

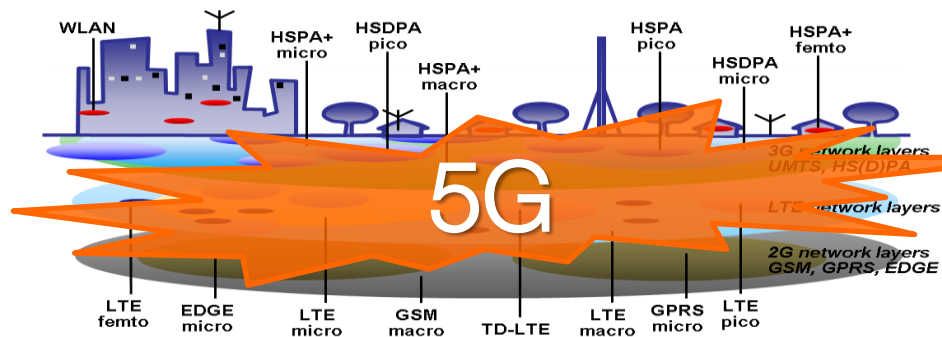
SON for 5G

Sana Ben Jemaa and Zwi Altman

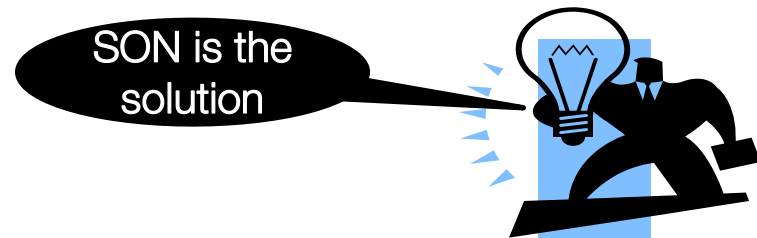


Introduction

- Complexity of future wireless access networks
 - Multi-RAT, Multi-layer, Multi-vendor
 - Multitude of tunable radio parameters
 - Higher dynamicity
 - Higher end user expectation



- Growing pressure for higher network management efficiency
 - Operability (OPEX ↓)
 - Operational efficiency (CAPEX ↓)
 - Customer satisfaction ↑

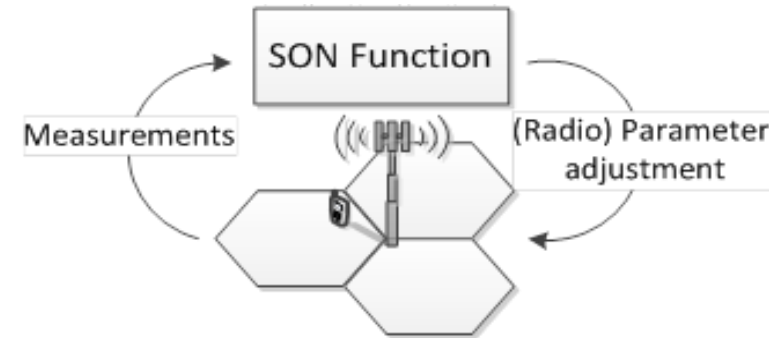




Self-organized networks

Self-organized networks (1/2)

- A **SON function** is a control loop that adjusts the network parameters based on the measurements feedback



SON standardized in 3GPP since release 8

- **Self-Configuration**

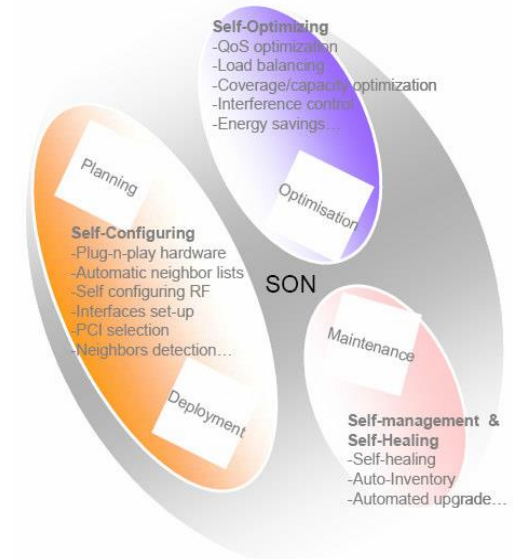
Automatic discovery and registration, Automatic software update, Automatic download of radio and transport parameters, Automatic neighboring relations (ANR) ...

- **Self-Optimization**

Mobility Load Balancing, RACH, optimization, Mobility Robustness, Drive test minimization, Energy Saving...

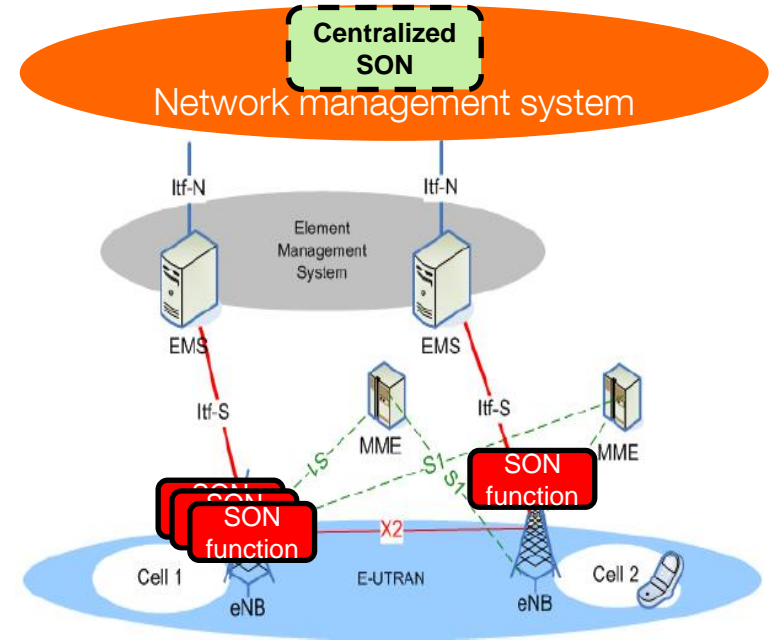
- **Self-Healing & Self-Management**

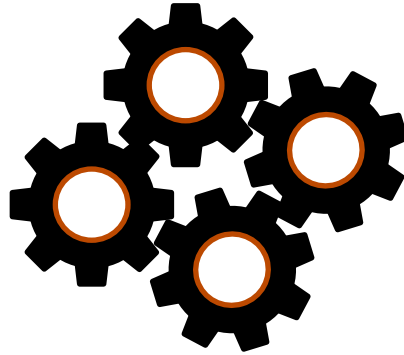
Cell outage compensation. Board fault detection...



Self-organized networks (2/2)

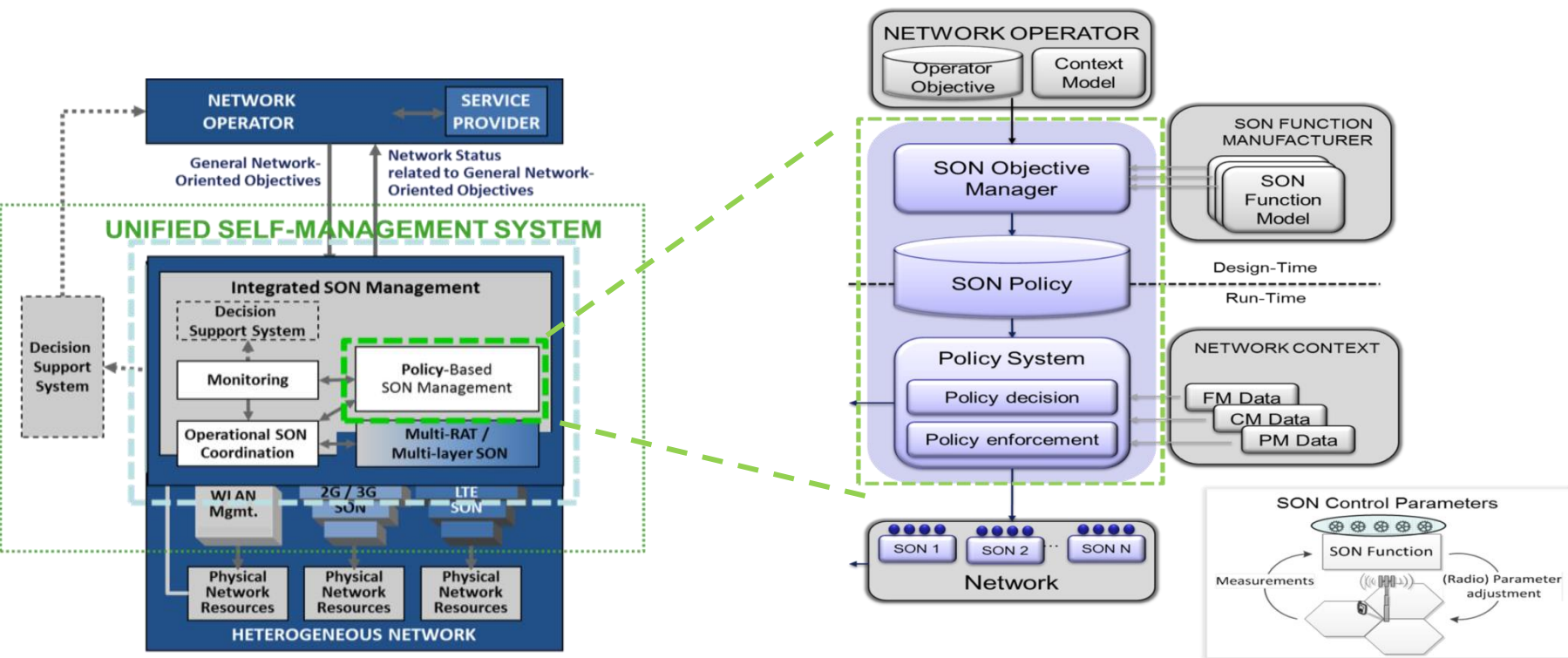
- Distributed SON solutions
 - at the base station level
 - in the domain of the RAN vendor
- Centralized SON Solutions: in the operator OSS
 - emergence of new actors providing Centralized SON solutions
- Current Status
 - Both distributed and centralized SON are deployed
 - Centralized SON is gaining momentum





From a SON enabled network to ONE Self Organized Network

Global Self-Management in a SON enabled RAN

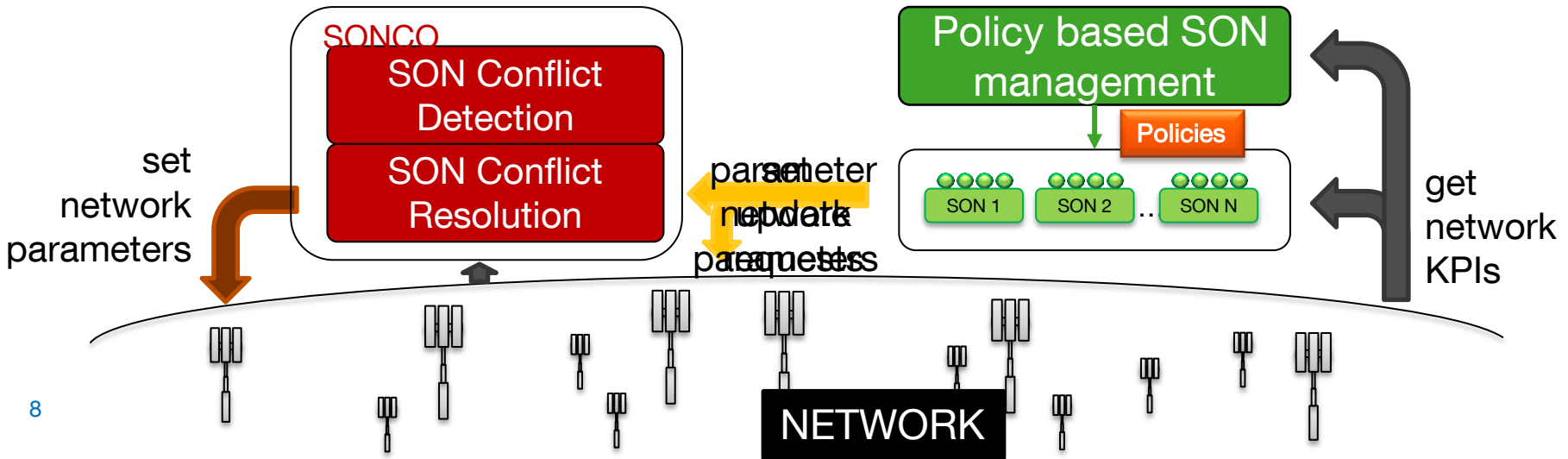
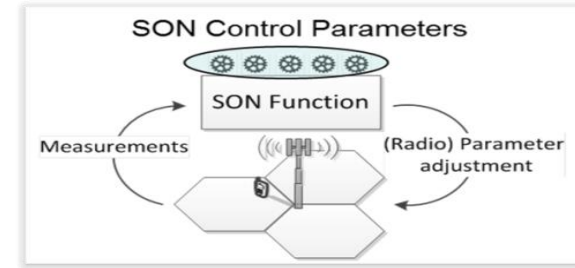


Semafour unified self-management system

Policy based SON management (PBSM)

SON management and coordination

- Assumption: SON functions are black boxes
→ the leverage for SON management: SON control parameters





New challenges for RAN management

5G: new challenges for RAN management

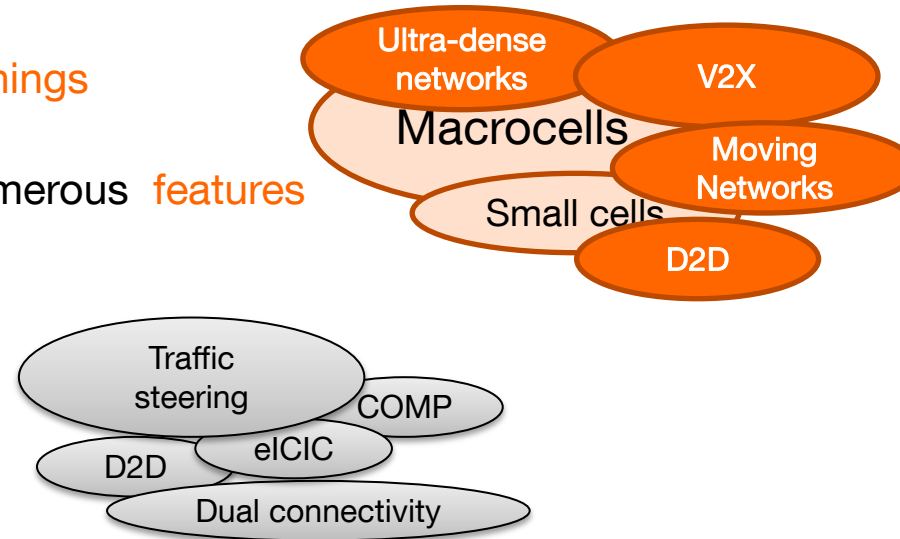
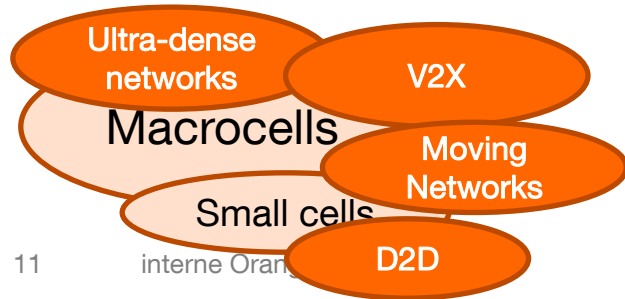


Source: <https://5g-ppp.eu/>

- 5G is **virtualized from day one**:
 - ➔ 5G RAN management should optimize both **virtual** and **radio resources**
- 5G is **vertical driven**:
 - ➔ Satisfy requirements from both operators and verticals
- 5G **new features** and technos:
 - ➔ Trigger the most appropriate feature to self-heal or self-optimize the network **at a given state and context**

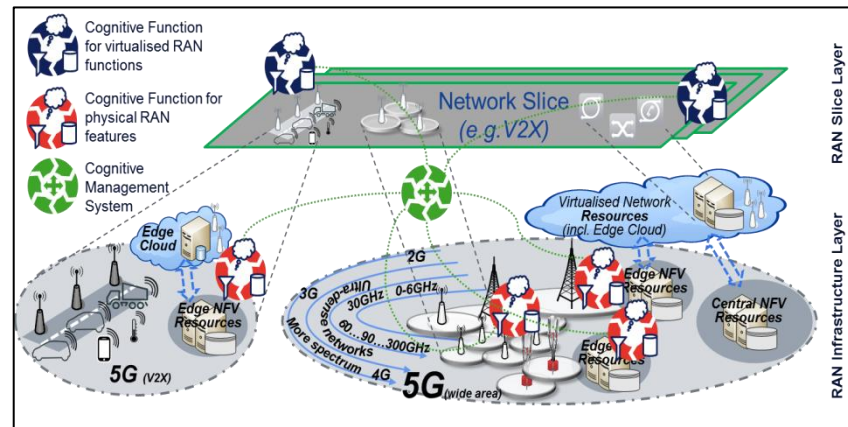
SON for 5G: Even 'old' SON functions should be rethought!

- Automatic Neighbor Relation (ANR)
 - 5G ANR with Massive MIMO/beamforming will have to reach the **granularity of cells and beams**
 - Rethink ANR for 5G
- Mobility robustness optimization (MRO) for seamless mobility
 - **New connectivity options** in 5G
 - Rethink MRO for **networks, devices and things**
- Load Balancing:
 - A plethora of **connectivity options** and numerous **features**
 - Rethink load balancing for 5G



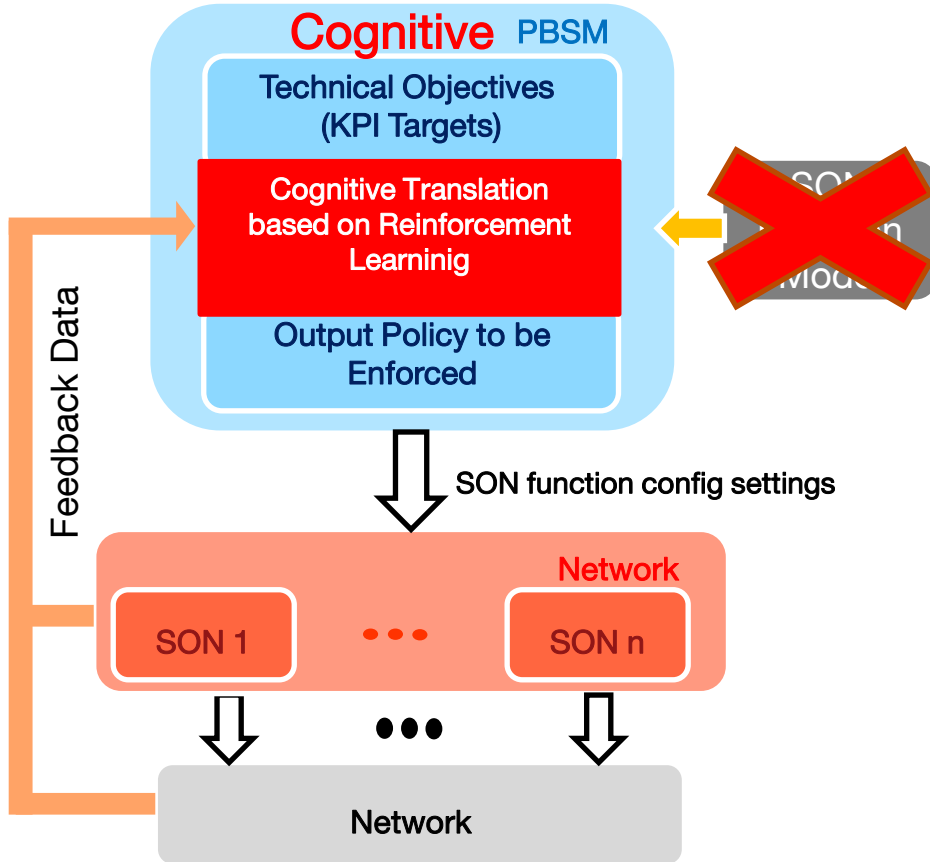
Cognitive RAN Management to enable 5G realize its full potential

- **5G SON** to optimize new features and resource usage (virtual & physical)
 - with cognition capability

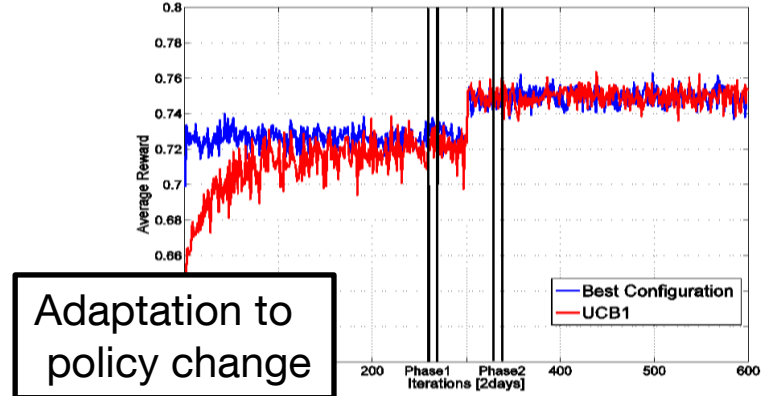
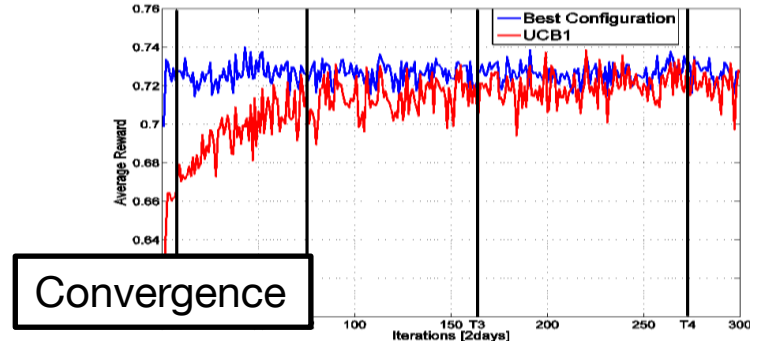


- Global management of 5G RAN towards
 - Slice management at RAN level: How to develop solutions in **5G RAN** in order to fulfill **e2e requirements** from verticals and operators
 - Cognition empowered management functions for knowledge building and intelligent decision making

Cognitive Policy Based SON Management



- Reinforcement learning algorithm: Multi-Armed Bandit



Thank you

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