

# SON Management Based on Weighted Objectives and Combined SON Function Models

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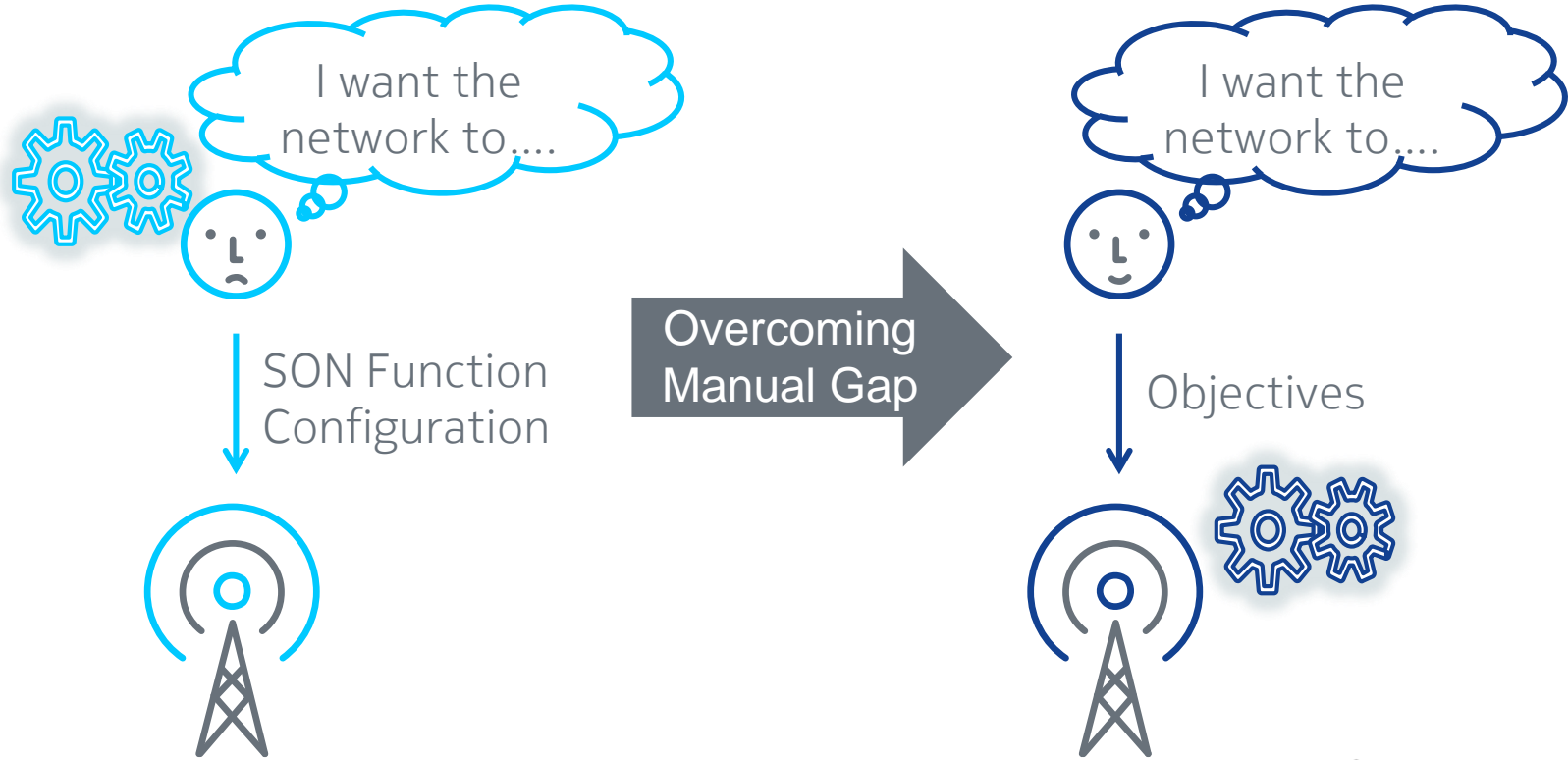
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*Nokia, Munich, Germany*

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## Motivation

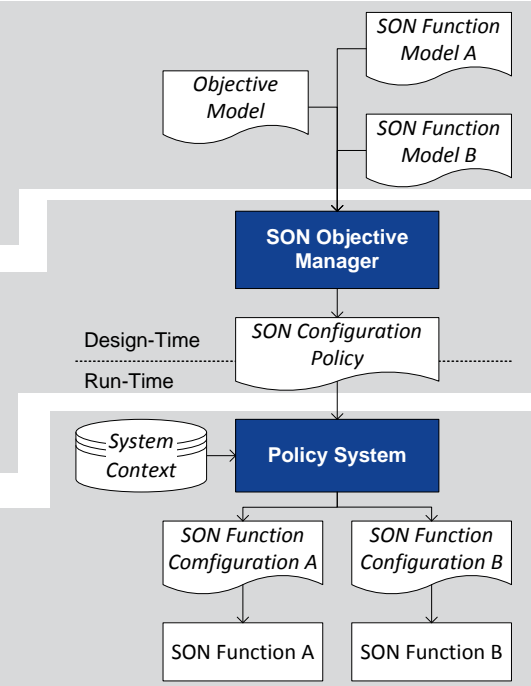
Managing a Self-Organizing Network (SON) with objectives instead of configurations



# Context

SON Objective Manager introduced to fill manual gap

- Different models that separate
  - Context-dependent objectives on Key Performance Indicators (KPI)
  - Effects of a SON function configuration on KPIs
- The SON Objective Manager combines them to a policy that determines the best configuration for each network cell context
- The policy system evaluates the policy depending on the context and deploys the applicable configuration to the SON



# Problem

## Shortcomings of the SON Objective Manager

### Limited expressivity

- SON function model and objective model can only express maximization, minimization, and neutrality regarding KPIs

### Prioritized objectives

- Priorities on objectives do not allow a trade-off if not all objectives can be satisfied

### Complexity

- Policy creation can lead to state space explosion since the configurations for all possible system contexts need to be computed

# Goal

Overcoming the shortcomings with an improved SON Objective Manager

## Limited expressivity



### Set-based semantics of models

- Allows more predicates
- Well-defined model combination and utilization

## Prioritized objectives



### Decision theoretic selection

- Weighted objectives and utility calculation allows a trade-off

## Complexity

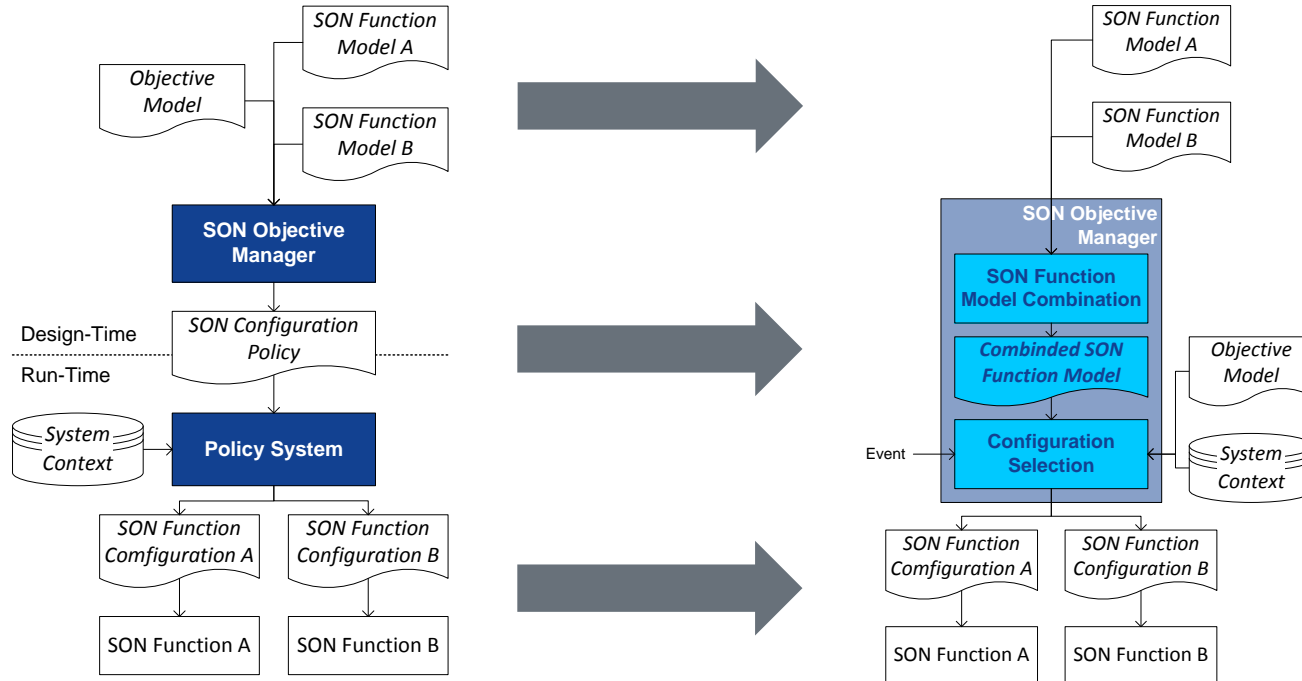


### Run-time computation

- Solely considers the actual current network cell context for the configuration

# Solution: Overview

Functional overview of a new approach for the SON Objective Manager



## Solution: Overview

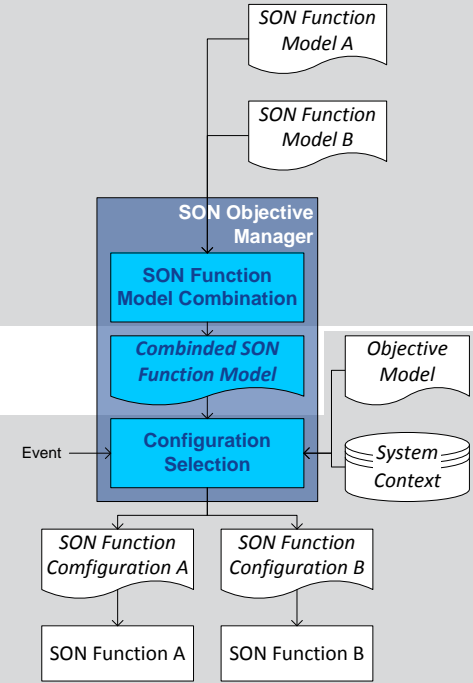
Functional overview of a new approach for the SON Objective Manager

### SON function model combination

- Predict the network performance for all combinations of SON function configurations

### Configuration selection

- Get applicable objectives for context
- Calculate the utility of combined SON function configurations
- Deploy best combined configuration

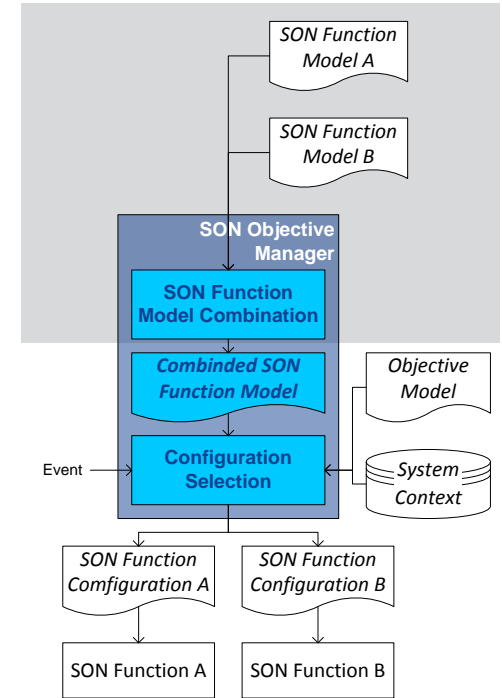
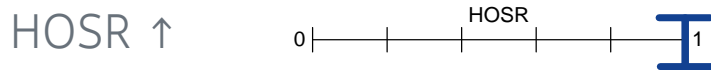


# Solution: SON Function Model Combination

Network performance prediction for combined SON function configurations

## SON function model

- Contains a set of configurations and their effects on each and every KPI for one SON function
  - An effect is the definition of KPI values that are possible
  - Set-based semantics: an effect is a subset of the set of all values of a KPI, e.g.,





# Solution: SON Function Model Combination

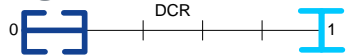
Network performance prediction for combined SON function configurations

## SON function model combination

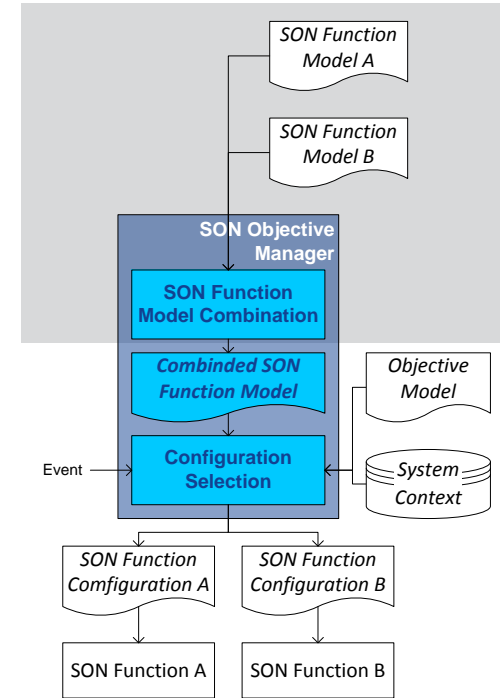
- Effect prediction for multiple SON functions with specific configurations
  - A KPI value is an effect of a combined SON function configuration if it is the effect of all configurations, i.e., intersection of the effects



- Conflicts between configurations can lead to undesired system behavior, e.g., oscillating network configuration
  - A pair of SON function configurations is in conflict if they do not agree on their effects, i.e., the effects do not overlap



- Recomputation required on changes of SON function models



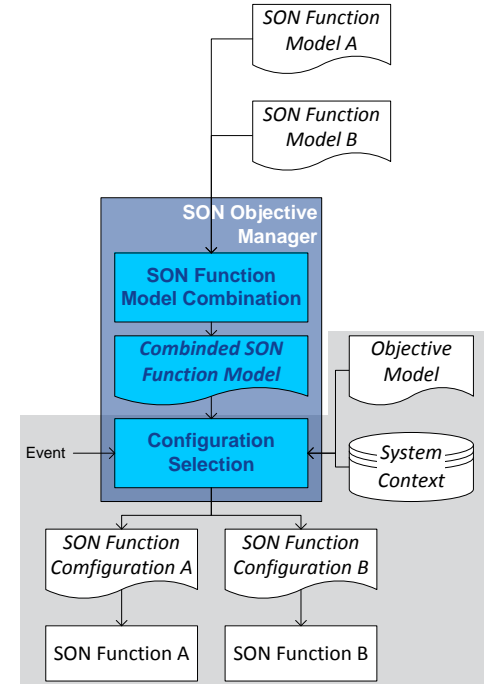
# Solution: Configuration Selection

Calculation of utility of combined SON function configurations for actual objectives

## Objective model

- An objective is a pair of a target for a KPI and a weight
- An target is the definition of a set of acceptable values for a KPI (semantics analogous to SON function model)
- A weight defines the importance of the satisfaction of the target, i.e., it allows a trade-off between objectives if not all can satisfied
- Objectives are context dependent, e.g., through rules

**IF location=rural THEN dcr  $\leq$  0.02 WITH 0.5**

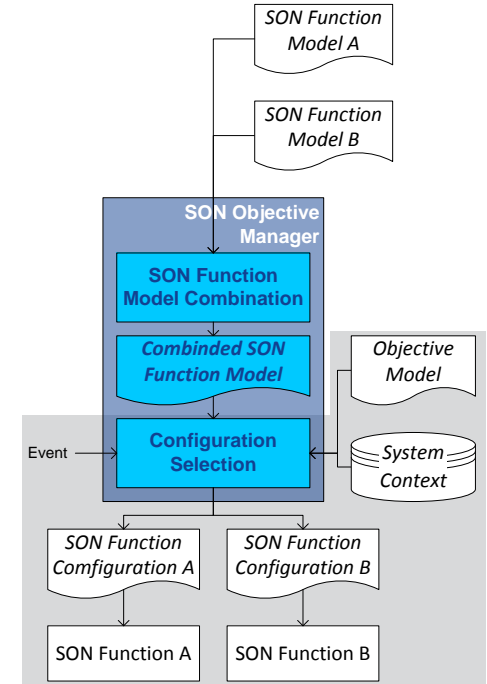


# Solution: Configuration Selection

Calculation of utility of combined SON function configurations for actual objectives

## Utility of combined SON function configuration models

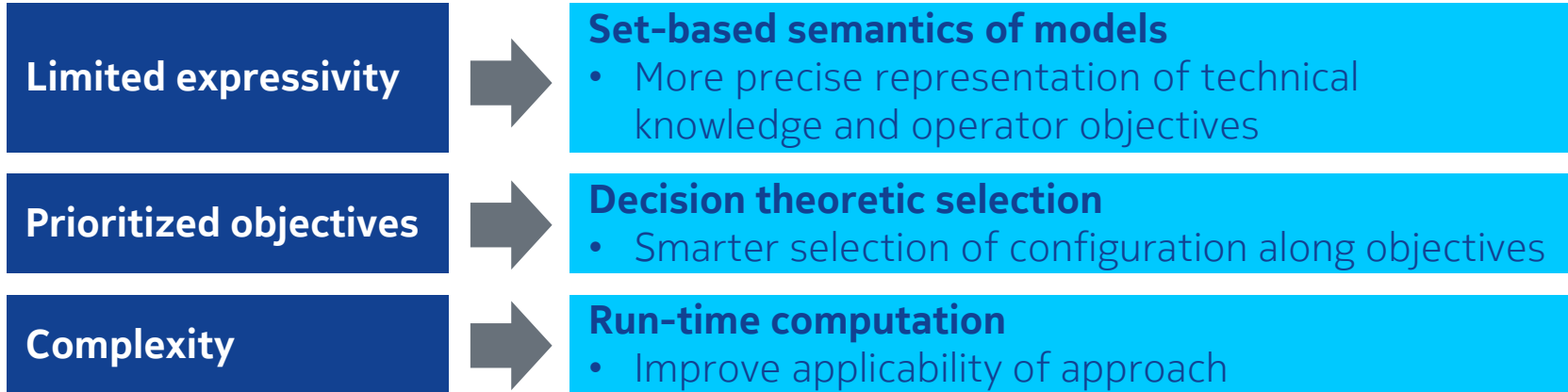
- Iteratively performed for each and every cell
  1. Collect the applicable objectives for the current cell context
  2. Calculate the utility for each combined SON function configuration
    - Utility = sum of weights of satisfied objectives
    - An objective is satisfied if the entire effect of the combined SON function configuration satisfies the objective target, i.e., the effect is a subset of the target
  3. Deploy the combined SON function configuration with the highest utility
- Execution triggered by events, e.g., timer or network changes



## Conclusion

What the new approach achieves

- Managing a mobile network through objectives instead of network parameters
- Improving the previously introduced SON Objective Manager



# NOKIA

**UNA** Universität  
Augsburg  
University

The screenshot displays the SEMAFOUR Operator Panel interface. The window title is "Operator Panel" and the application name is "SEMAFOUR Operator Panel". The date and time in the top right corner are "2014-09-23 09:01:28".

The interface is divided into several sections:

- Objectives:** This section contains a configuration area for two objectives: **CLASS\_001\_NORMAL** and **CLASS\_002\_BUSY**. Each objective has several adjustable parameters: CDR (Control Delay Ratio), HOSR (Handover Success Rate), UT (User Throughput), and CL (Control Loop). For CLASS\_001\_NORMAL, CDR is set to 4, HOSR to 90, UT to HIGH, and CL to LOW. For CLASS\_002\_BUSY, CDR is set to 10, HOSR to 80, UT to MEDIUM, and CL to HIGH. Below the configuration area, there are buttons for "OBJECTIVE Set I" through "OBJECTIVE Set IV" and a "New" button. A "Deploy" button is located at the bottom right of this section.
- SON Parameters:** This section shows the configuration for SON (Self-Organizing Networks) parameters. The "MRC" (Mobility Reference Class) is set to "MLB" and the "SCV Set" (Service Class Value Set) is set to "MRO\_7". The parameters are listed as follows:

Parameter	Value
Method	Window
Window	120
Events	-1
Policy	1, 05, 7
Hysteresis	0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10
Time_to_trigger	0, 1, 2, 3, 4, 5, 6, 10, 12, 25, 51
- Policy:** This section displays a list of classes and their associated MRC (Mobility Reference Class) and MLB (Mobility Level) values. The classes are listed in a table:

Class	MRC	MLB
CLASS_001_BUSY	MRO_7	MLB_41
CLASS_001_NORMAL	MRO_1	MLB_2
CLASS_002_BUSY	MRO_7	MLB_67
CLASS_002_NORMAL	MRO_7	MLB_67
CLASS_003_BUSY	MRO_7	MLB_67
CLASS_003_NORMAL	MRO_7	MLB_67
CLASS_004_BUSY	MRO_5	MLB_2
CLASS_004_NORMAL	MRO_5	MLB_2
CLASS_005_BUSY	MRO_7	MLB_67
CLASS_005_NORMAL	MRO_7	MLB_67
CLASS_009_BUSY	MRO_7	MLB_41
CLASS_009_NORMAL	MRO_7	MLB_67