Self Organising LTE/SAE Network – Operator Requirements & Examples

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T-Mobile

Overview

- Main Drivers for Self Organisation
- Main Functionality of Self Organisation
  - Self Planning & Self Configuration
  - Self Optimisation & Example: Capacity Optimisation
  - Self Testing & Self Healing
  - Self Maintenance
- Self Organising Principles
- Impact of Self Organising Network on Architecture
- Summary

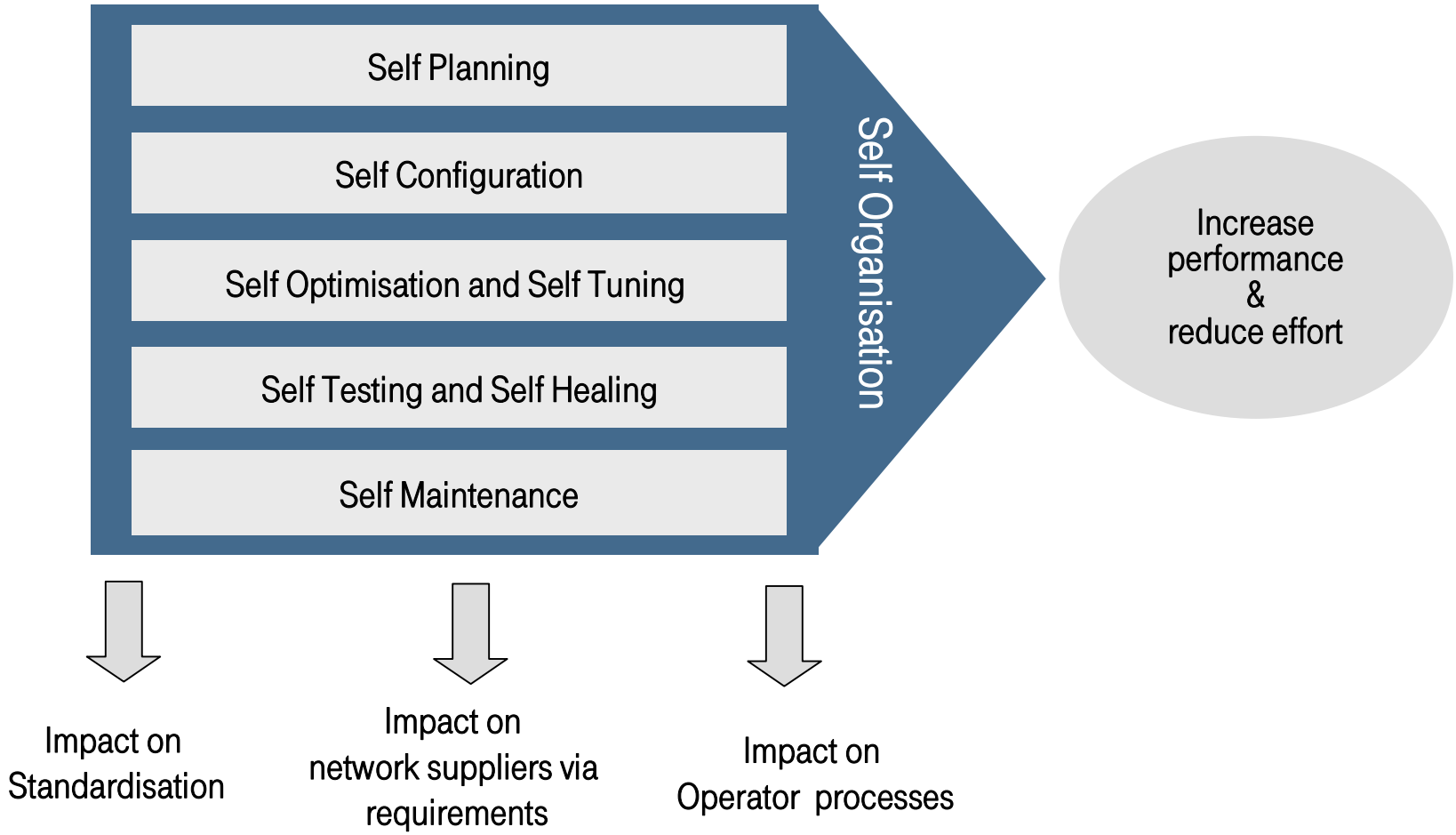
Main Drivers for Self Organisation

High complexity and high number of parameters	→ Improve capacity and performance
Parallel operation of 3 networks (GSM, UMTS and LTE/SAE) required	→ Reduce effort
Introduction of Home BTS* may lead to huge number of Nodes to be operated in a complex multi vendor scenario	→ Handling of mass radio nodes

→ T-Mobile: Self organizing functionality is mandatory for SAE/LTE

*Home BTS: mass NodeB installed by customer operating in licensed spectrum (similar to WLAN access point)

Main Functionality of Self Organisation



Self Planning & Self Configuration

Self Configuration by:

→„Plug & Play“ behaviour of new net elements (e.g. eNodeB, aGW, transmission nodes)

Basic Setup

- Initial Transport Parameter Setting & Configuration of IP link
- Authentication
- Association of O&M and Access Gate Ways
- Download of basic software and parameter set

Radio Configuration (based on planning tool/measurements)

- Automated Neighbour detection and list generation
- Automated initial HF parameter setting

Operational State: Self-Optimisation Mode

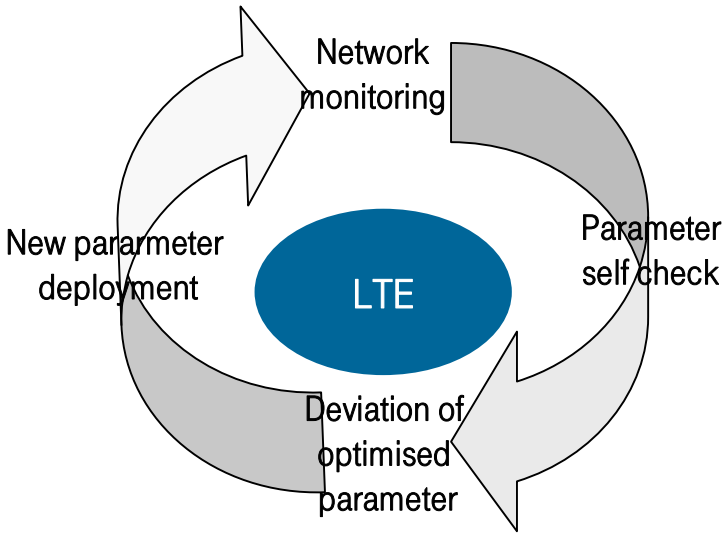
- Continuous optimisation of parameter based on measurements

→ Faster rollout, reduced cost, less failures

Self Optimisation

Self optimisation by:

- Self optimisation loop
- Self training, Self learning

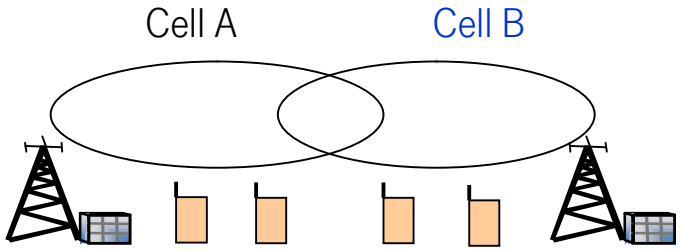


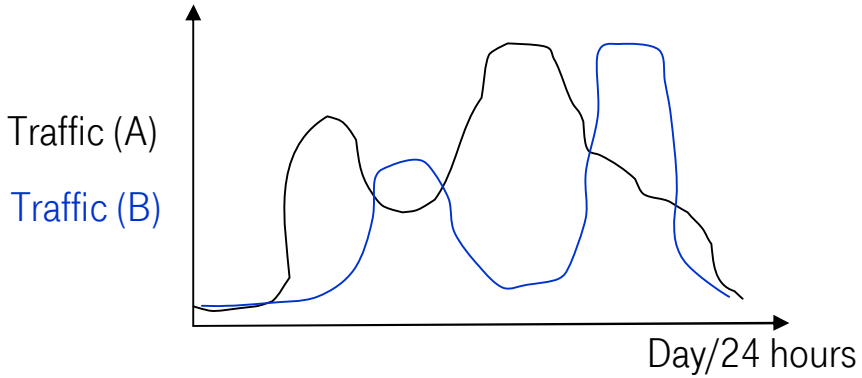
In UMTS up to 500-1000 different parameter per RAN area are operator configurable, many of them can be set per cell level, this may result in up to 100.000 parameter per RAN area

Reduce planning effort, reduce failures, increase performance, increase quality

Example: Capacity Optimisation

Measure traffic of serving and neighbour cells





Possible dynamic optimisation actions on a per minute/hour basis (off-line character):

- Bandwidth optimisation (more sub-channels for cell with traffic peak)
- More Power for cell with traffic peak
- Optimisation of antenna tilt/azimuth (more for long-term traffic variation)

Self Testing and Self Healing

- Automatic build in tests during run time for preventive maintenance
- Automatic failure detection and localisation of 99% failures
- Automatic system functionality test by reference UE* (e.g. to avoid sleeping cells)
- Automatic healing mechanism for several failure classes (e.g. reduce output power for temperature failure, automatic fallback to previous software version)

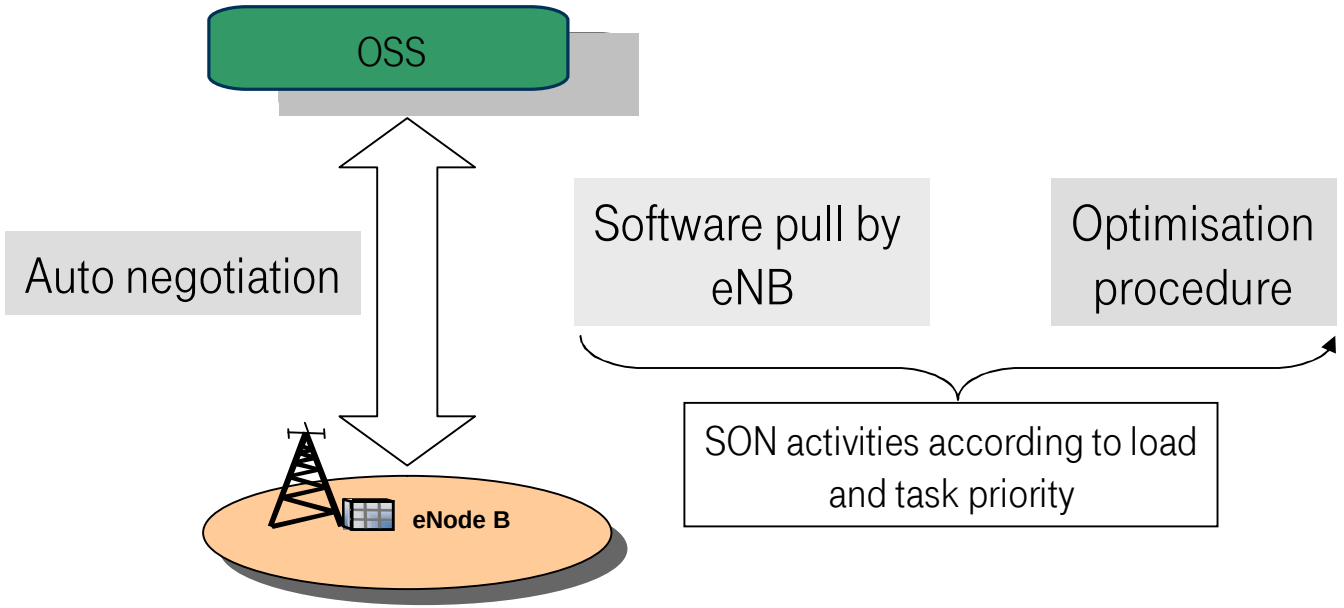
→ Reduce unplanned site visits and maintenance costs

- other possibilities to aim “self healing” effects
  - High redundancy
  - Smart algorithm on higher resource management layer
  - Inter-RAT change or Inter PLMN change to reduce impact of corrupted net elements and to increase the customer service

* integrated in eNodeB or external UE (probe) as monitoring instance

Self Maintenance

- Efficient O&M system as integrated part of SON with focus on minimisation of operational effort
- O&M system supports self organising principles



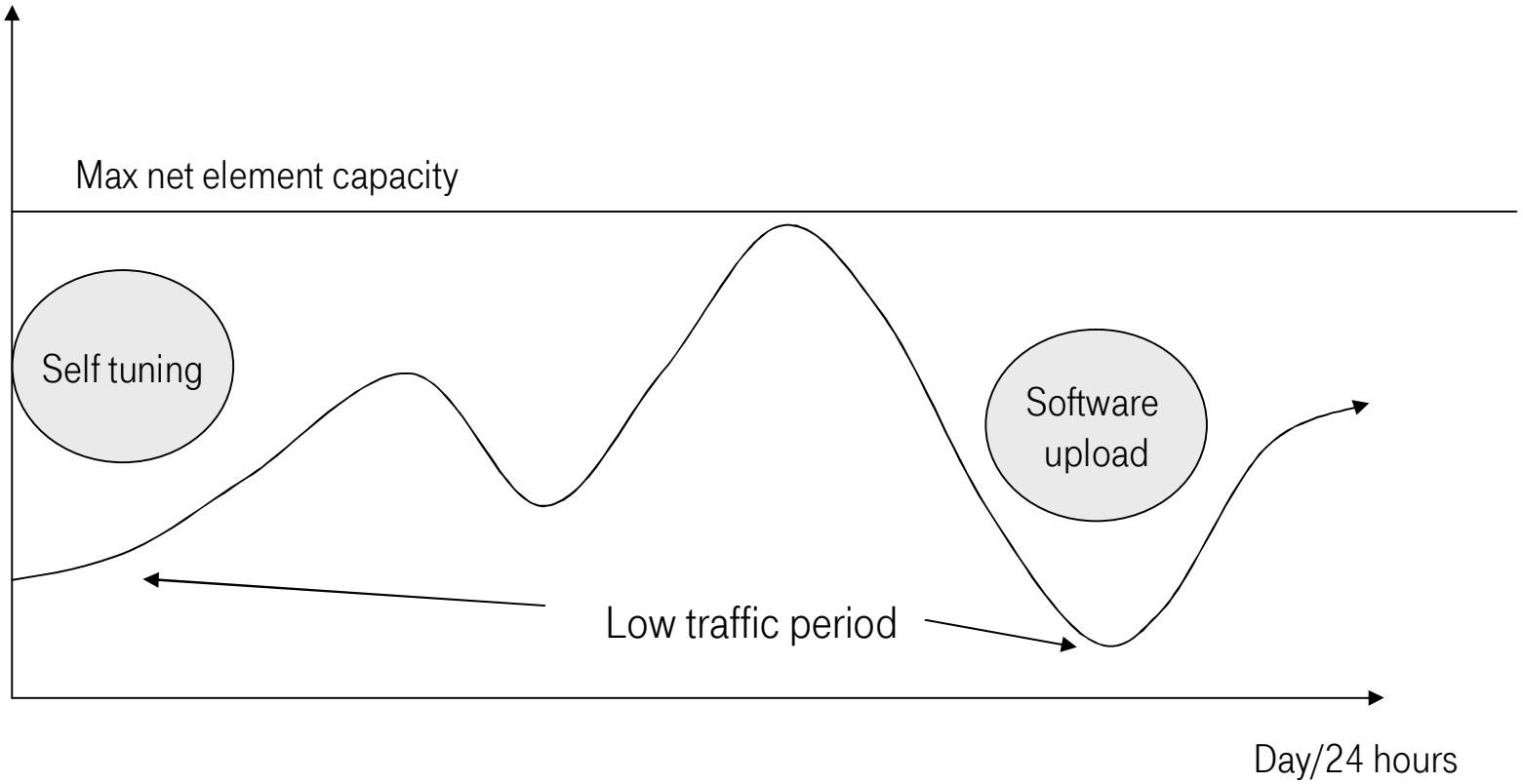
- Focussing on significant parameters with impact on network quality & performance
- Self organising, self configuration, self optimisation and self testing behaviour as characteristics of every network element and its units

→ Reduce maintenance costs

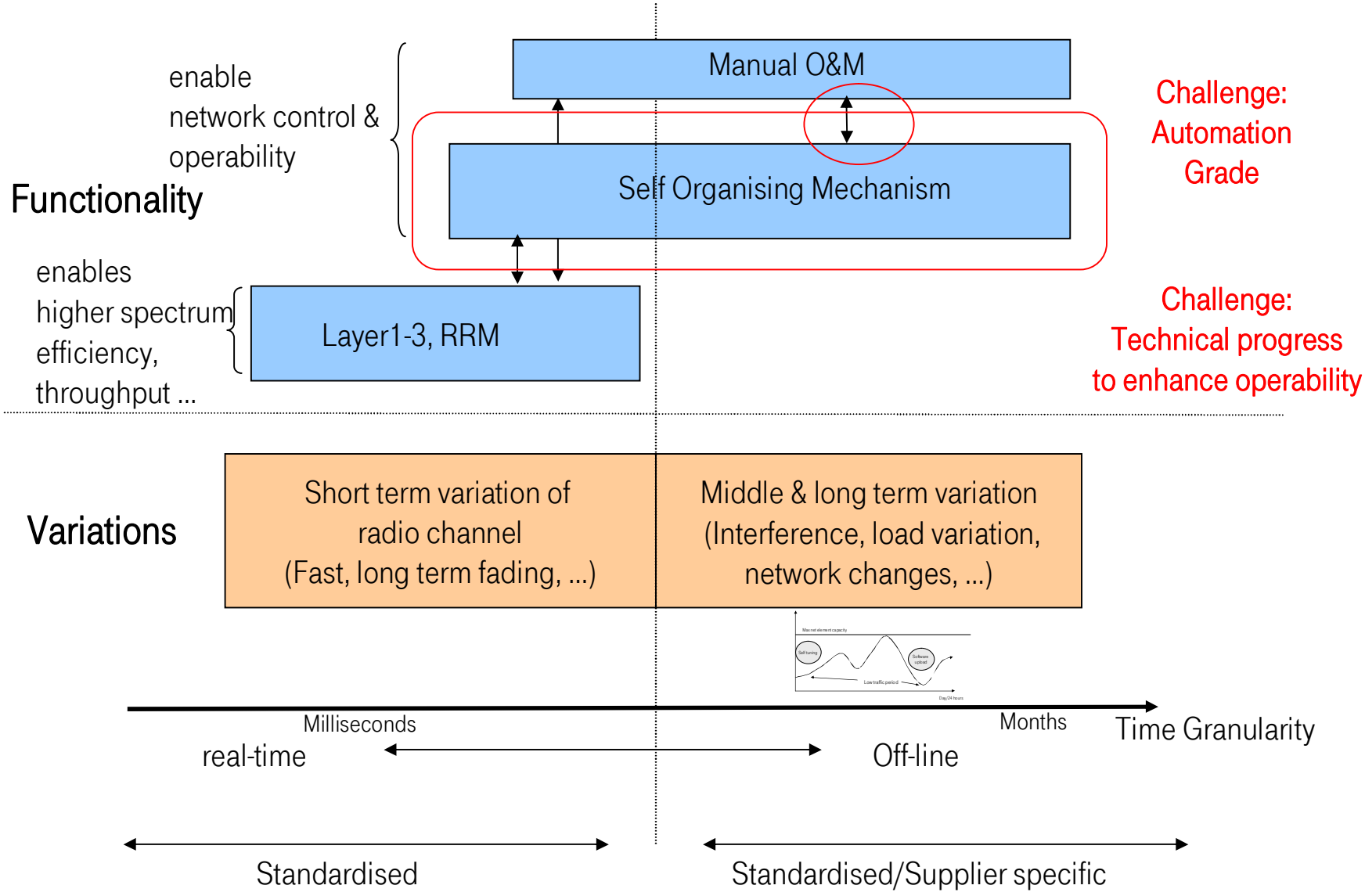
Self Organizing Principles

- O&M tasks as well as optimisation tasks are dedicated to task priorities
- Intelligent optimising algorithm taking into account priority of tasks

→ Dynamic behaviour increase overall system capacity

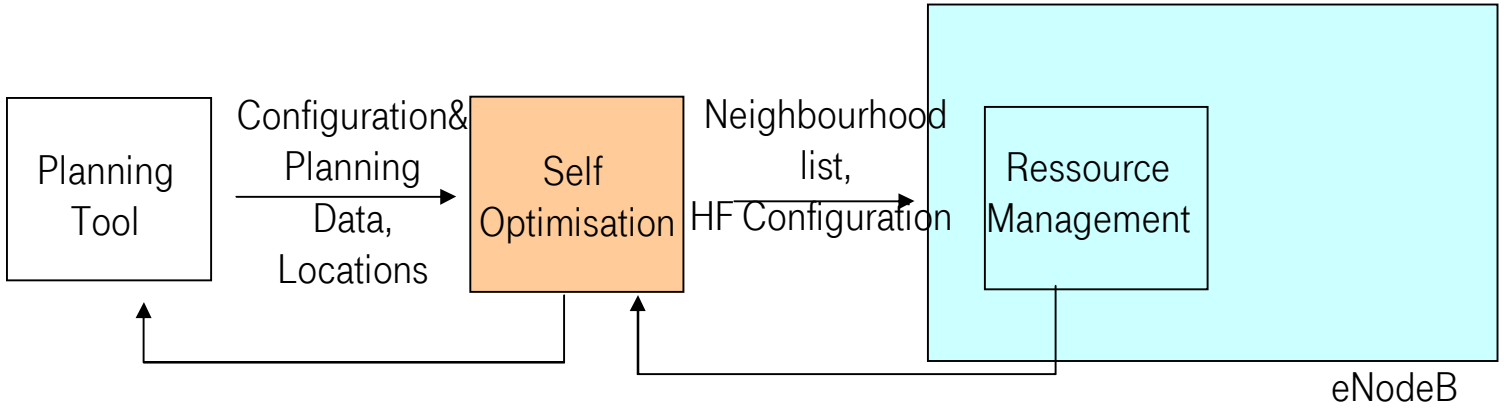


Self Organising Principles II

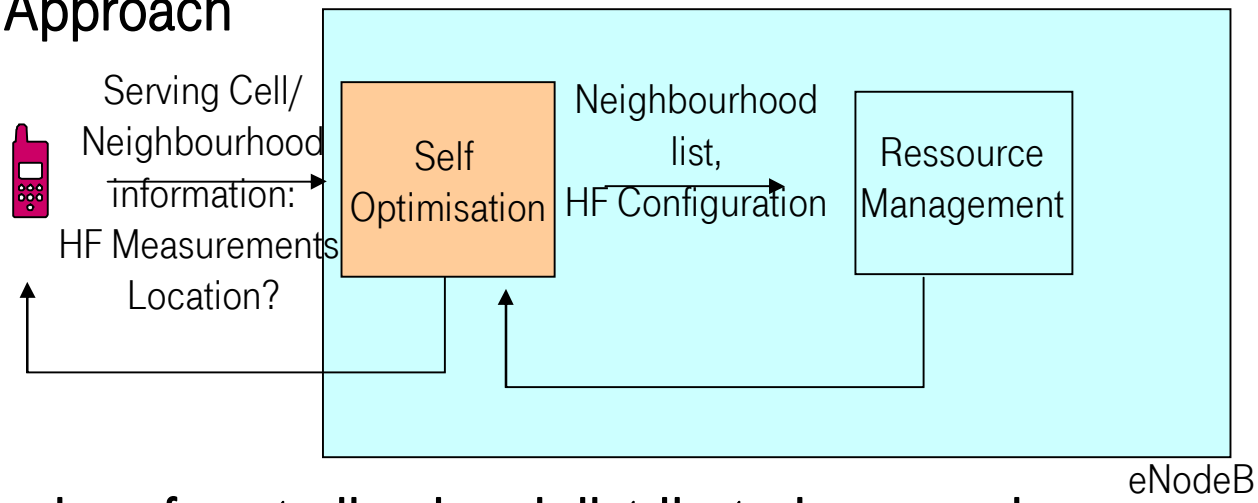


Impact of Self Organising Network on Architecture

Centralised Approach

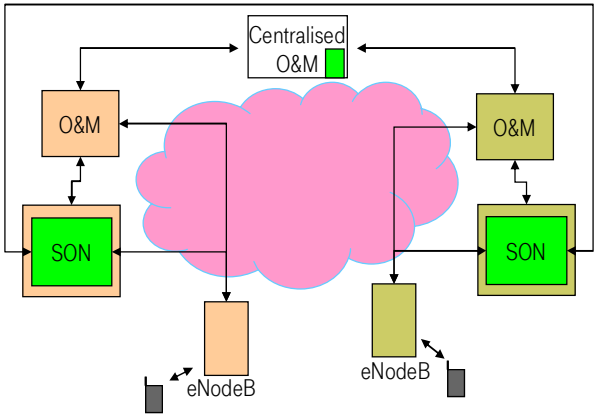


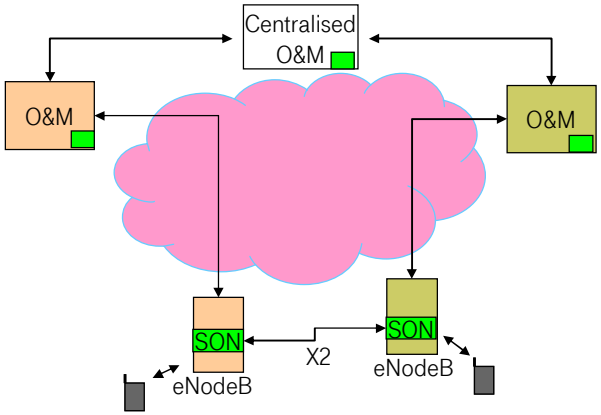
Distributed Approach

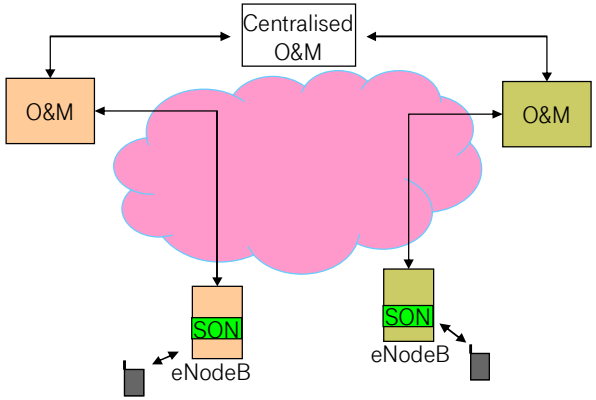


Mixed Scenarios of centralised and distributed approaches

Impact of Self Organising Network on Architecture II







Centralised SON functionality

- Established concept based on O&M (similar) architecture
- Options: Intf. N (or similar) standardisation extension/ "X3" between eNodeB & SON Centre
- Slow inter-supplier optimisation
  - Critical for complex multi supplier scenarios

Distributed SON functionality

- Fast optimisation
- Good support of multi supplier scenarios with standardised interface (X2)
- Standardisation Effort (Extension for X2)

Simplified distributed SON functionality

- Simplification: Simplified SON functionality only in eNodeB based on standardised air interface UE measurements
- Easy support of multi supplier scenarios
- Low standardisation effort
- Problem: Complexity/ reliability of optimisation algorithm

Summary

- Operation of network as a crucial issue requires self organising mechanism from begin of LTE/SAE life time
- Impact on standardisation, design and implementation of LTE/SAE
- Benefit: SON as an enabler of excellent performance and handling of network
- Challenges:
  - Standardisation of Plug&Play functionality and support for optimisation
  - Intelligent algorithms for Self-Optimisation
  - Architecture approach meeting functional & cost efficiency
  - Security
  - Concept acc. Home BTS
  - Time to market issue: SON is mandatory from the begin of LTE/SAE
  - Integration of GSM and UMTS
- Need for change of mind set: technical progress not only for improving technical characteristics like throughput - also for improvement of operability
- Need for cooperation between operators, suppliers and research centres

Thank you