LTE Rel-12 and Beyond

Renesas Mobile Europe Ltd

Innovative solutions
for tomorrows challenges

RWS-120022

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Outline

- Industry trends
- Tighter Integration of Local and Wide Area
- Local Area Enhancements
- Improved Local Area Mobility
- D2D
- Further Enhanced Receivers
- Testing and Certification

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Industry trends

- Wireless data consumption is sky-rocketing worldwide
  - 70-80% volume from indoor & hot spots already now
  - Mobile data traffic expected to grow 500-1000x by 2020
  - New kinds of devices will enter the market
  - Increased network density introduces Local Area Cells

- Optimization for Local Area Cells will play a key role
  - The availability new frequencies on higher frequency bands (e.g. 3.5 GHz) – applicable to Local Area cells
  - Wider system bandwidth can become reality
  - Improvements for Local Area can be different compared to WA improvements – Specific solutions
  - Local and Wide Area interworking of major importance in future – Intelligent match

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Tighter Integration of Local and Wide Area

- Simultaneous use of LA and WA
  - Assume presence/availability of WA networks
  - Connection to both local and wide area

- Optimum selection between networks
  - Service differentiation between LA and WA
  - Interworking functions integrates LA into the WA network
- WA interworking functions to improve overall performance
  - LA discovery functions
  - Mobility function
  - Possible network settings etc..

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Local Area Enhancements

- Rel-12 Local Area Enhancements can mainly build on existing functionality and studies
  - New carrier type
    - Further enhancements needed to allow standalone operation
  - ePDCCH
    - Further enhancements needed to allow operation with only ePDCCH
  - Flexible TDD design
    - Frequency resource can be used in the direction with actual traffic
    - Rapid changing based on traffic changes – especially when the number of terminals is low
    - Improved TDD frame structure
- Architecture
  - Needs to support initial LA deployment with minimal upgrade to existing networks.
  - Dual radio (UE-based)
    - Potentially allows introduction of local area cells without changes to macro network (Study needed)
    - Enhanced by macro network providing assistance in small cell discovery

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Local Area Enhancements

- Improvements to small cell discovery
  - To allow power efficient small cell discovery, consider a new physical signal
  - Coordination with D2D discovery
- OFDMA for both uplink and downlink
  - Main drawbacks of OFDMA are not critical in LA environment
  - More flexible and favorable for the interference coordination
- Improvements to Energy consumption
  - UE active: during the data transmission of actual traffic (e.g. Youtube, Outlook) in system operation
  - Network: Allow less frequent Control transmissions when cell load is low
- LA optimized numerology - Beyond Rel-12
  - Optimized for radio environment
  - Improving latency in LTE is difficult without changing LTE numerology
  - New possibilities for reduced terminal and network energy consumption

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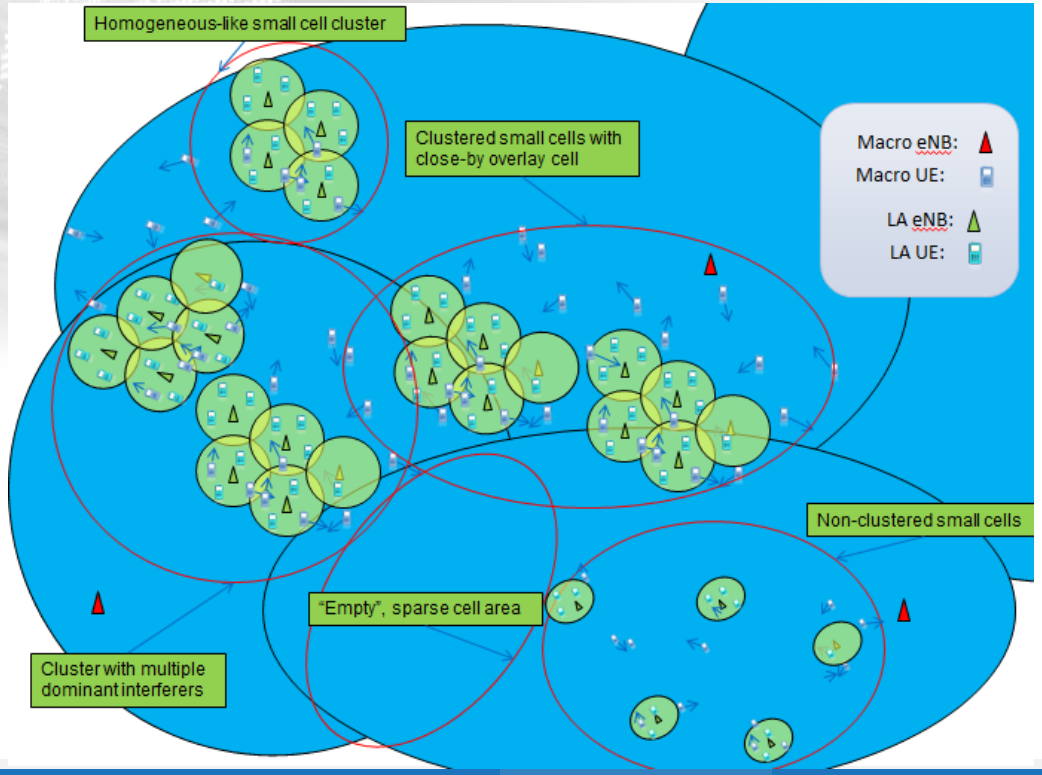
Improved Local Area Mobility

- Dense local area will bring more challenges to efficient mobility
  - Mobility should be robust enough to handle dense networks
    - The roles of UE and network could be re-thought to better adapt to the network topology (e.g. different UE behaviour based on speed)
  - 3GPP should consider what the relevant mobility scenarios are for local area
  - Mobility does not happen just within one RAT!

Existing mobility procedures should be followed as much as possible

Key items for local area mobility:

- **Efficient** measurements
- **Fast** mobility procedures
- **Robust Adaptation** to different interference conditions



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3GPP Proximity Services (ProSe) / D2D

- Provide new opportunities for commercial applications based on LTE platform
  - **Proximity** based
    - Social applications
      - Friend finder, exchange of files, photos, etc.
    - Advertising
    - Network offloading
    - Gaming
  - **LTE** can provide
    - Security
    - Network control/assistance
    - Session continuation
      - Between D2D & infrastructure based
    - QoS provisioning
- Build LTE to become the main platform for **Public Safety** worldwide
  - Public Safety requirements more demanding and cannot be fulfilled with current solutions

➢ Equip LTE with efficient radio level **UE discovery** and direct **Device-to-Device** communication

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Further Enhanced Receivers

- Strengthening advanced receivers operation in LTE is of key importance for a balanced system evolution
- Current Rel-11 inter cell interference mitigation methods include
  - Specifying CoMP operation in RAN1
  - Specifying advanced receivers UE performance requirements in RAN4
- Further enhancements to inter cell interference mitigation could be achieved by increasing the degree of co-operation between transmitter and receiver
- Explore further
  - Enable UE receiver to exploit different modulation alphabet characteristics
    - For example using the single antenna interference cancellation (SAIC) principle in GSM
  - Coordinate allocation of modulation and rank for improved system performance
    - CoMP-like coordination between cells is likely to exist already in Rel-11 specification and can be leveraged here

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Testing and Certification

- With a continuously growing number of features, industry commitment to testing and certification is becoming even more important
- Devices not properly tested and certified render features unusable
- 3GPP must encourage the industry to guarantee that only features that can be properly tested and certified are deployed

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