

LTE Rel-12 and beyond

Dino Flore

Chairman of 3GPP RAN

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Introduction

- 📶 3GPP RAN has started a new innovation cycle which will be shaping next generation cellular systems
- 📶 A variety of radio technologies are being considered for standardization in Rel-12 or future releases
- 📶 This presentation provides a brief overview of the main technology areas 3GPP RAN is working on for Rel-12 and beyond

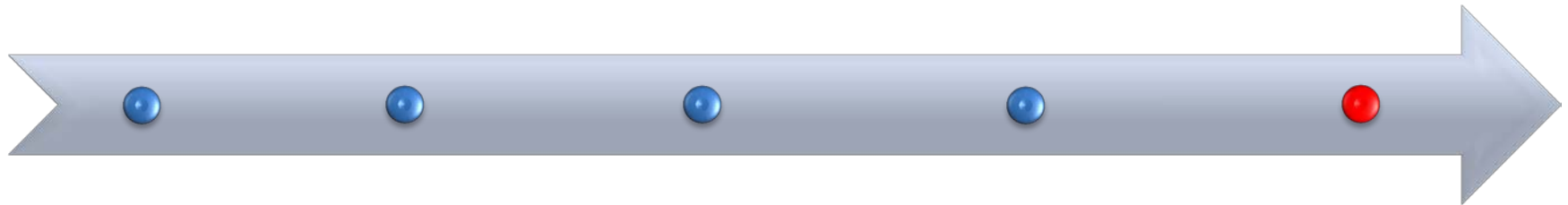
LTE: continual evolution

Rel-9 (Dec. '09)

- eMBMS
- Dual stream beamforming
- Positioning
- Enhanced HeNB/CSG support
- Emergency services

Rel-11 (Jun. '13)

- DL and UL CoMP
- In-device coexistence
- Enhanced Physical Downlink Control Channel (ePDCCH)
- Further eICIC



Rel-8 (Dec. '08)

- FDD and TDD mode
- Flexible bandwidth (1.4MHz to 20MHz)
- DL SU-MIMO (4 layers) and SDMA
- UL TX diversity and SDMA
- Inter-cell power control and interference management
- Inter-eNB and Inter-RAT mobility
- HeNB/CSG & SON support

Rel-10 (Jun. '11)

- CA (up to 5 CCs)
- Enhanced MIMO (8 DL and 4 UL layers)
- eICIC
- Relays
- Enhanced SON & MDT

Rel-12 (Dec. '14)

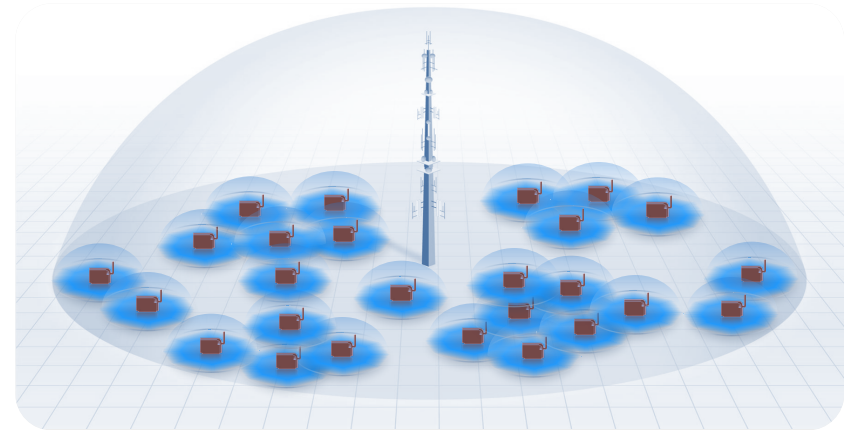
LTE Rel-12 and beyond

Technologies that improve network capacity and cell-edge performance

Network hyper-densification

Physical Layer enhancements for Small Cells

- 📶 Higher order modulation i.e. 256 QAM for downlink
- 📶 Small cell discovery and support of cell on/off mechanisms
- 📶 Radio interface based inter-cell synchronization
- 📶 Interference management and traffic adaptation for LTE TDD
 - Interference management when neighbor cells have different UL/DL ratio
 - More dynamic reconfiguration of UL/DL ratio of a cell



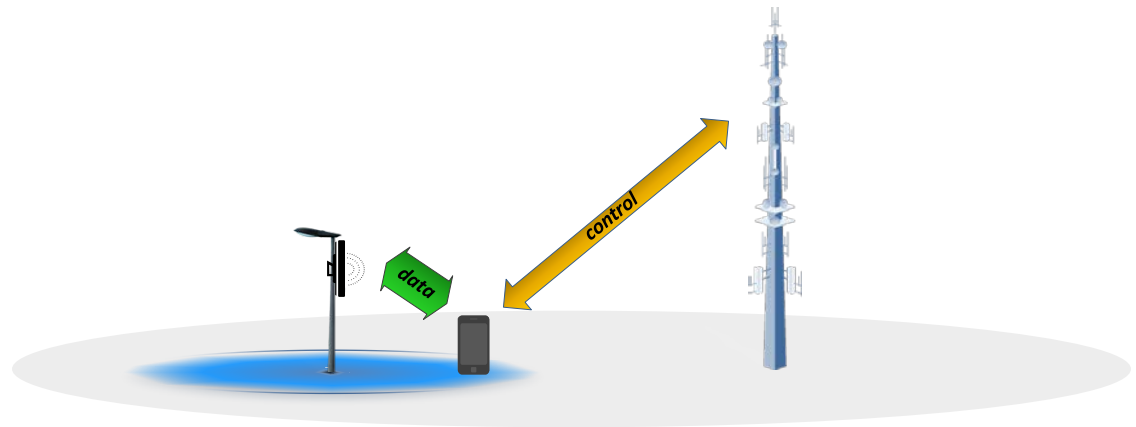
Towards hyper-dense networks

Network hyper-densification (2)

New protocol/architectural enhancements for Small Cells

 Dual Connectivity

 Mobility and SON enhancements



Example of Dual Connectivity: anchoring connections to macro cells while boosting datarate via small cells

Multi-antenna technology advancements

 3D channel modeling study to enable future work on:

- Terminal-specific elevation beamforming
- Full-dimension MIMO
 - MIMO systems with large number of antennas, e.g. 64
 - To become relevant with the use of higher frequencies

Other technologies

- Coordinated Multi-Point (CoMP) operation with non ideal-backhaul
- Advanced interference suppression at the terminal
 - Support of interference suppression on the data channel, with semi-static network assistance

LTE Rel-12 and beyond

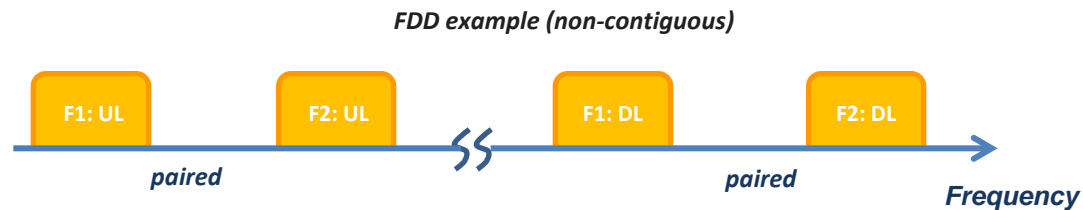
Technologies that make more spectrum available at the terminal

Carrier Aggregation advancements

 RF requirements definition for CA combinations with:

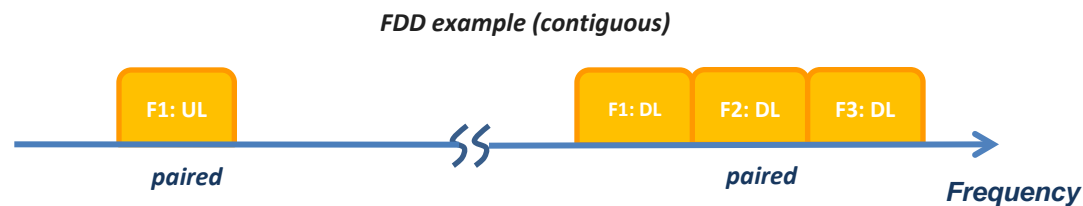
2 uplink carriers

- Non-contiguous for intra-band and inter-band



3 downlink carriers (with 1 uplink)

- Contiguous and non contiguous for intra-band and inter-band



Carrier Aggregation advancements (2)

FDD/TDD carrier aggregation framework

- Further integration between the two modes allowing operators to fully utilize their spectrum
- Connections to be anchored either to the FDD or to the TDD carrier

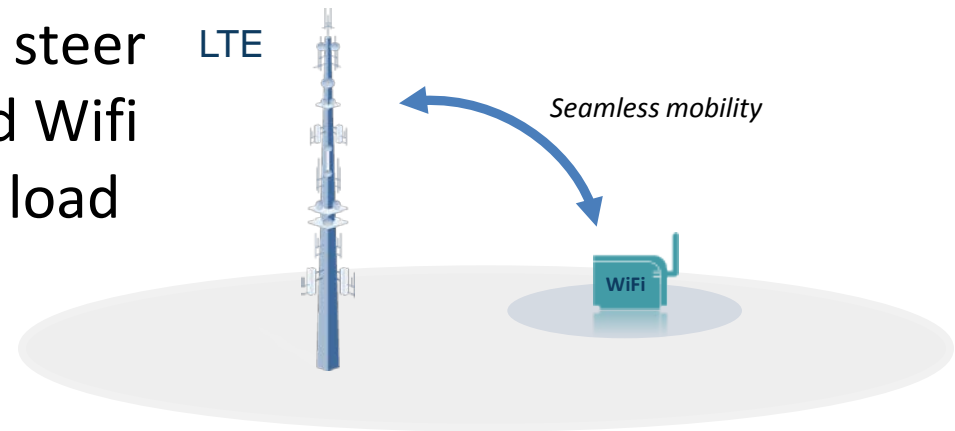
RF requirements definition for actual CA band combinations to follow



LTE-WiFi radio interworking

Enhanced inter-working solutions between LTE and WiFi, in idle and connected mode

Goal is to allow operators to steer traffic between their LTE and Wifi networks, based on radio or load conditions



LTE in unlicensed spectrum

- 📶 Proposal to enhance LTE to operate in unlicensed spectrum being considered for Rel-13
- 📶 Goal is to offer cellular operators the option to utilize unlicensed spectrum with a unified network
 - Offering potential operational cost saving, improved spectral efficiency and better user experience
- 📶 More information on the status of the discussion available on www.3gpp.org

LTE Rel-12 and beyond

Technologies that enable new services or enhance existing ones

Low-cost MTC

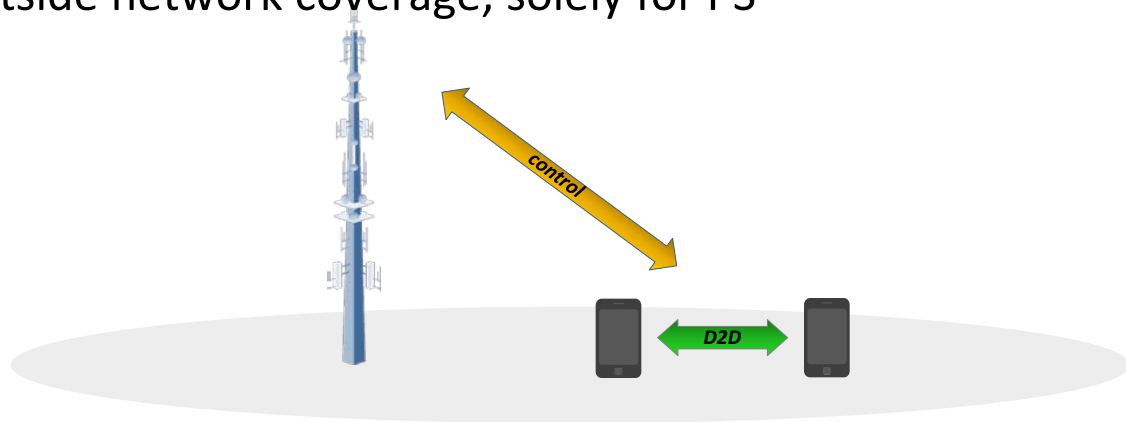
- Goal is to reduce modem cost for low datarate Machine-Type Communications (MTC)
- Low cost enablers introduced in Rel-12
 - New low datarate UE category (~1Mbps max throughput)
 - 1 RX antenna operation

Device-to-device (D2D)

📶 Goal is to enable proximity services for **Public Safety (PS)** and **Consumer** usecases

📶 Solutions for D2D discovery and communications, covering:

- D2D discovery under network coverage
- D2D communication under network coverage, with focus on PS applications
- D2D communication outside network coverage, solely for PS



Others

Group Communication for **Public Safety**

- Enablers allowing the support of Group Communications in LTE networks

eMBMS measurements

- Definition of eMBMS-related measurements to be used for planning purposes e.g. to optimize the quality of MBMS services being delivered
- New measurements to be collected using the existing MDT functionality

Voice & Emergency related enhancements

- Specification of uplink bundling to increase coverage of voice services
- Evaluation of further radio mechanisms to prioritize voice or emergency services during congestion situations

Thanks