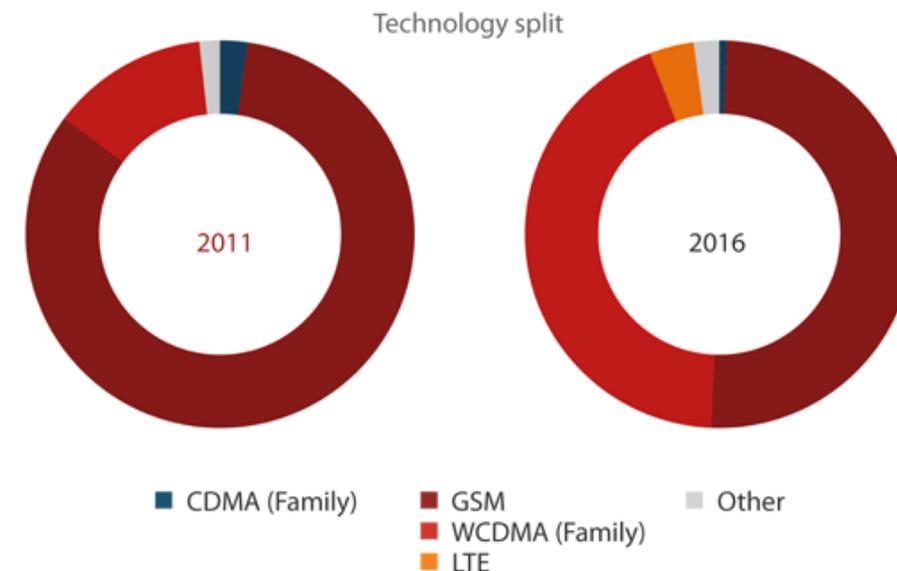
- 8 Carrier, DL 4X4 MIMO, UL MIMO + 64QAM
- No need for further increase of peak rate in Rel-12/13

Improved capacity with Heterogeneous networks in Rel-12

- Managing interaction between macro and small cells is crucial
- Limit physical layer impacts for backward compatibility

Potential additional areas for Rel-12

- Uplink enhancements



Americas: mobile connections/technology split, 2011–2016

Source: Wireless Intelligence

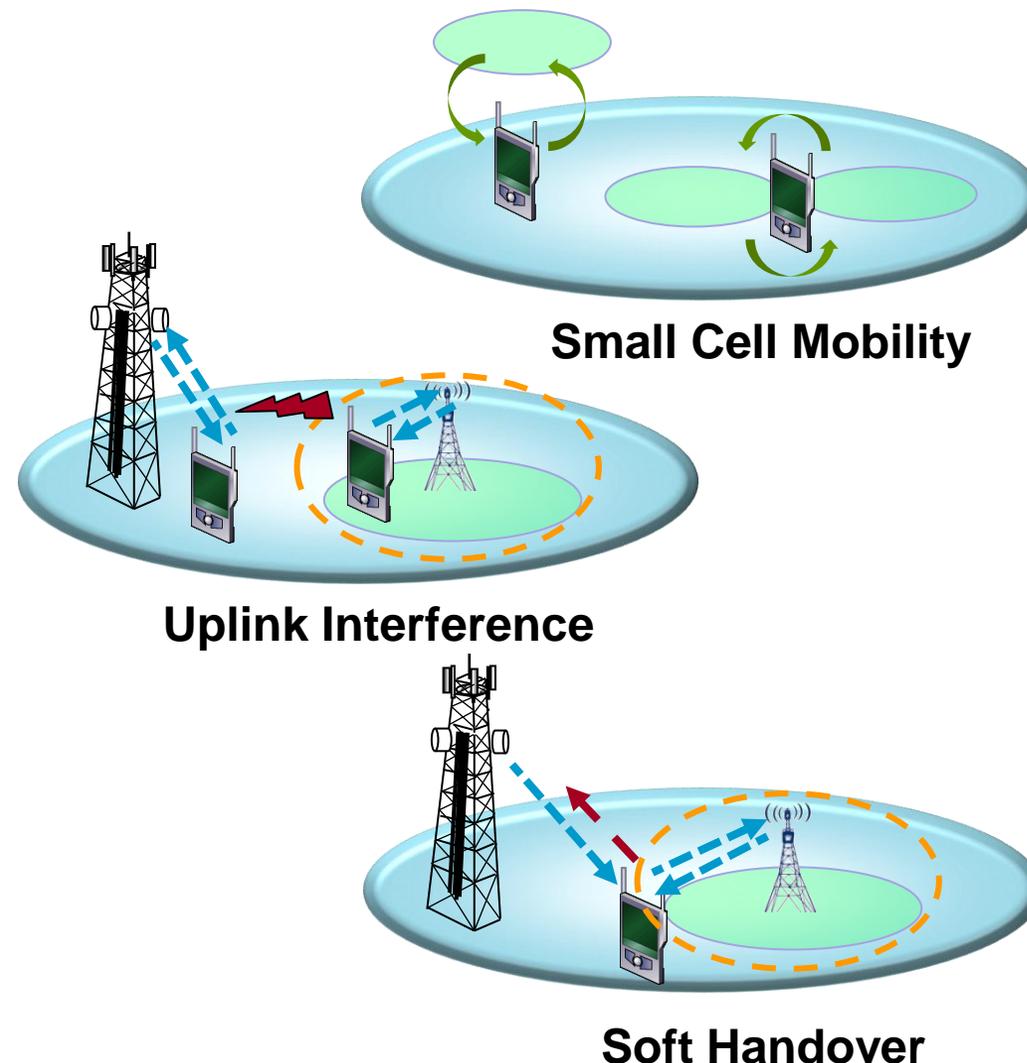
Improved Support for Heterogeneous Networks

Mobility enhancements

- Dedicated and shared carrier deployments
- Improve Inter-frequency small cell discovery
- Avoid PSC (Primary Scrambling Code) confusion with dense small cell deployments
- Optimize small cell handover based on UE speed

Interference management

- Shared carrier deployments
- Extension mechanisms for small cell coverage
- Improved support of soft-handover in HetNets
- Reduced uplink interference



Uplink Enhancements

Uplink Coverage Enhancement

- Rel-11 closed loop transmit diversity
- Extend applicability to cell-FACH state and in combination with DC-HSUPA

Uplink Capacity Enhancement

- Improve E-DCH resource efficiency by dynamic resource sharing
- Reduced interference from control channel optimisation (HS-DPCCH/E-DPCCH)

Thank you !

