Speed-5G project presentation

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"5G Focus Day"
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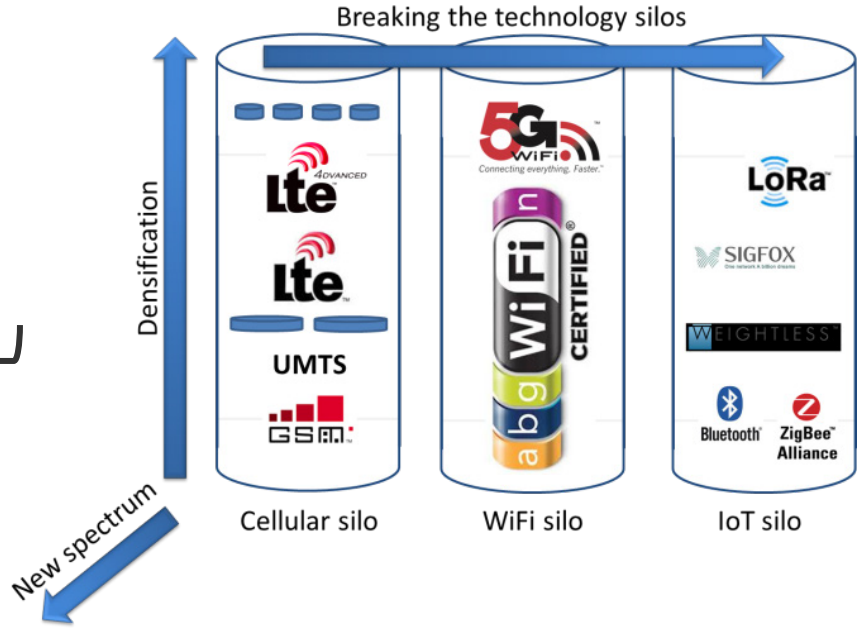
SPEED-5G Overview

Main objectives:

- Capacity expansion
- Novel spectrum management
- Lightly-licensed spectrum and licensed/unlicensed
- New MAC/RRM
- Extended Dynamic Spectrum Assignment (eDSA)

eDSA considers the following main dimensions:

- Ultra-densification through small cells,
- Additional (shared) spectrum,
- Exploitation of available resources across technologies



SPEED-5G Focus Areas

- SPEED-5G targets providing solutions at Layer 2, Layer 3 and above to enable enhanced Dynamic Spectrum Access with multiple RATs, and especially with FBMC, a 5G waveform candidate

- SPEED-5G doesn't work on physical layer design but provides the enablers for using in a coordinated way licensed, lightly-licensed and unlicensed spectrum mostly in dense and ultra-dense small cell networks

- A new MAC for the 5G will be developed and evaluated throughout different Use Cases and Scenarios

- New RRM mechanisms will be explored in order to enhance and enable a real Dynamic Spectrum Access

SPEED-5G Golden Nuggets

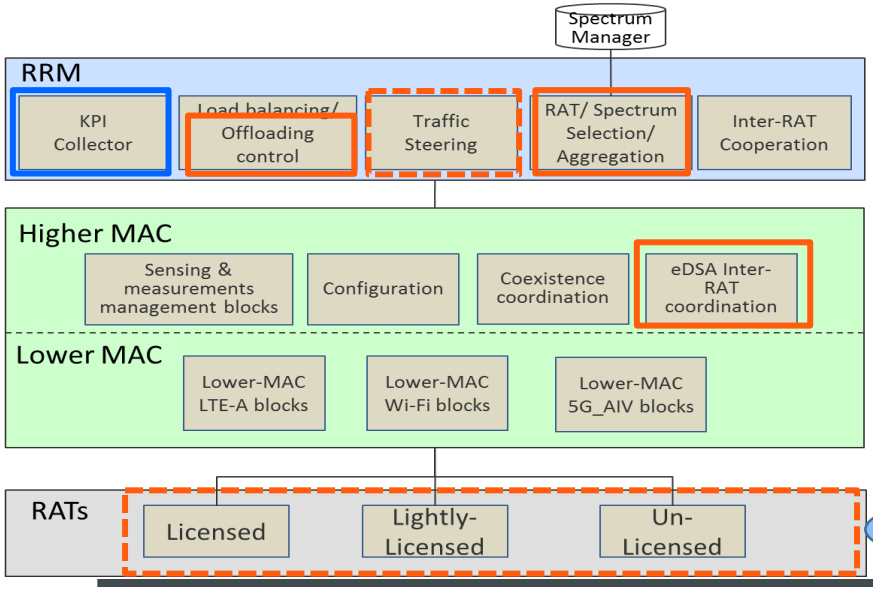
- Hierarchical (blending distributed and centralised) management of ultra-dense multi-RAT and multiband networks
- Flexible and adaptive multi-RAT MAC for dynamic spectrum access and aggregation
- Advanced RRM interacting with higher-level entities, enabling operator spectrum policy management for all types of regulatory regime

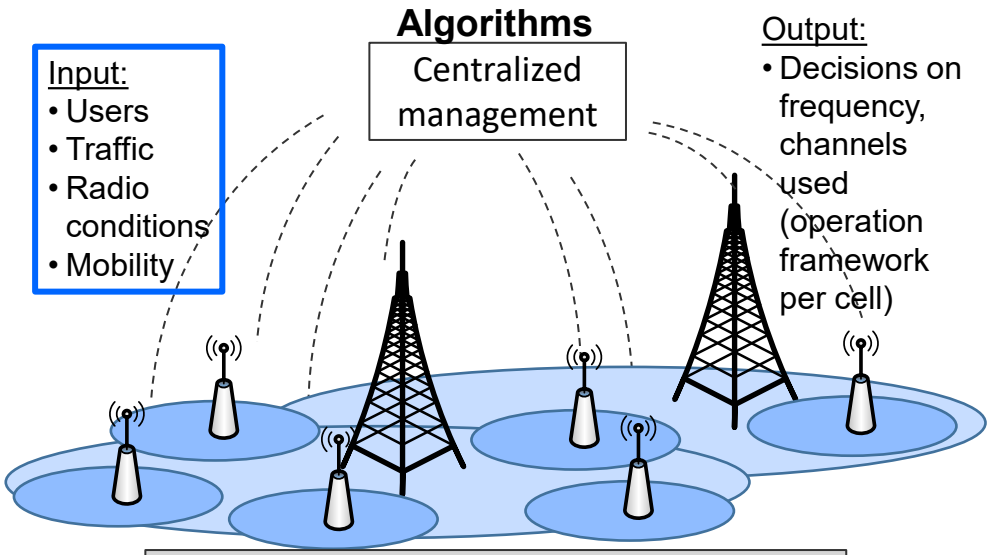
Focused Golden Nugget

- Develop *hierarchical (blending distributed and centralised) management of ultra-dense multi-RAT and multiband networks*

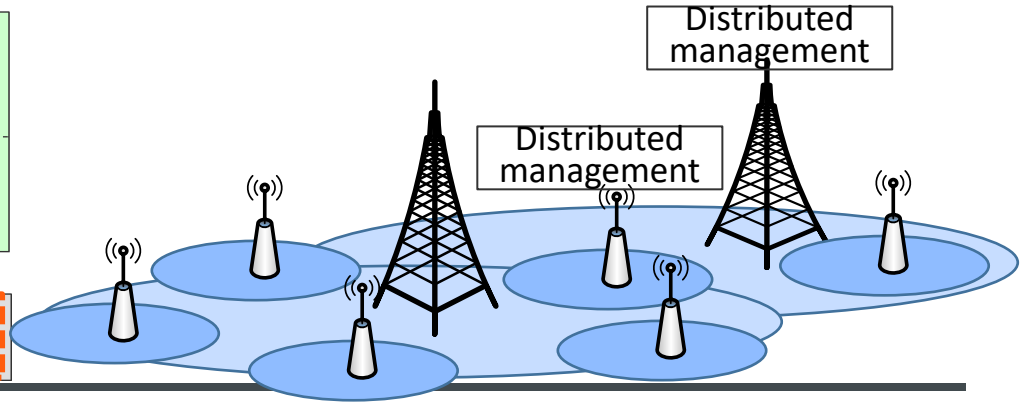
It will enable:

- ***Capacity*** → *Through small cells and efficient resource allocation*
- ***Scalability*** → *Through distributed management, in coordination with centralized schemes*
- ***Stability*** → *Through machine learning*

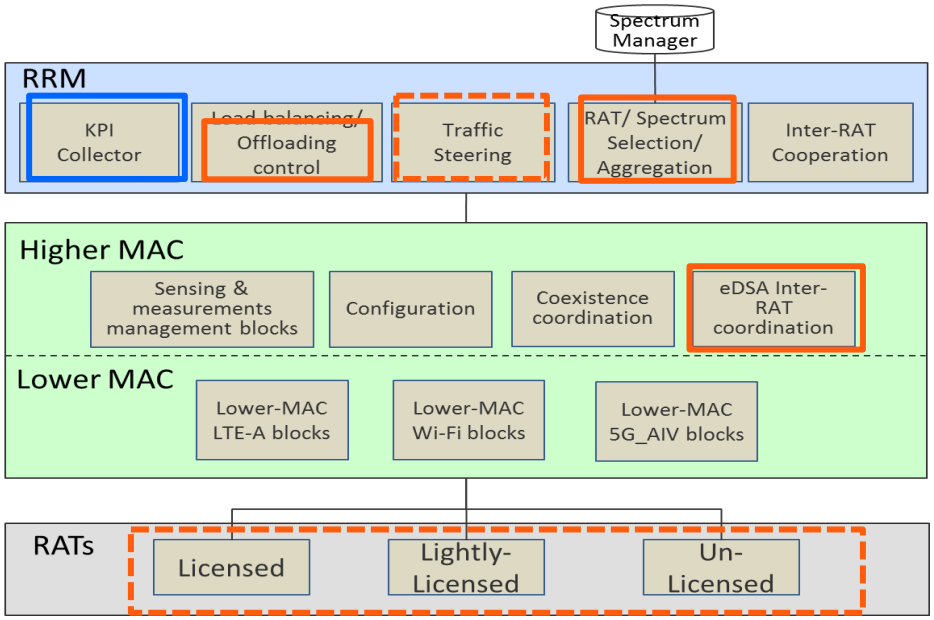




Problem: As networks scale in 5G era, centralized management is expected to scale as well

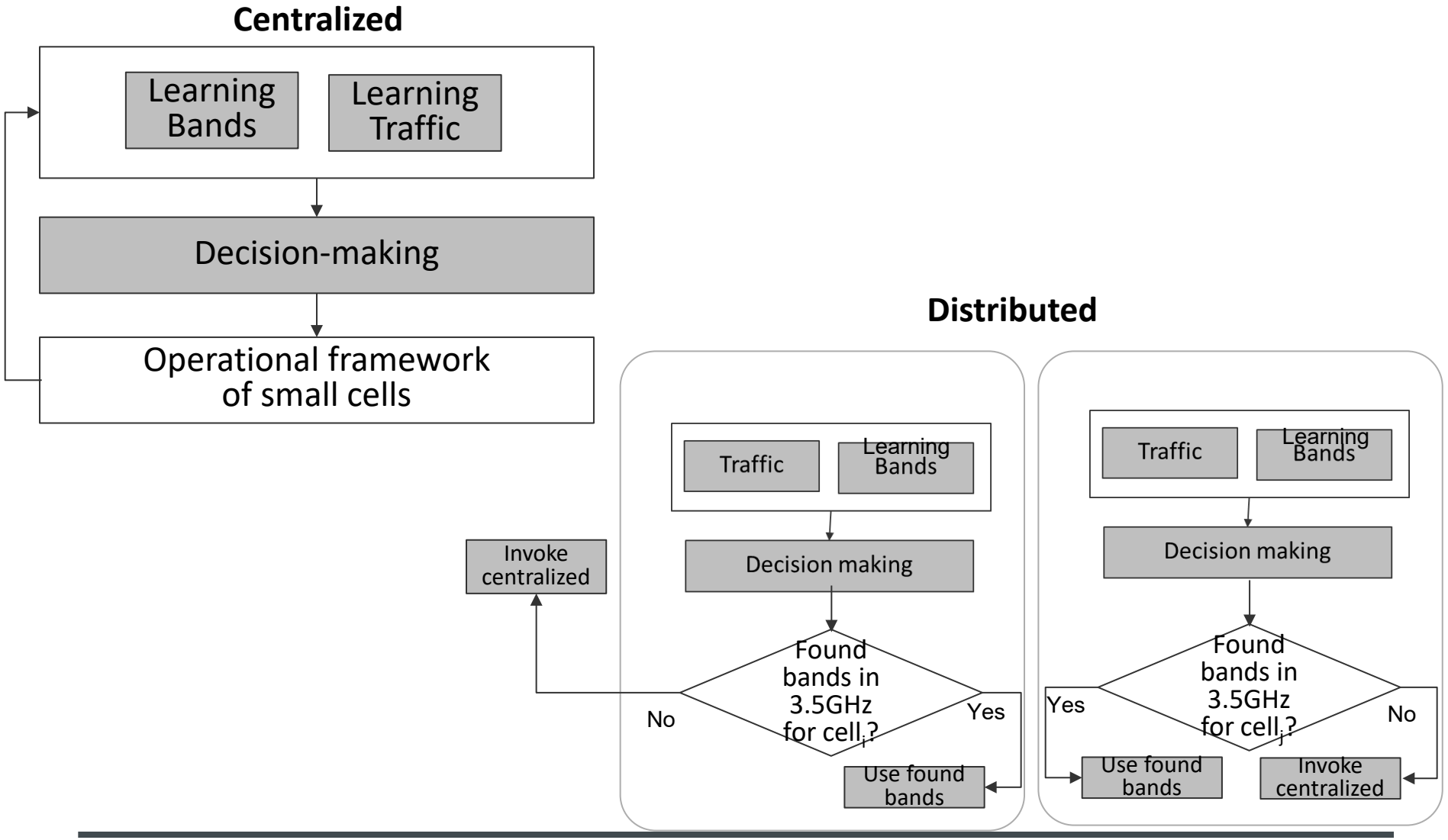


Problem Statement



- Centralized problem statement
  - ➔ Given a set of UEs *U* (static or moving), a set of cells *M*, a set of channels *C*, a set of available channels $C_a \subseteq C$
  - ➔ Find the most suitable channels and cells for satisfying requirements depending on service requirements
- Distributed problem statement
  - ➔ Given a set of UEs *U* (static or moving), in a cell, a set of channels *C*, a set of available channels $C_a \subseteq C$
  - ➔ Find the most suitable channels for the cell
- Proposed solutions:
  - ➔ Basic distributed solution based on channel segregation (e.g., D4.1)
  - ➔ Enhanced distributed solution based on advanced machine learning (to be considered for IPR)
  - ➔ Centralized solutions

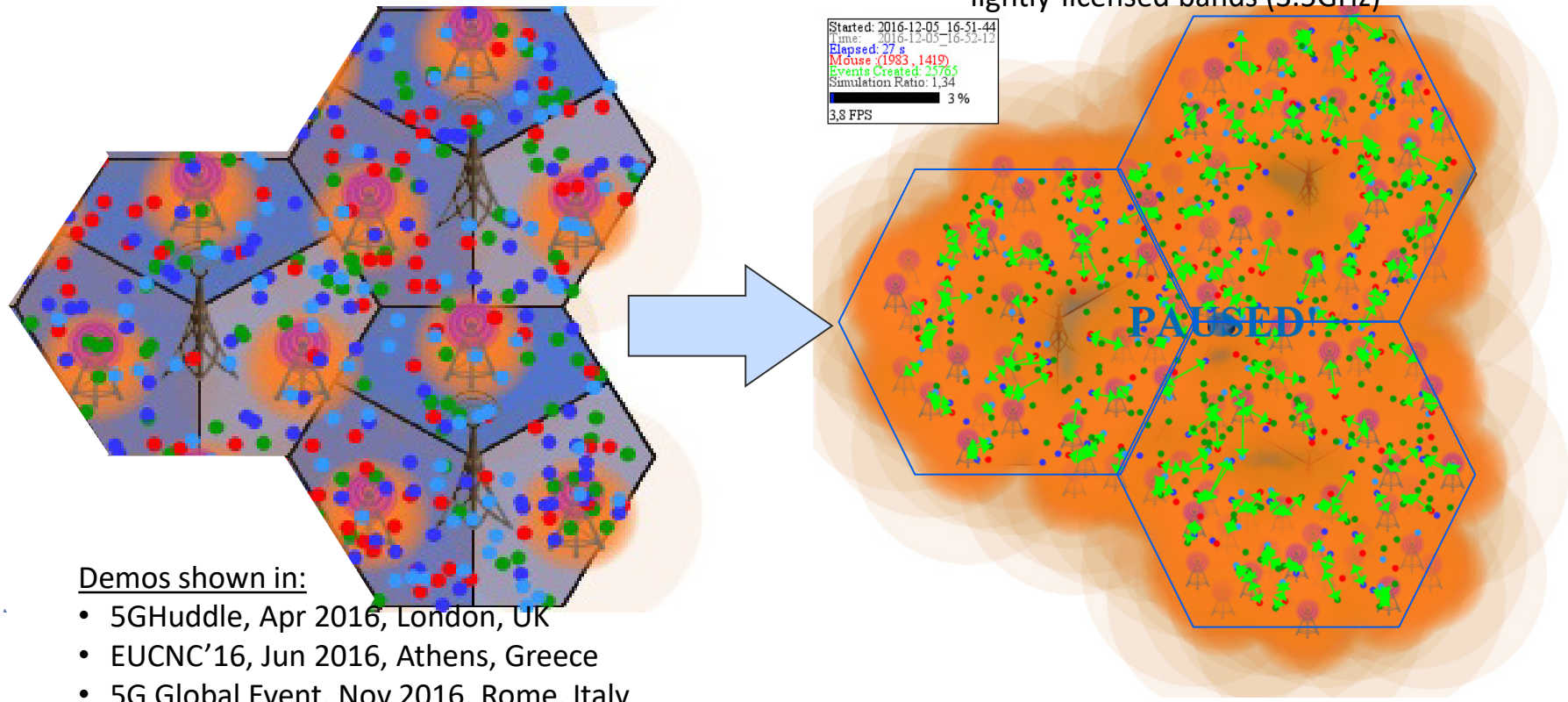
Algorithm Examples



Demo Aspects

Year 1 – 3GPP benchmark development and evaluation (limited number of small cells per BS)

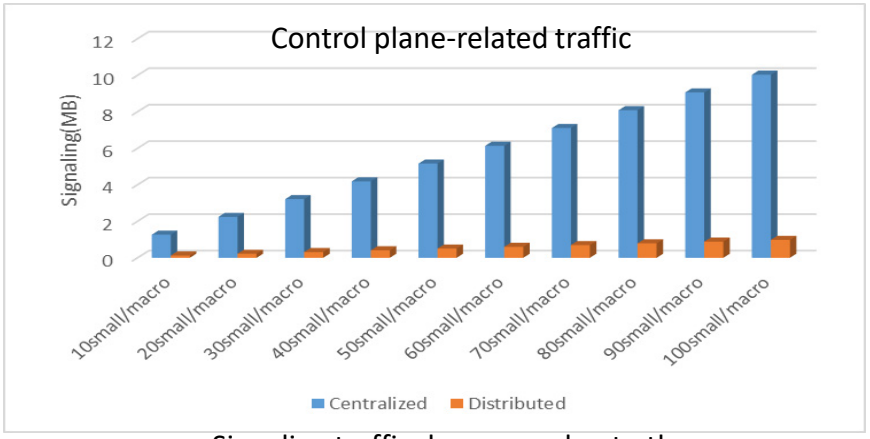
Year 2 – Extension to more demanding, dense environments towards 5G and demonstration of centralized vs. distributed management and usage of lightly-licensed bands (3.5GHz)



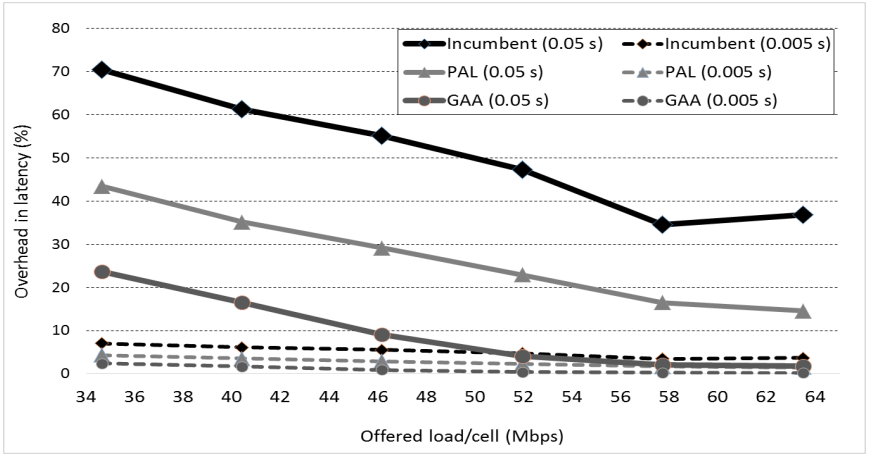
Demos shown in:

- 5GHuddle, Apr 2016, London, UK
- EUCNC'16, Jun 2016, Athens, Greece
- 5G Global Event, Nov 2016, Rome, Italy
- EUCNC'17, Jun 2017, Oulu, Finland

Results



Signaling traffic decreases due to the use of distributed management

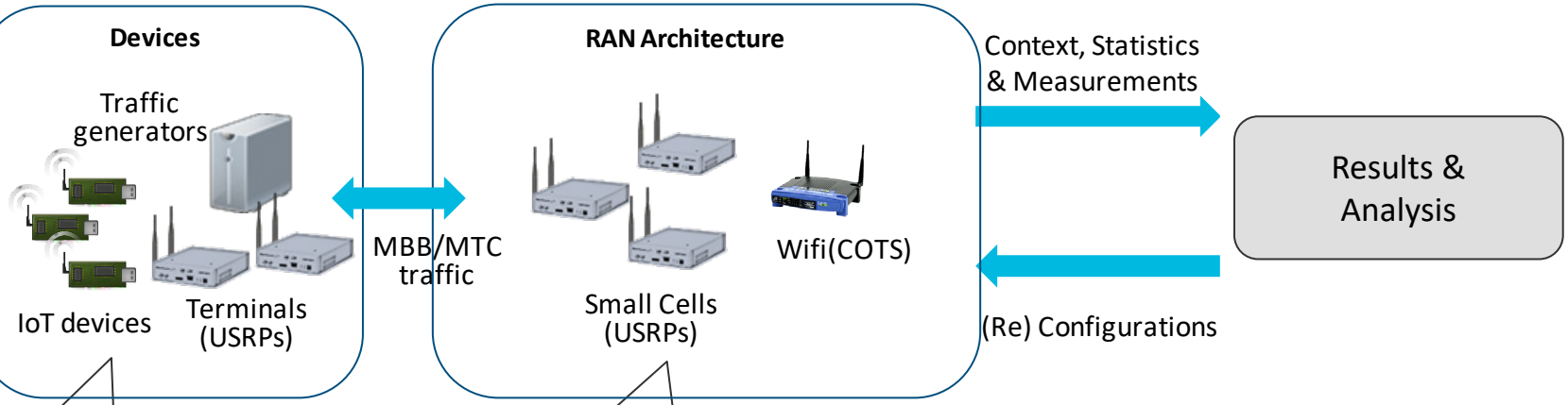


Achievement of 5G performance with up to 70% less cost (signalling due to hierarchical RAT/spectrum management)

Increased capacity and scalability issues

- The introduction of new small cells and new bands will add more capacity to the network
- Improve scalability through distributed management
  - ➔ As more small cells per macro are added, centralized decision making would need more data from each new cell (centralized management)
  - ➔ Distributed management: Intelligent nodes can handle decision making in a more local basis, hence related signaling will be limited (compared to centralized)

Hardware Evaluation



Generating traffic related to MBB or MTC applications (depending on the scenario)

USRPs are used for transmitting at 3.5GHz and other bands in order to check performance of proposed MAC/RRM

Way Forward

- SPEED-5G will further elaborate on PoCs the coming period
- PoCs will mainly demonstrate the benefits of proposed MAC and RRM functionality for capacity expansion
- “5G-Day” can be organized towards end-2017/ early-2018 in order to demonstrate Speed-5G key findings

Thank you for your attention!

Find us at www.speed-5g.eu

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