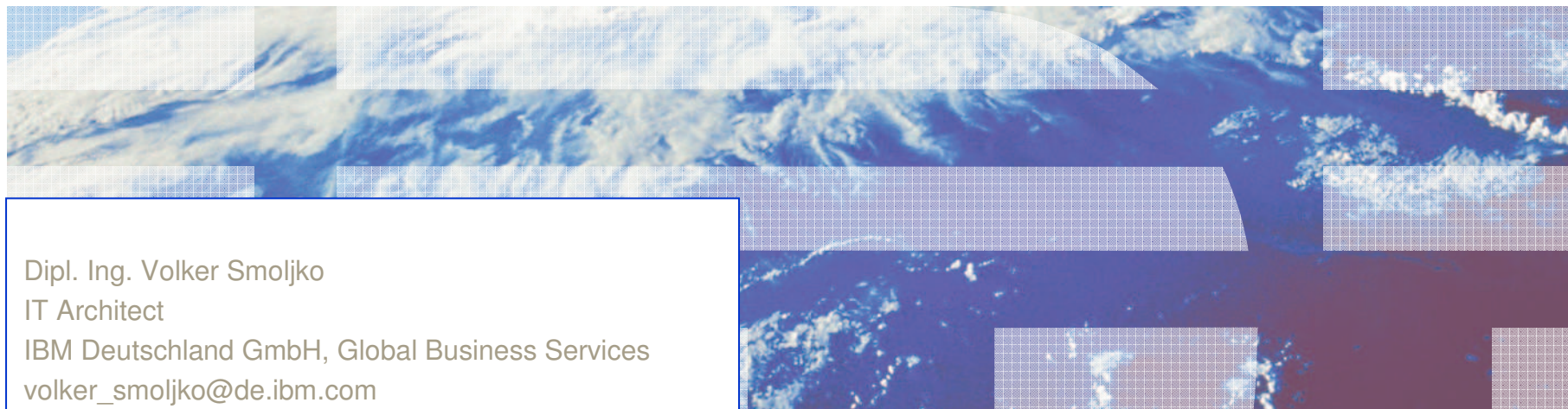


October 6th. 2010



Aspects of centralized solution for self-organizing networks (SON)

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Communication Networks and Systems
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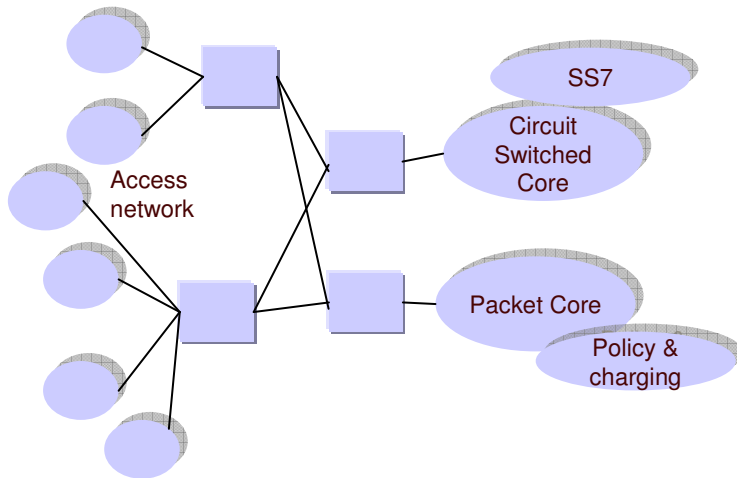
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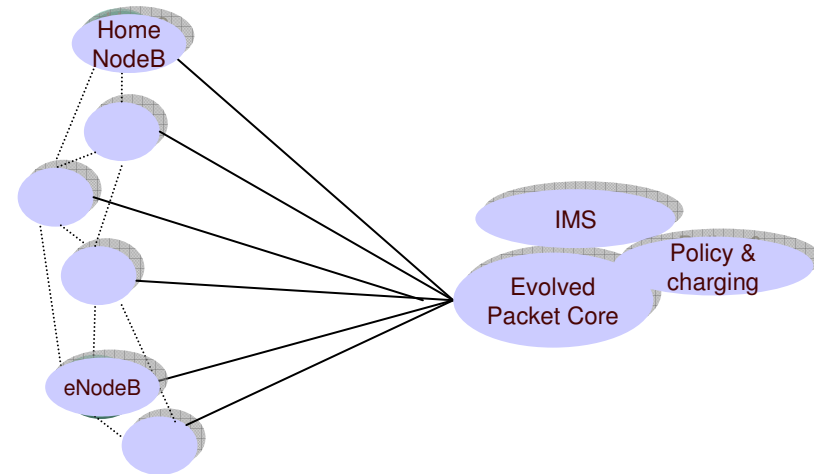
The industry is moving to a new , IP based, network architecture, aiming to greatly increase data capacity. It will be phased in, initially supplementing existing 3G. However, the LTE network cannot be operated economically with existing semi-manual processes.

2G & 3G – hierarchical network



- Manual Configuration
- Operation & maintenance by cell site visits.
- Large effort for testing and optimisation, e.g. by Drive Tests

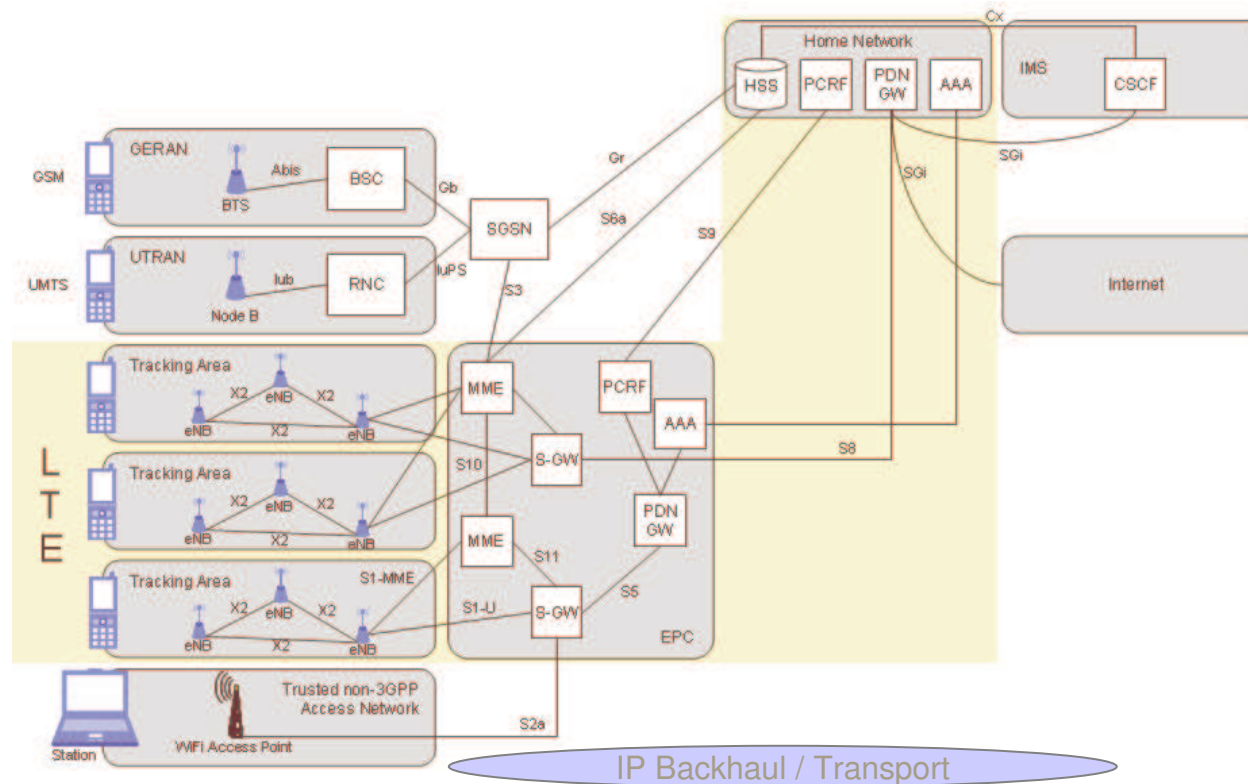
Long Term Evolution (LTE)



LTE has:

- Greater density of Nodes (maybe 3x)
- Meshed network – each node interconnected with neighbours

Network evolution forces a transition of current OSS to provide end-to-end capabilities to manage all types of technologies 2G, 3G and 4G, for Radio, core and transport network from different vendors.



- Operator need to manage multiple types of access networks in parallel for next coming years
 - Multi-technology, multi-vendor
- • There is a demand to increase the operational efficiency
 - No additional staff to manage new technologies like LTE
 - New technology with high dense nodes can't be managed in future with manual processes

Standard Bodies and Alliances driving SON

■ 3GPP

- Standardisation of E-UTRAN (LTE)
- Self-Optimising Networks
 - Introduced in Q2 '07
 - Considered primarily in TSGs RAN2/3, SA5
- Releases
 - R8 (frozen): Some auto-configuration concepts included – Automatic neighbour relation, Automatic physical cell ID discovery
 - R9 (tentatively frozen 12/2009): Key RAN3 work items – Coverage and capacity optimisation, Interference reduction, Load balancing, Coverage hole management and cell outage management, Handover optimisation
- 'Self-configuring and self-optimizing network use cases and solutions', 3GPP Technical Report 36.902, maintained by RAN3



■ TM Forum

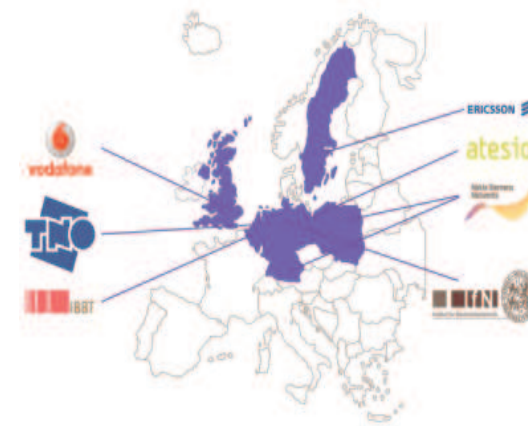
- Specification and promotion of standards in telecommunication operations area
- With more than 700 corporate members in 195 countries, TM Forum is the world's leading industry association focused on enabling best-in-class IT for service providers in the communications, media and cloud service markets. The Forum provides business-critical industry standards and expertise to enable the creation, delivery and monetization of digital services.



Standard Bodies and Alliances (cont'd)

- NGMN (Alliance)
 - World Leading Mobile Operations Collaborative Effort
 - Establish clear performance targets, fundamental recommendations and deployment scenarios
 - ‘Operational Efficiency’ project
 - SON WP is a continuation of ‘Project 12’
 - Develop operator vision on self-organisation
 - Ensure that self-organisation capabilities become an inherent part of the initial design of future systems
 - Push vendors to fulfil operator requirements regarding the implementation of particular solutions

- SOCRATES Initiative (Self-Optimization and Self-Configuration in Wireless Networks)
 - Development of self-organization methods to enhance the operations of wireless access networks, by integrating network planning, configuration and optimization into a single, mostly automated process requiring minimal manual intervention.
 - SOCRATES project is supported by the European Union under the 7th Framework Program, and will run from January 1, 2008 until December 31, 2010
 - *Focus on 3GPP's LTE radio interface (E-UTRAN)*
 - The SOCRATES project brings together
 - Equipment Vendors
 - Mobile Operator
 - Mobile Network Planning & Operations Tools Development
 - Research Organizations
 - IBBT
 - TNO, Information and Communication Technology
 - TU, Braunschweig



Links:

www.ngmn.org

www.3gpp.org

www.fp7-socrates.org

ict-e3.eu

SON Challenges

What SON is not:

- SON is **no guide line for network design**: SON does not determine network topology or network configuration
- SON is also **no substitute for network planning**

What SON is in fact:

- SON is a target architecture for networks and network management systems that enables the **robust and transparent automatic handling** of complex self-organizing processes and data
- SON supports network operations by **automatic network adaptations** based on automatic analysis

What SON requires:

- An **integrated solution** covering various network domains and vendor equipment types
- Clear **governance** of overall architecture and implementation
- Elaboration of **algorithms and work split** among solution components
- **Vendor-independent definition of architecture** components and Interfaces
- Efficient **configuration of SON logic** (e. g. how to evaluate which network parameters, how to react in which cases)
- **Transparent monitoring** of evaluation results and configuration actions performed

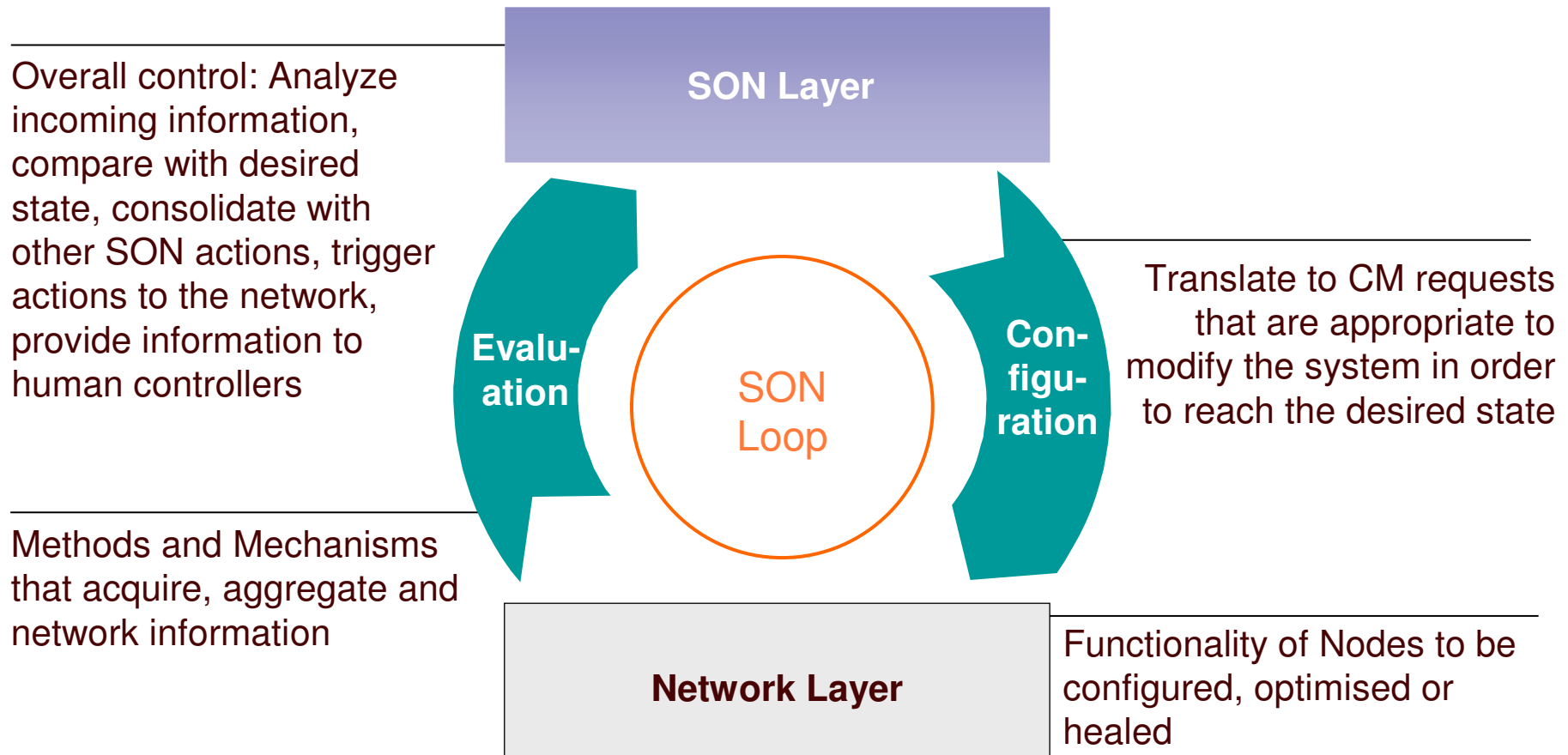
A centralized / modular SON architecture is able to cover multiple use cases in different domains. NGMN has defined 32 SON use cases in total.

No	Use Case	Description	SON Domain
1	Handover Optimization	Performs automated optimization of HO parameters (2G, 3G). Automation is introduced to support ,chained approval process' (RAN optimization – Operations/ RAN configuration).	Optimization
2	Auto-Deployment (LTE/4G)	Supports automated system deployment of new 4G/LTE Radio equipment in the field. Will interwork with existing PKI Infrastructure and performs automated load of appropriate node configuration.	Deployment
3	SW- Management/ Deployment	Supports automated SW management-, distribution process for nodes in RAN/ UTRAN (E-UTRAN). May interwork with existing SW-Distribution Server. Based on ITIL main processes (Change Mgmt).	Deployment/ Maintenance
4	Auto-Diagnosis	Supports automated Fault Diagnosis based on ,bayesian networks method'; determines probabilities of root cause and most suitable recovery action. Integrates with existing FM-, and TT Systems.	Maintenance
5	Radio-Access Planning-, and Optimization	Supports automated radio access planning and optimization to determine the most suitable (economic) way to connect the NBs/ eNBs to core network.	Planning
6	Auto- Configuration Management for Radio Access Networks	Supports auto configuration of RAN-, UTRAN nodes. Potentially introduced in context with ITIL main processes (Change Mgmt).	Maintenance
7	Energy Saving (GERAN/ UTRAN/ E-UTRAN)	Performs fully automated energy saving mode to leverage overlay network infrastructure of 2G and 3G network and automatically switch-off/on 3G cells based on recent traffic conditions.	Optimization
8	Auto- Configuration Management for EPC/ IP transport networks	Supports auto configuration of core network / EPC nodes and IP transport nodes. Potentially introduced in context with ITIL main processes (Change Mgmt).	Maintenance
9	Radio Network Planning/ Demand Planning	Supports automated planning of RAN starting with demand planning.	Planning
10	Sleeping Cell detection and system recovery	Supports automated detection and recovery of of ,sleeping cells'.	Maintenance

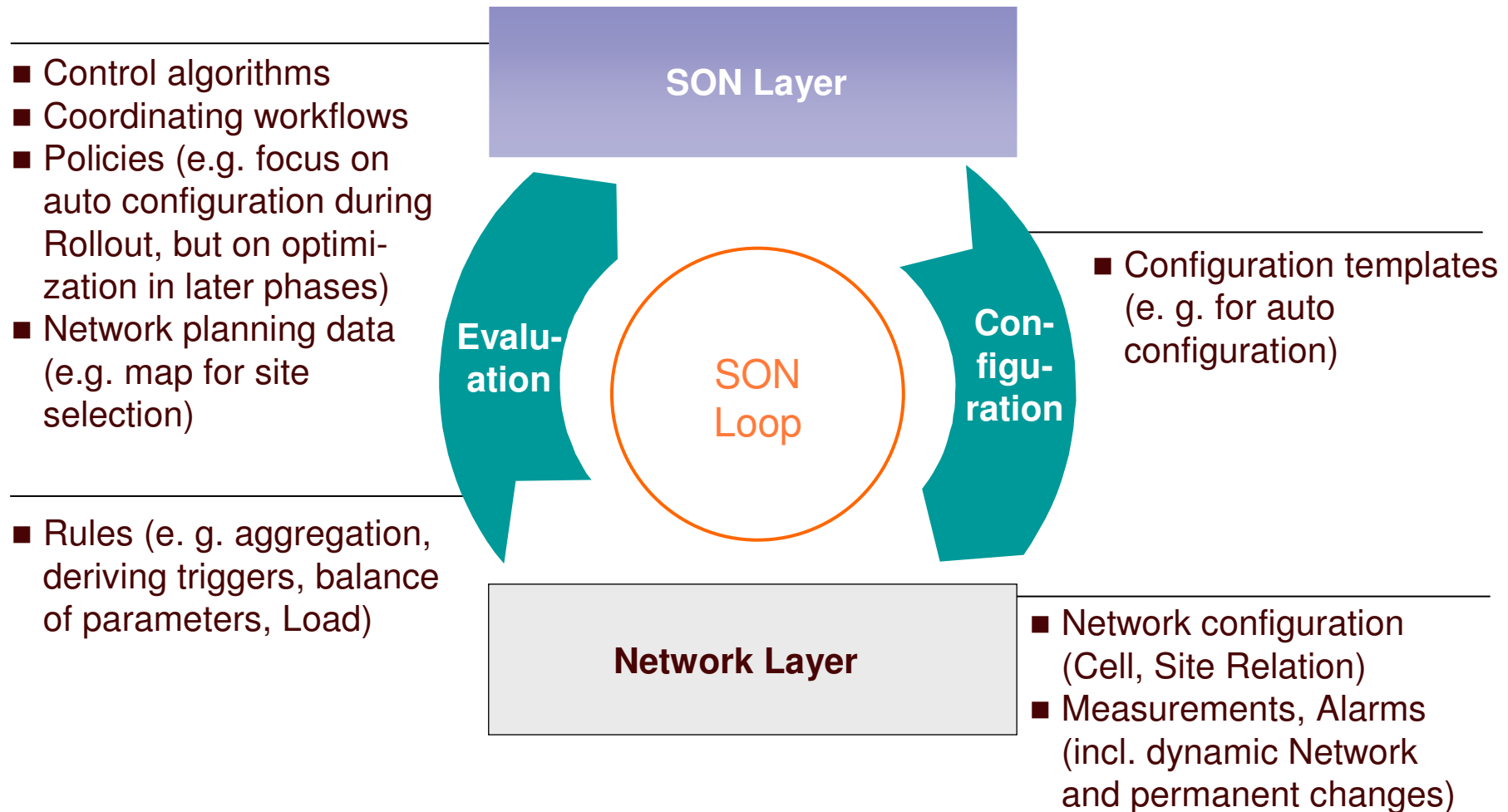
Where the savings come from

	Capability	Savings
Plug and play installation	Automated integration of new nodes via auto connection to OSS (DHCP, Network Element Manager), core network, Security Gateway and neighbor sites, plus auto-configuration of software and firmware	Reduce site visits. Reduce manual configuration effort of Radio, Core and Transmission Network.
Automatic Neighbour Relationship ANR	Automatic configuration and optimisation of neighbour relationships.	Currently about 50% of the network configuration changes contain adjacent cell adaptations. Large reduction in engineering & operations
OSS interfaces	Vendor independent interfaces between Element Managers and Network Managers	Multi-vendor sourcing and reduced integration costs
Automatic Optimisation	Automated optimisation of coverage & capacity parameters, QoS and GoS, mobility and handover, cell & service outages	Minimise drive-testing, performance analysis and operation costs
Automated software management	Automated “health check”, download and rollback	Reduce manual effort and errors
Energy saving	Network elements shut down when lower capacity required and re-start on-demand.	Could save up to 25% of power (RAN)

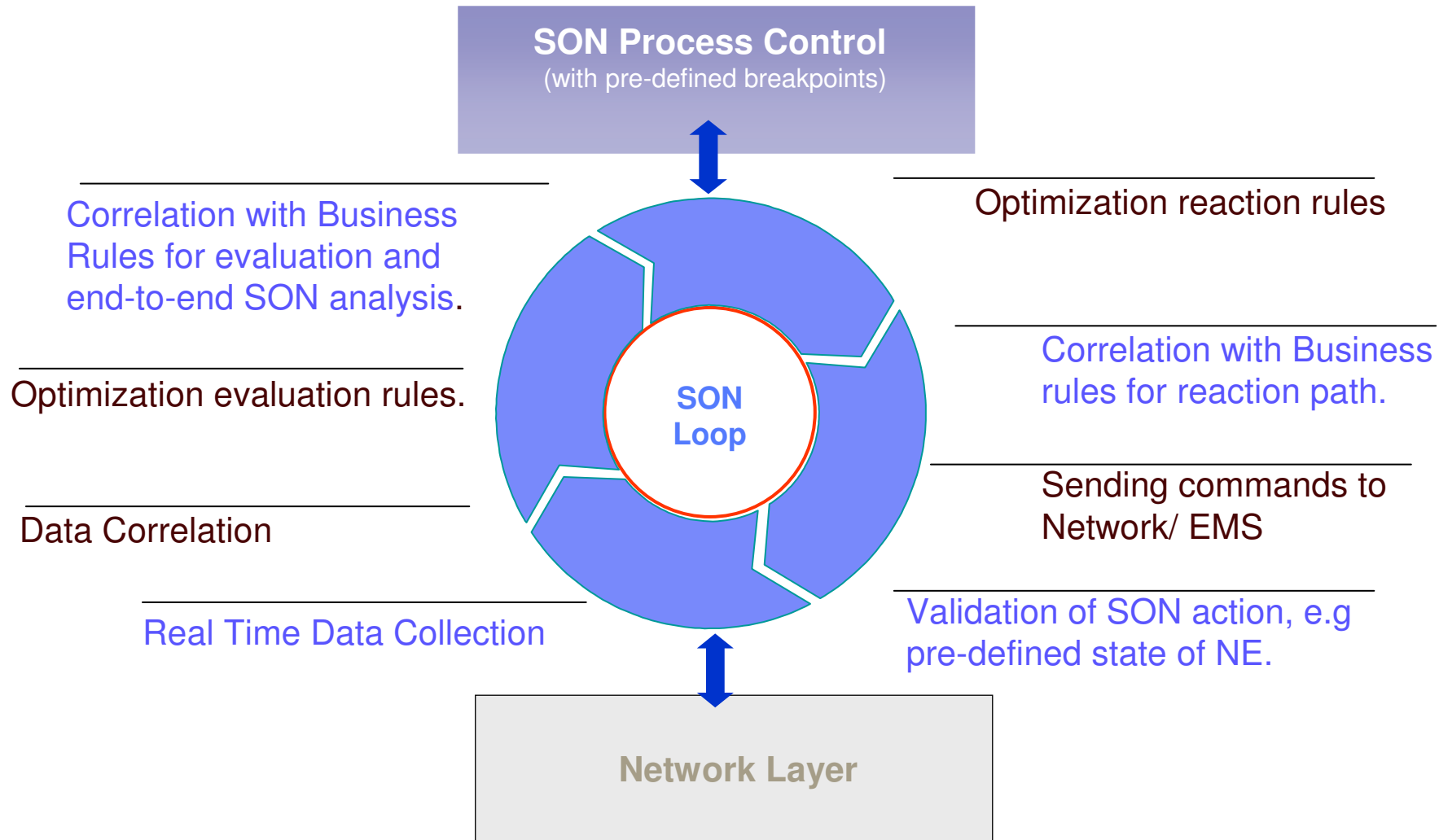
The SON automatically orchestrates distributed, complex and dynamic processes



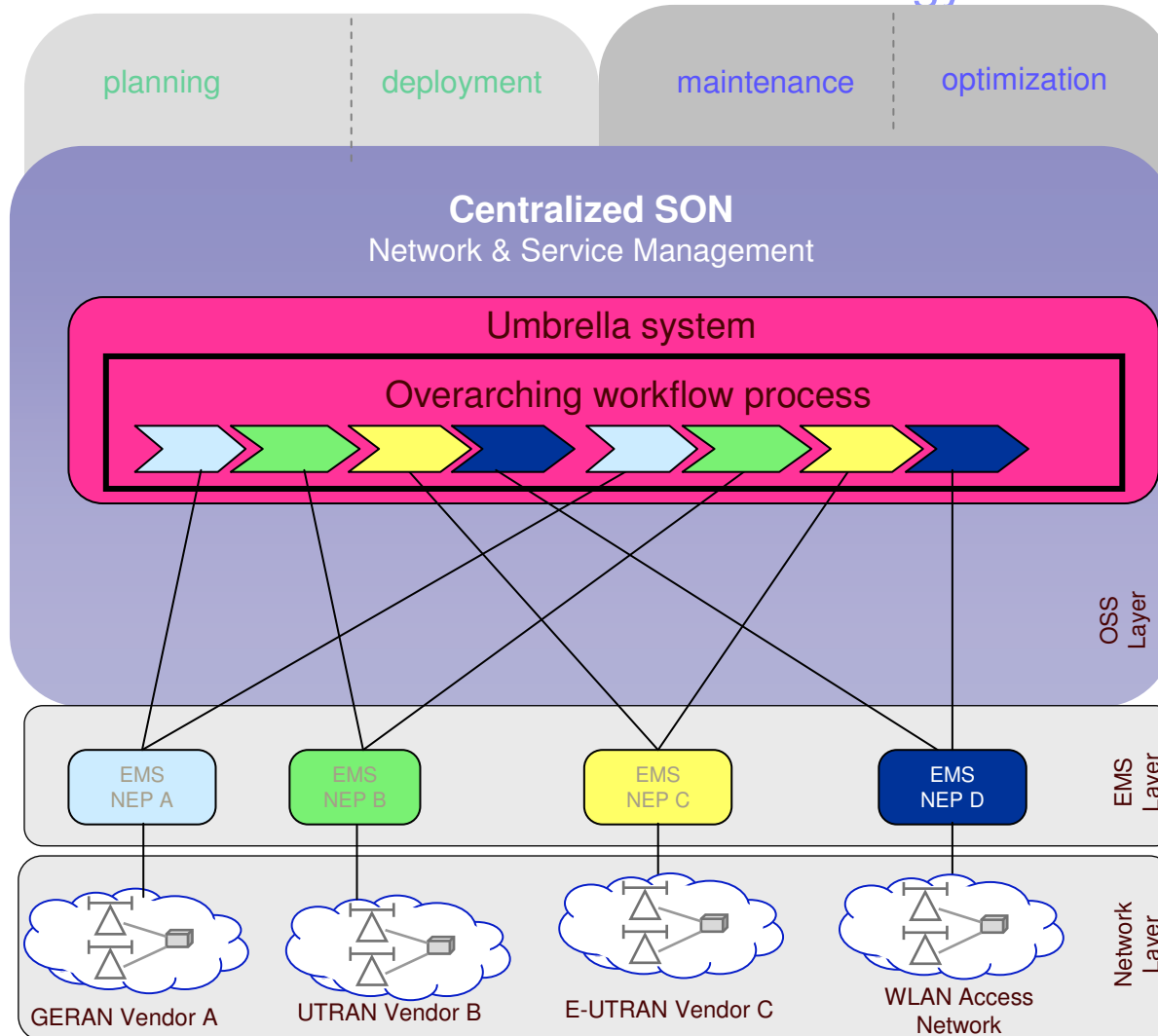
The SON automatically handles various types of information



With the centralized SON solution we are introducing new SON capabilities to enable an overarching and automated process managing multi-technology and multi vendor networks.

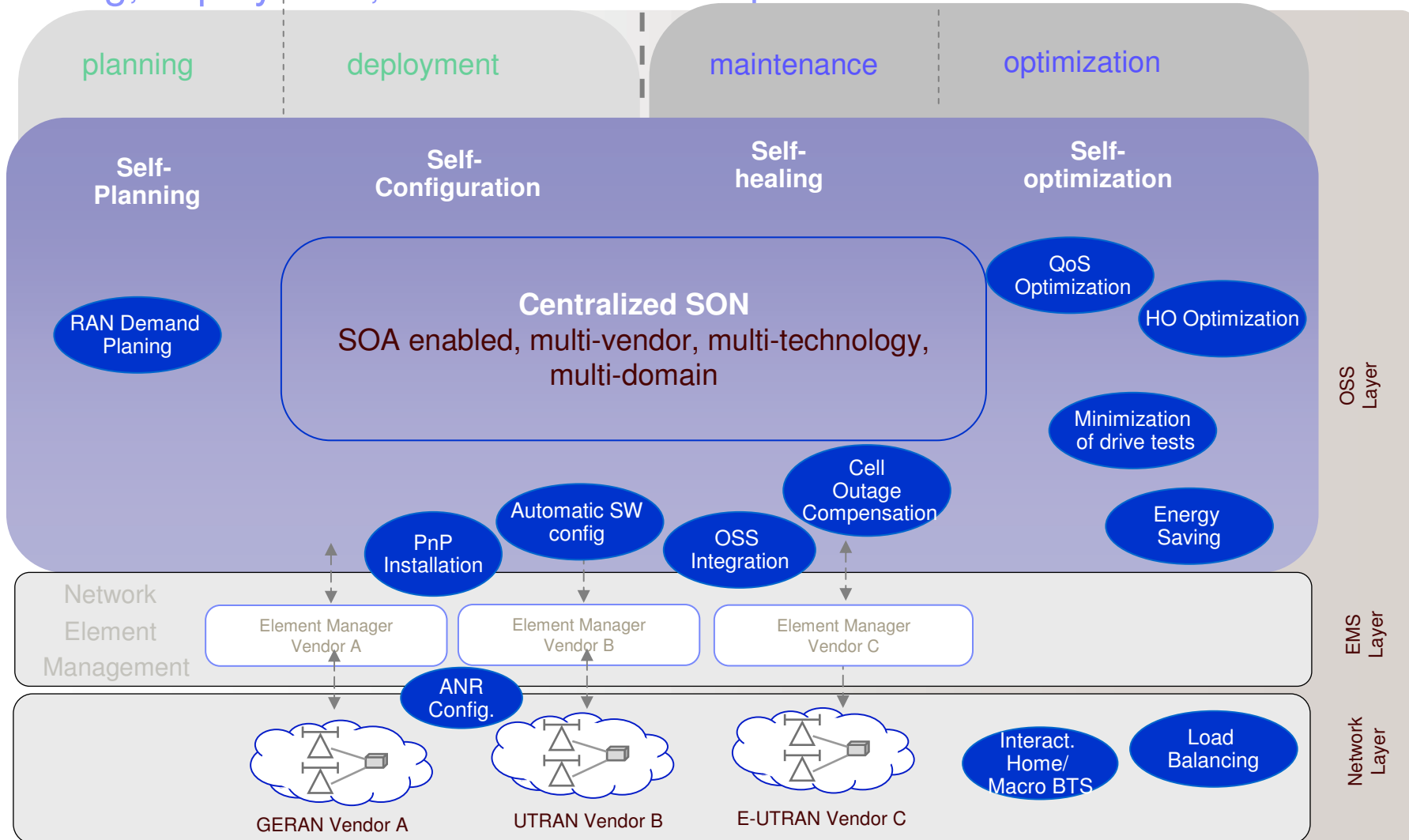


Components as provided by different Network Equipment Providers (NEPs) are integrated and orchestrated using an Umbrella System to support multiple use cases for multi-vendor and multi-technology.

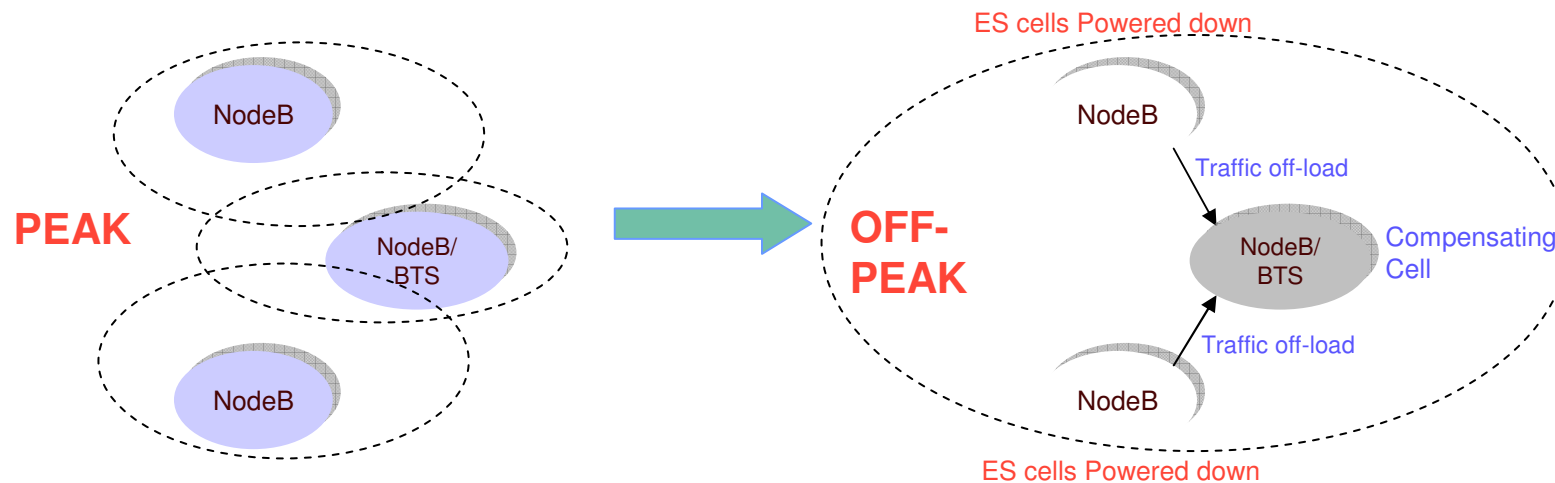


- A hierarchical architecture helps to manage the overall SON complexity
- The hierarchy enables the overall system to become NEP agnostic:
 - NEPs will design their solution with focus on their own equipment
 - Overarching layer will **orchestrate** various NEP centric components that may exist on lower levels.
 - support a real end to end view at network and service level.

SON Solution need to support use cases with different grade of integration for multi-vendor, multi-technology and multi-domain environment in the areas of planning, deployment, maintenance and optimization.



Use Case Energy Saving provides capabilities to power down cells within low traffic periods. The time window will be calculated and adjusted according traffic data provided by the network.



Main principles for the Use case 'Energy Saving' for 2G- 3G network

- The Energy Saving mode is based on the principle that an overlay network/ technology (compensation cells) covers the area/ capacity of Energy Saving Cells (ES) during switch-off period. (traffic off-load from 3G to 2G/EDGE)
- Calculation of the mapping between Energy Saving (ES) and Compensating Cells (CC) done based on Performance Measurements and adjusted constantly.
- The decision to switch-on/ off is realized on actual traffic data in near-realtime within the area and business rules (e.g. calendar, black list, etc.) to provide more flexibility and control.
- Fully automated process with user break points

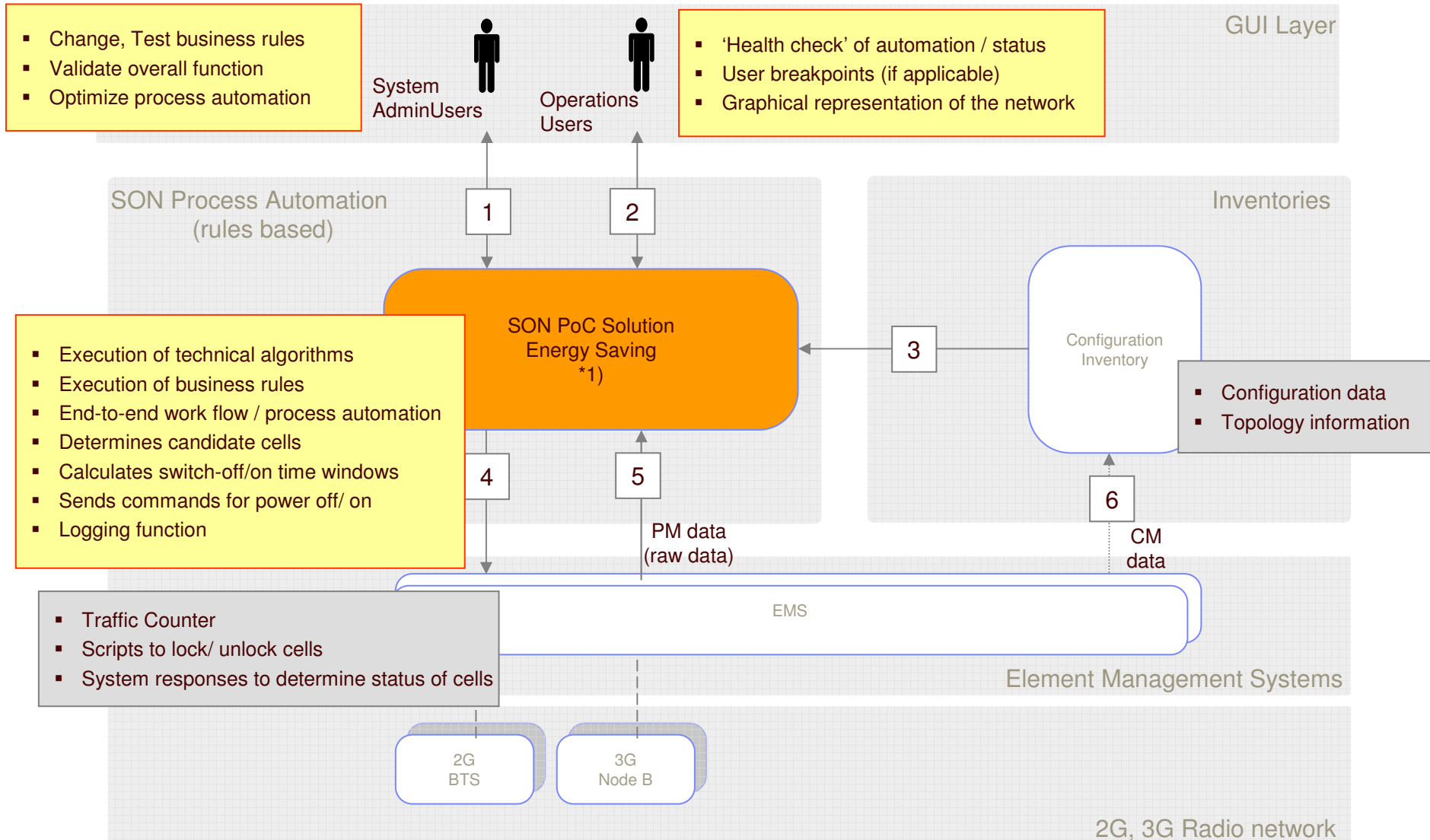
With the Proof of Concept for Use Case Energy Saving we have demonstrated a robust and stable process automation which can contribute to achieve significant energy savings per year.

SON PoC Objectives

- Demonstrate the added value of a centralized, integrated and automated SON solution.
- Demonstrate the support of multi-vendor and multi-technology 2G, 3G Radio Access.
- Demonstrate the added value of integration of 3rd party component for RAN specific (technical) optimization rules and Process Automation and Business Rules Engine from IBM.
- Demonstrate SON evaluation path (technical optimization and business rules) based on near-real time Performance Measurement data collected from a selected test network (Live network)
- Demonstrate reaction rules by simulation.
- Demonstrate combination of human interactions ('break points') with automated SON functions.
- Documentation of automated SON activities (Reports, logs, Monitoring, etc.)
- Demonstrate near-real time analytics for evaluation and reaction path (simulated) of SON.
- Demonstrate of transparency, reproducibility, and traceability of automated SON activities by providing documentation e.g. Reports, logs, Monitoring.

System Context Diagram

SON PoC for Energy Saving realized together with Tier-1 Mobile Network Provider



Why IBM?

- IBM can provide the products and capabilities for
 - Comprehensive reporting based on COGNOS
 - Profound handling of Rules and Workflows mainly via iLOG
 - Transparent End-to-End solution, combining
 - Pre-integrated infrastructure e.g. Tivoli Suite
 - Operational processes (ITIL V3 readiness for change Mgmt)
 - WW lead for methodology and tooling (SOA, SOA Services, SOA transformation and integration with legacy IT components, e.g. WFM, ..)
- IBM can integrate the various NEP specific partial solutions into a consistent overall architecture
- IBM can provide architectural governance and WW project experience

Conclusion

Centralized SON.....

- is the best way to achieve ‚overarching‘ and automated operational processes
- can combine processes with user interaction (ITIL, other) and automated processes.
- is able to introduce process automation gradually as desired by the operator.
- is focused on use cases where end-to-end function is essential.
- is based on an open, modular and flexible architecture and able to cover multiple use cases.
- is available today and realization can start immediately
- Is able to manage multi-technology, multi-domain and multi-vendor networks efficiently ¹⁾ ²⁾
- is adhering to standards (3GPP, TMF) where possible and where available.
- is an OSS centric approach adhering to SOA principles
- can manage multiple use cases and avoid interference / conflicts between the use cases

1) SON standardization currently focused on eUTRAN aspects

2) To avoid domain specific O&M silos (e.g. 3G, LTE, WiFi)

Thank you for your attention!

Any questions?