



COHERENT Vision on Software Defined Networks for 5G

IAESI, THALES, FAIRSPECTRUM, EICT,
VTT, EURECOM, CREATE-NET, OTE,
POLITECHNIKA POZNANSKA

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Outline



- 📶 About COHERENT
- 📶 SDN in cellular networks
- 📶 General framework
- 📶 Objectives
- 📶 Proposed technologies
- 📶 Conclusions

Coherent in a Nutshell



📶 Research & Innovation Action (RIA) project under EU Horizon 2020 ICT-14; a 5G-PPP project

📶 High level objectives

- Research and develop a unified control and coordination framework for 5G heterogeneous radio access networks (RAN), with focuses on
 - Software Defined Networking (SDN) for RANs
 - Efficient radio resource modelling and management in programmable RANs
 - Flexible spectrum management

📶 Project Coordinator

- Dr. Tao Chen, *VTT Technical Research Centre of Finland Ltd.*

SDN concepts applied to cellular networks



 Control/data plane separation already well defined at core network level, but not at RAN level

- The “classic” SDN concepts may work only at GWs level

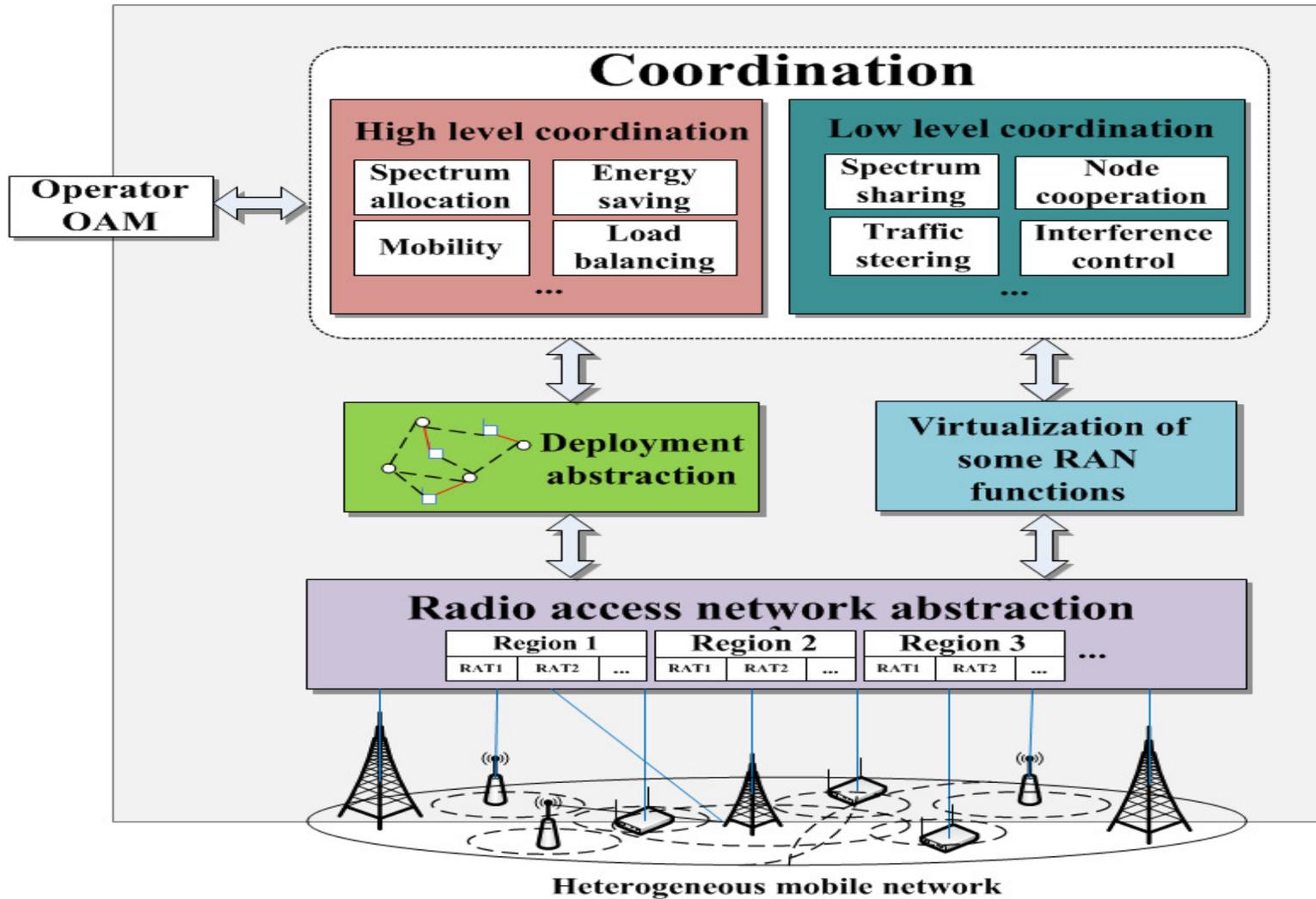
 Virtualization of user plane

- Key concept
- May increase flexibility and adaptability of RAN
- New functionality in context of virtualization

 Central coordination

- A mix of benefits and challenges

General framework

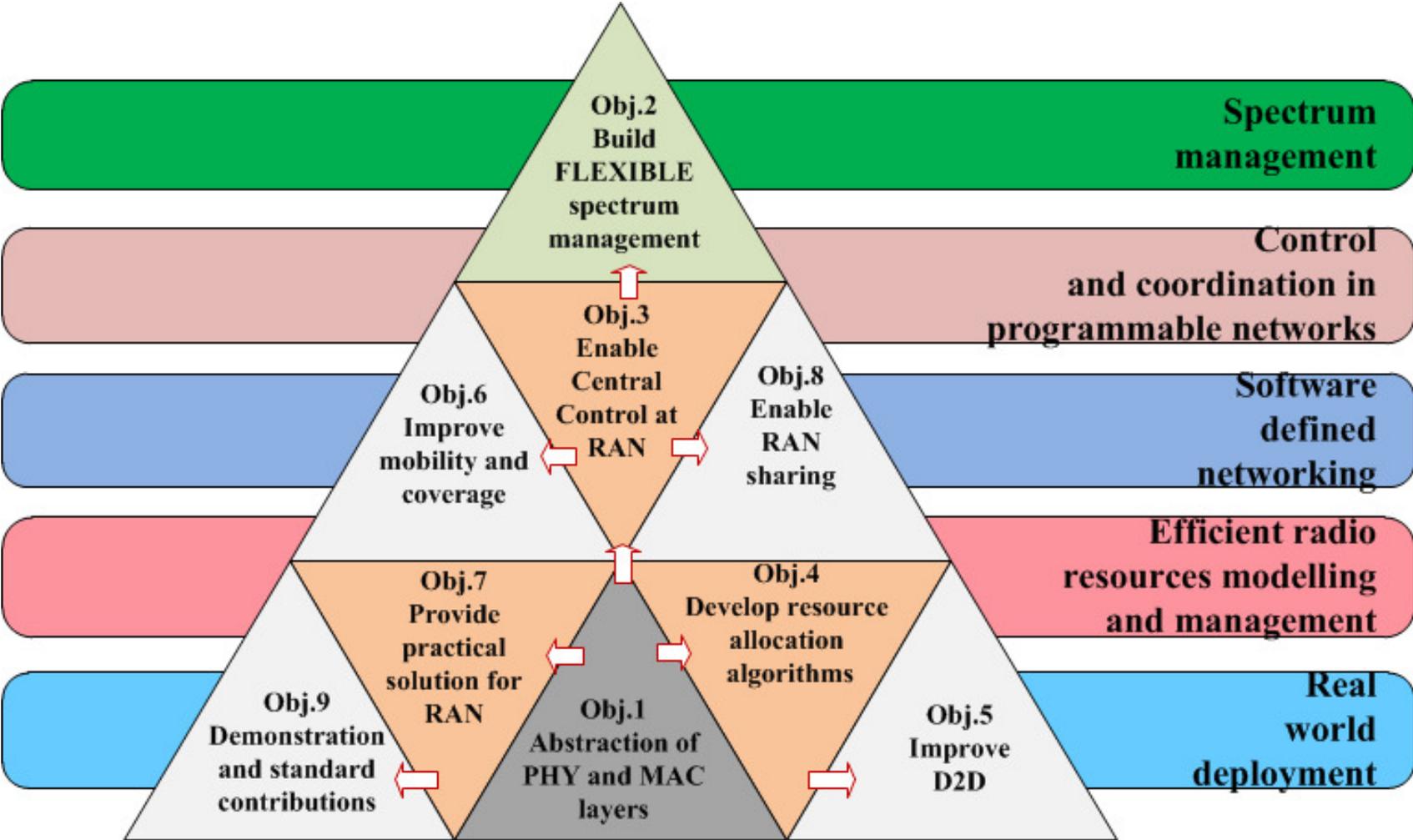


Objectives



1. Increased user Quality of Experience
 - Increased user data rates
 - Lower delays
 - Lower number of dropped packets
2. Reduced operator expenditures
3. Energy saving
4. Service continuity between different RATs
5. High number of connected devices
6. Coverage improvement

COHERENT Objectives and Challenges



Challenges

COHERENT Objectives – cont.



Objective	Mechanism	Standardization / Regulatory activity
Fast and RAT-independent coordination	PHY, MAC abstractions	RAN3
Improved spectrum utilization	Flexible spectrum management	ECC PT1: Flexible UL channel use in FDD; RAN2, RAN3
Very high density deployment	Central coordination and virtualization	RAN2, RAN3 SA2?
Improved coverage	Improved D2D	RAN1, RAN2, RAN3
Improved mobility and coverage	Central coordination and virtualization	RAN2, RAN3 SA2?
Provide practical solutions for RAN	Network graphs	RAN1, RAN2, RAN3
Reduced costs & improved spectral efficiency	RAN and/or spectrum sharing	RAN3 SA2?

Central Control in LTE – today limitations



CSI report is a limited tool

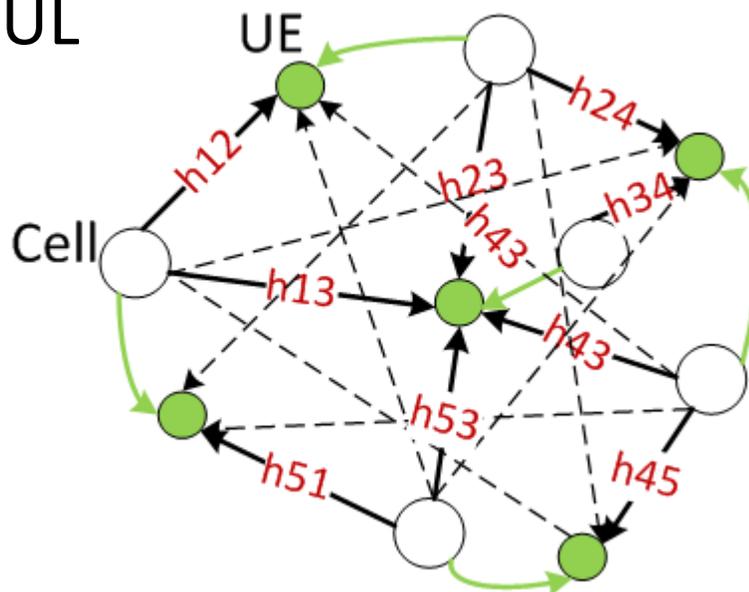
- In a dense deployment are needed too many CSI processes
 - Each combination of active and non-active transmissions point needs one CSI process
 - Exponential increase of number of needed CSI processes with number of eNBs!
- CQI from different nodes cannot be linearly combined
 - A Central Coordinator has limited possibilities to preview the interference status in short time

Existing X2 support for a Central Coordinator is limited to coordination of protected resources

- Silence does not carry any data!

Wireless Network Graphs

- 📶 Linear tool to be used by a Central Coordinator
 - The interference can be assessed for a combination of interference sources through a linear operation
- 📶 Today: missing suitable UE reports for DL and eNB reports for UL



Technology elements



- 📶 Central Coordinator for dense deployments
- 📶 Virtualization of lower data plane facilitating:
 - Seamless mobility
 - Network MIMO
- 📶 Support for network graphs
- 📶 UE reports and messages enabling performant operation of a Central Coordinator
- 📶 PHY/MAC abstractions for faster and RAT-independent coordination

Conclusions



- 📶 Central Coordination and Virtualization are key factors for performance improvement in dense deployments
- 📶 Network graphs empower the operation of a Central Coordinator
- 📶 Virtualization and central coordination facilitate:
 - Seamless mobility
 - Network MIMO
- 📶 PHY/MAC abstractions allow faster and RAT-independent coordination

Backup slide

COHERENT STRUCTURAL VIEW

