



Nokia Siemens
Networks



TUM

Technische Universität München



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VDE/ITG Workshop on
“Consistent System Optimization”

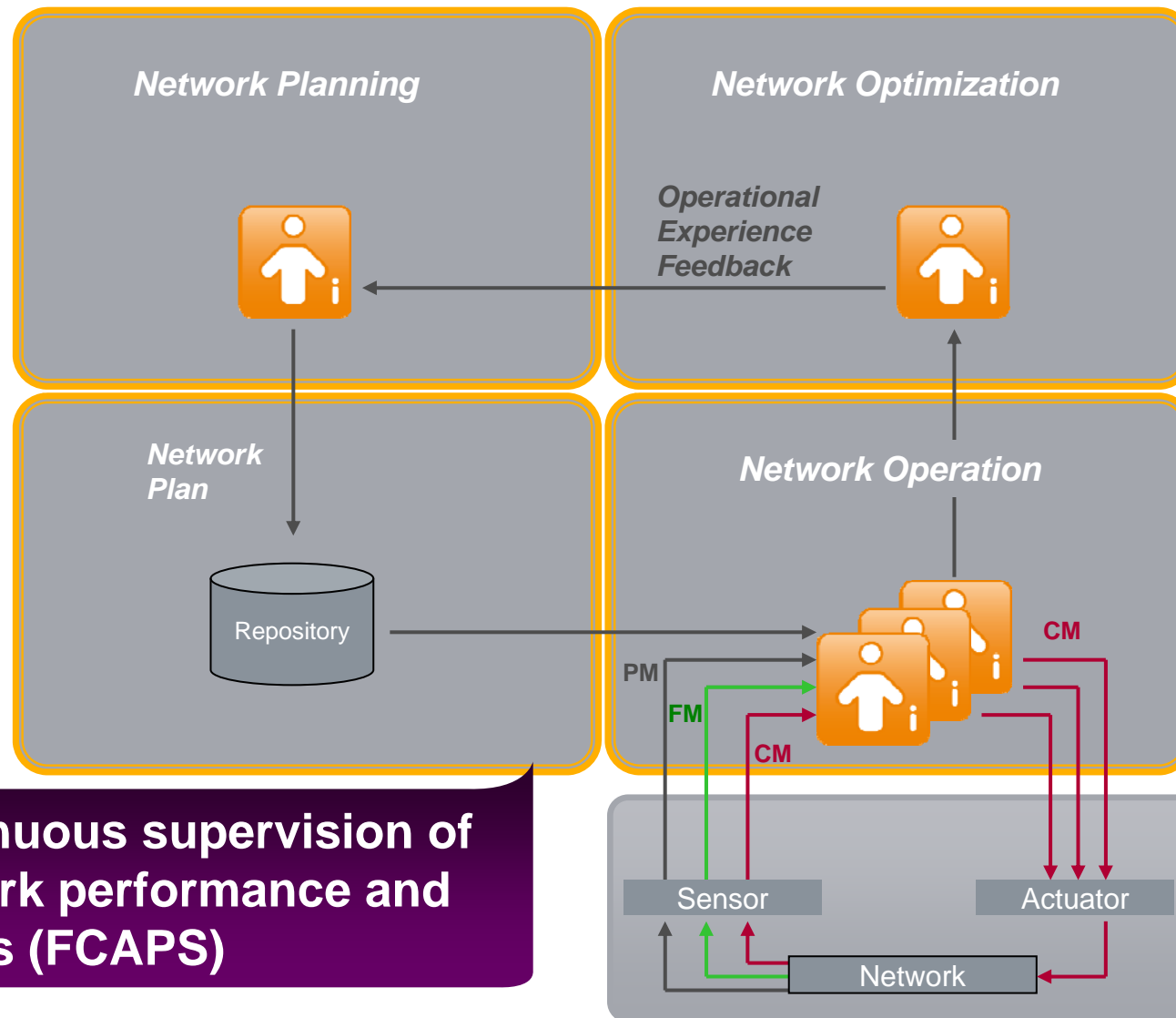
Policy-based Coordination and Management of SON Functions

Tobias Bandh – TU München

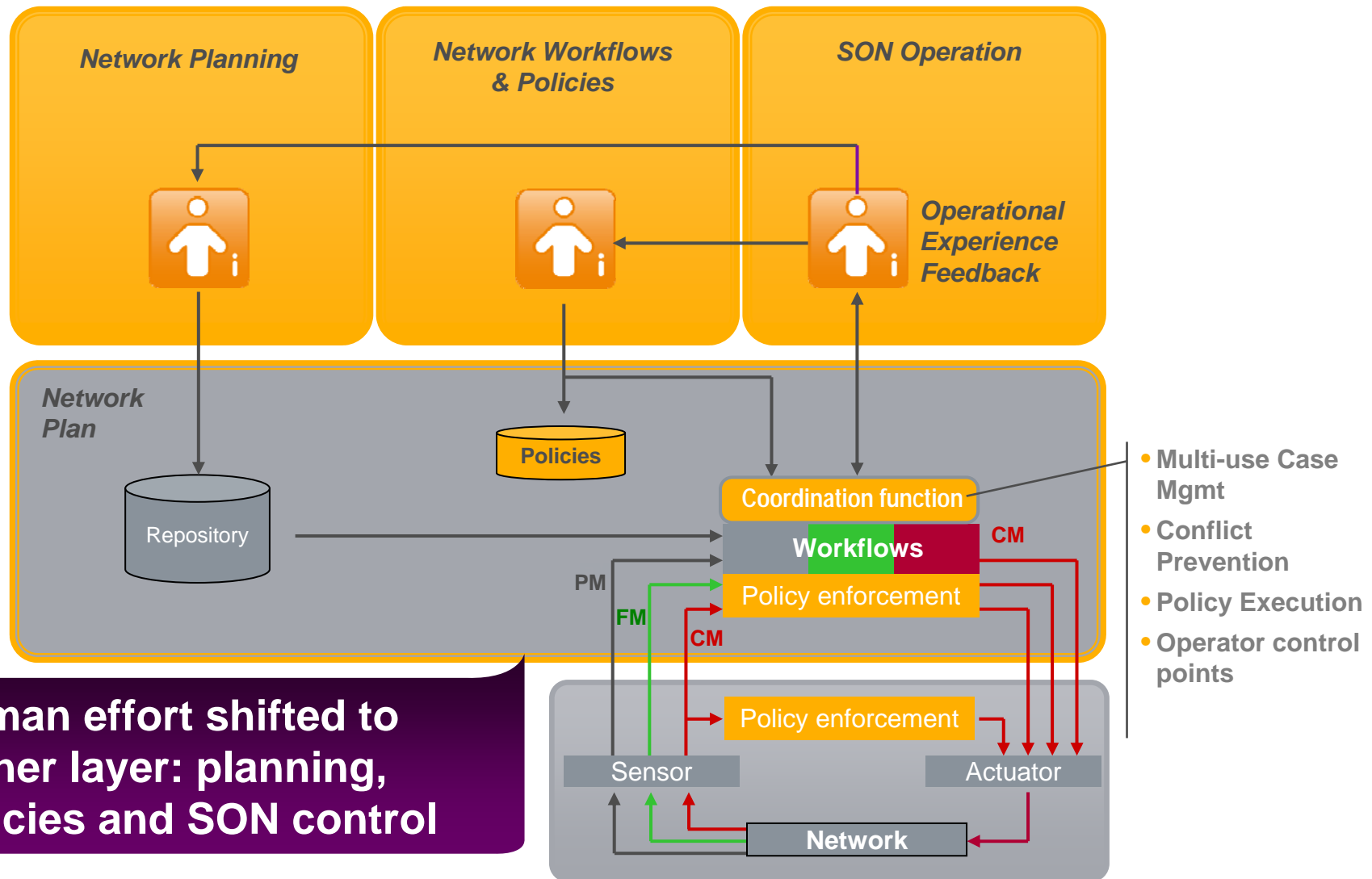
Raphael Romeikat – Uni Augsburg

**Henning Sanneck, Haitao Tang –
Nokia Siemens Networks Research**

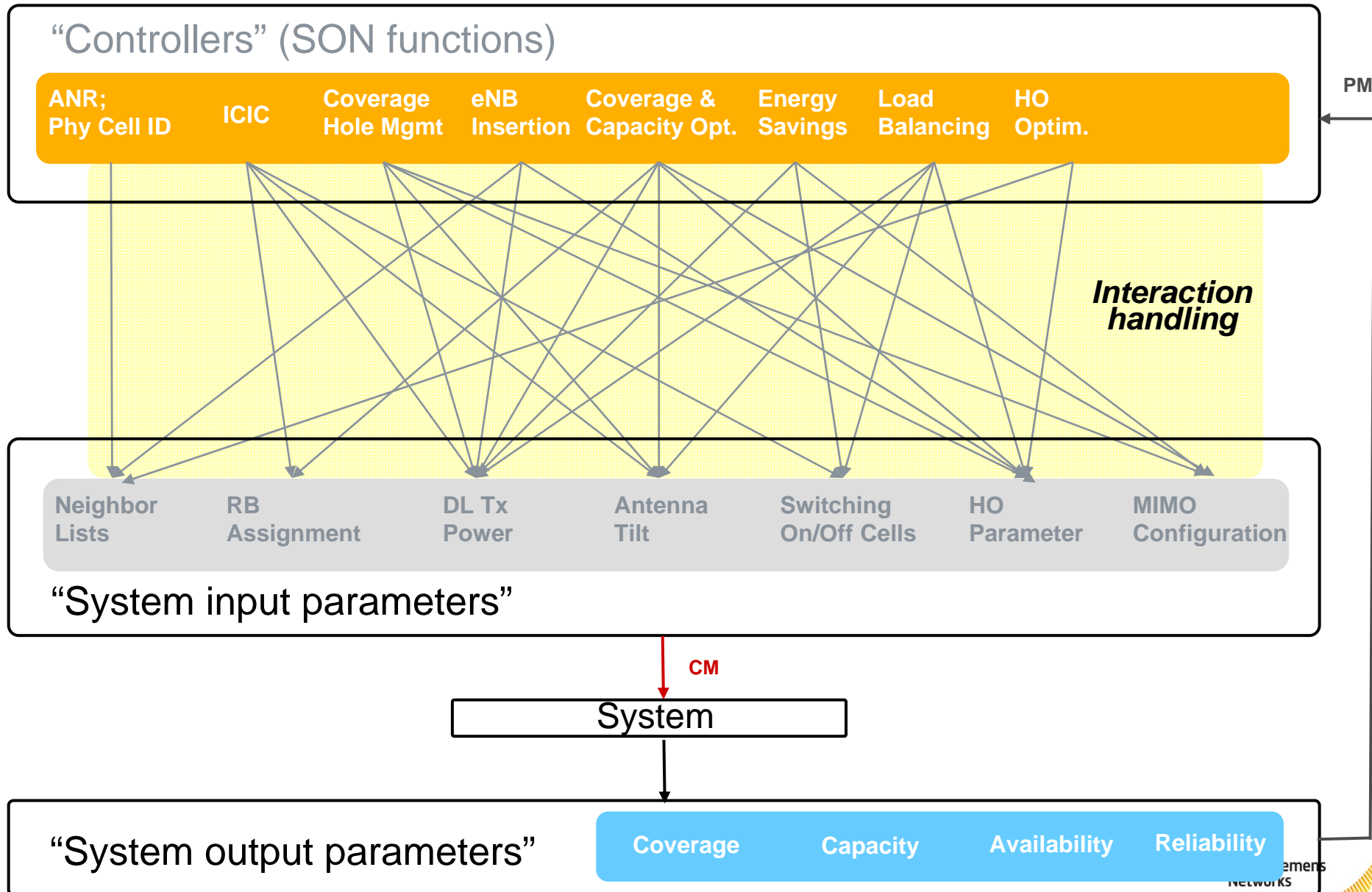
Network Operations today



SON Vision – closed loop automation

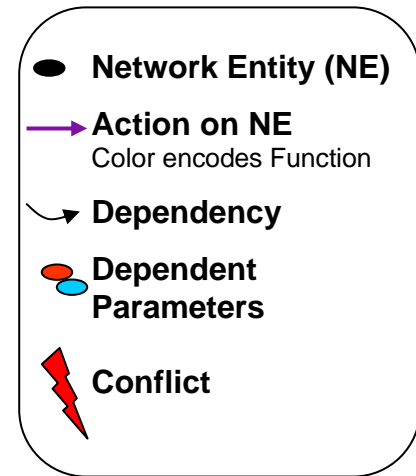
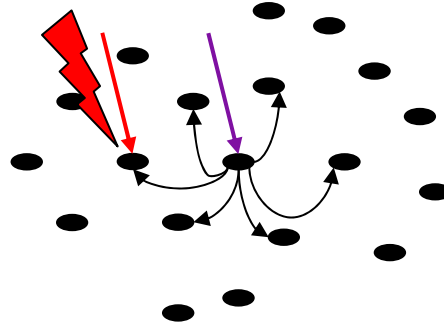


Control engineering view on a SON system

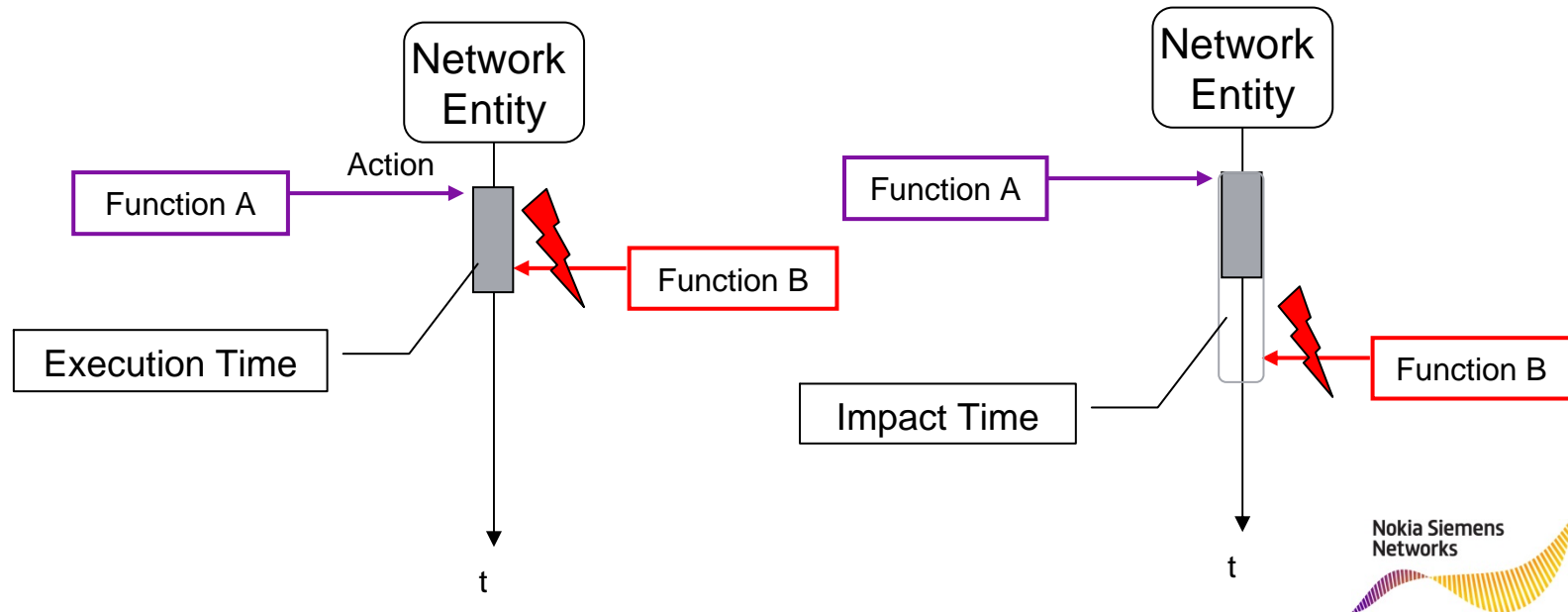


SON Function Dependencies → Conflicts

- Spatial



- Temporal



Policy-based Coordination and Management of SON Functions: Approach

Goals:

1. Enabling the control of the SON system by the human operator (governing the behaviour of the SON functions based on business-level requirements)
2. Assuring the stable operation of the SON system as a whole:

Analysis of SON function interaction semantics: **what** are potential interactions / conflicts between actions of SON functions (logical errors / oscillations, race conditions, deadlocks)

Decision trees

SON function interaction handling concept: **how** can potential interactions be detected and resolved at run-time

- Detection: **context** on the SON functions and the network entities they operate on
- Resolution: **policy**-based coordination of functions (policies realize the decision trees)

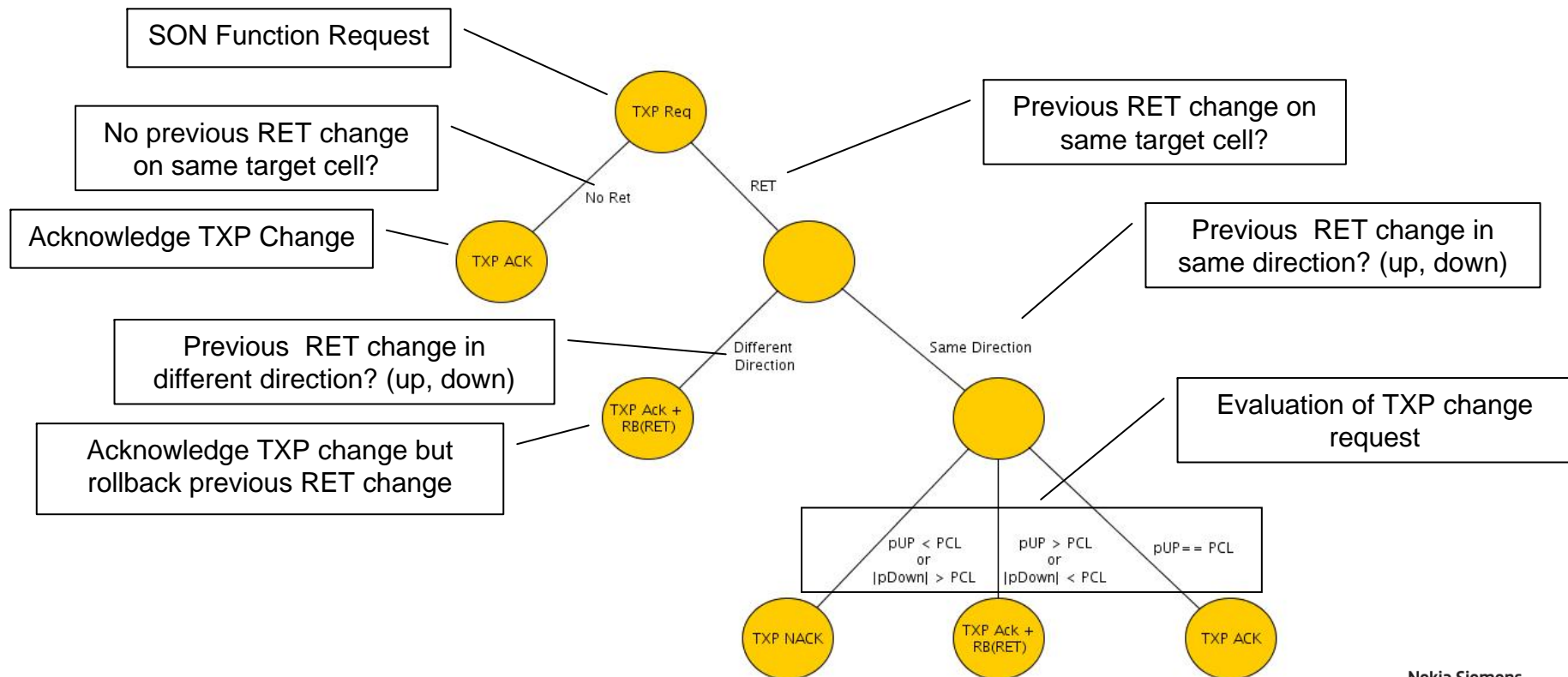
Coordination functions

Example: Coverage and Capacity Optimization

- Modification of cell sizes to
 - reach full coverage
 - balance load and optimize the per cell capacity
- Two independent SON Functions realize the CCO
 - CCO-TXP → Changes transmit power
 - CCO-RET → Changes Antenna Tilt
- Both functions influence cell size / coverage area
 - Concurrent execution on the same cell not possible
- Requires coordination of functions to avoid negative impacts
 - A request for a configuration change by a SON function causes an evaluation of the network context
 - The request is acknowledged (ACK) or discarded (NACK); it is possible that an acknowledged change has to be rolled back (RB) later

Example: Coverage and Capacity Optimization

- Analysis of SON Functions produces solution agnostic decision trees
- Step by step guideline for acknowledgement or discarding of SON Function execution request

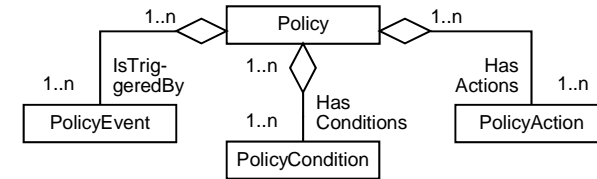


Example: Coverage and Capacity Optimization

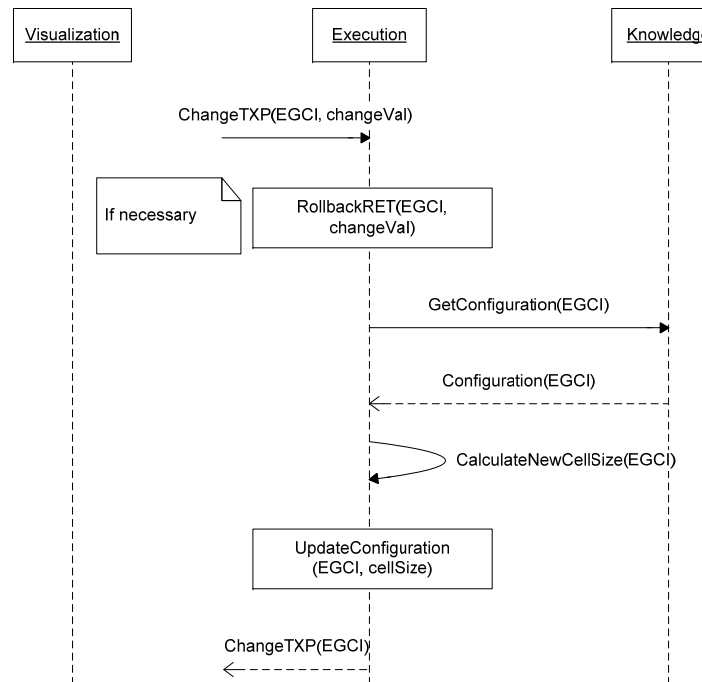
Change TXP policy

```

policy event: root/event/workflow/changeTXP;
condition: [ :property :changeVal |
  (root/conditionChecker noRET:property) |
  (root/conditionChecker lastRETWithDifferentDirection:property changeVal:changeVal) |
  (root/conditionChecker powerConditionTXP:changeVal)
];
action: [ :id :property :changeVal |
  root/actionExecutor changeTXP:id property:property changeVal:changeVal
].
  
```

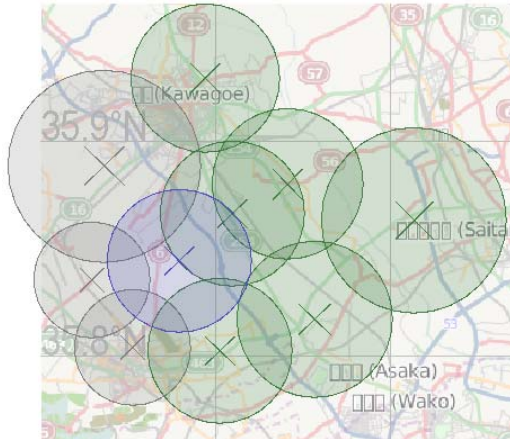


Change TXP function

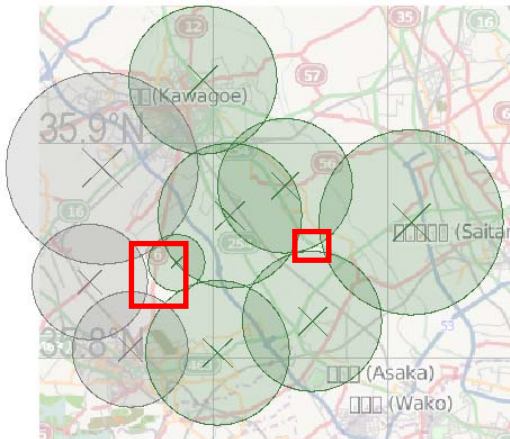


Example: Coverage and Capacity Optimization

- Result with coordination: optimized coverage



- Result without coordination: some coverage holes remaining



Change	Value	Cell	Coordination
RET	-1	18	ACK ←
RET	-1	17	ACK ←
RET	-0.5	16	ACK ←
TXP	0.25	20	ACK
TXP	0.25	23	ACK
TXP	0.4	25	ACK
TXP	-0.6	16	NACK
TXP	0.35	17	ACK, Rollback
TXP	0.2	19	ACK
TXP	0.3	18	ACK, Rollback

Conclusions

- Automation of Network Management is crucial for the introduction of next generation (mobile) network technologies
- Control by the human operator as well as stability of the automated network management system is assured
 - High efficiency through parallel SON function execution
 - Conflicts in case of common impact area and impact time are avoided
- Policy-based management and coordination of SON functions provides framework for:
 - Automatic enforcement of “operator presets”
 - Automatic conflict avoidance based on context

Call for Papers: International Workshop on Self-Organizing Networks



May 15, 2011

- <http://www.ieeevtc.org/vtc2011spring/workshops.php>
- Scope:
 - SON for mobile networks (radio / core / transport) as enabler for efficient network operation
 - Focus on 3GPP technologies (LTE)
 - Results from industry and academia
 - Keynote, papers, posters & demonstrations
- Topics: self-configuration, -optimization, -healing, supporting SON functions and technologies
- **Submission deadline: November 15, 2010**
- Organizers:

