Dynamic, Context-Specific SON Management Driven by Operator Objectives

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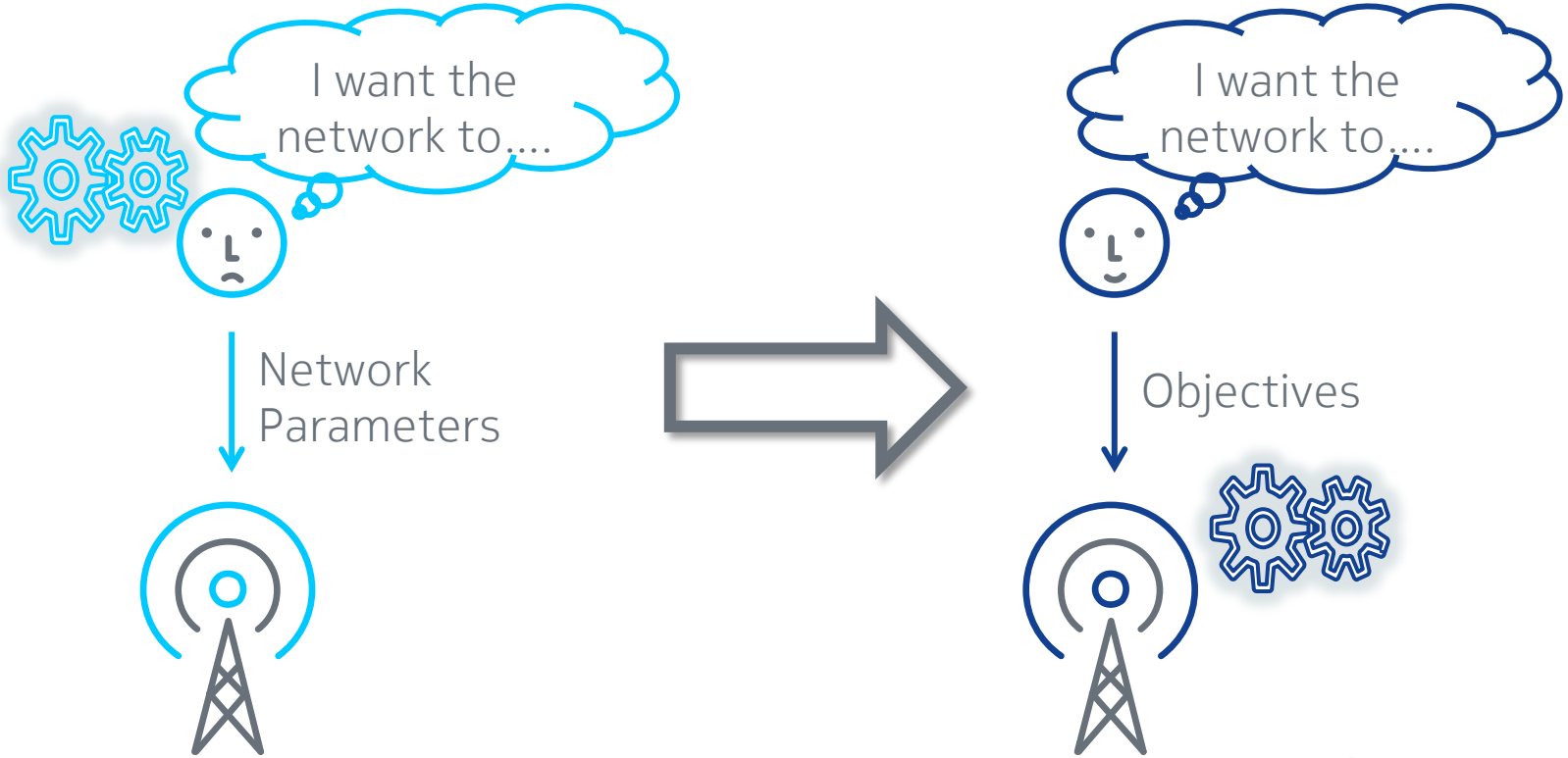
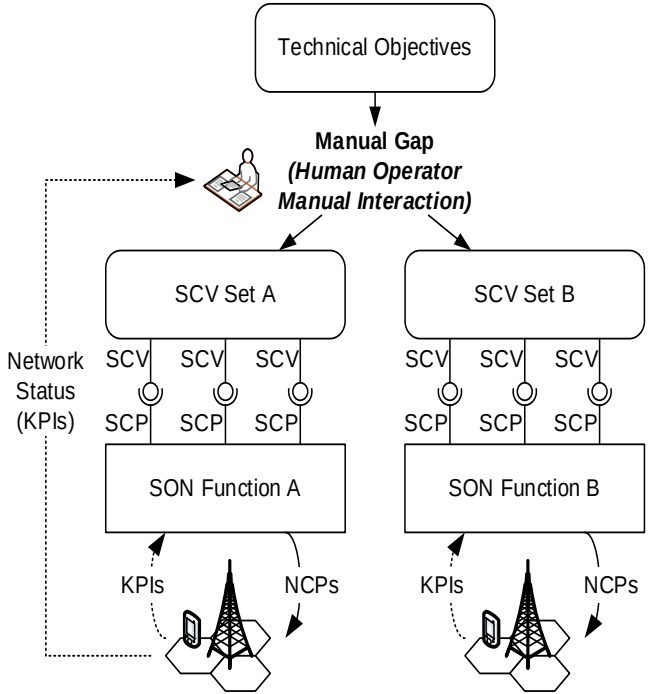
The Goal (from 30.000 ft) …

… Managing a Mobile Network through Objectives instead of Network Parameters



Problem

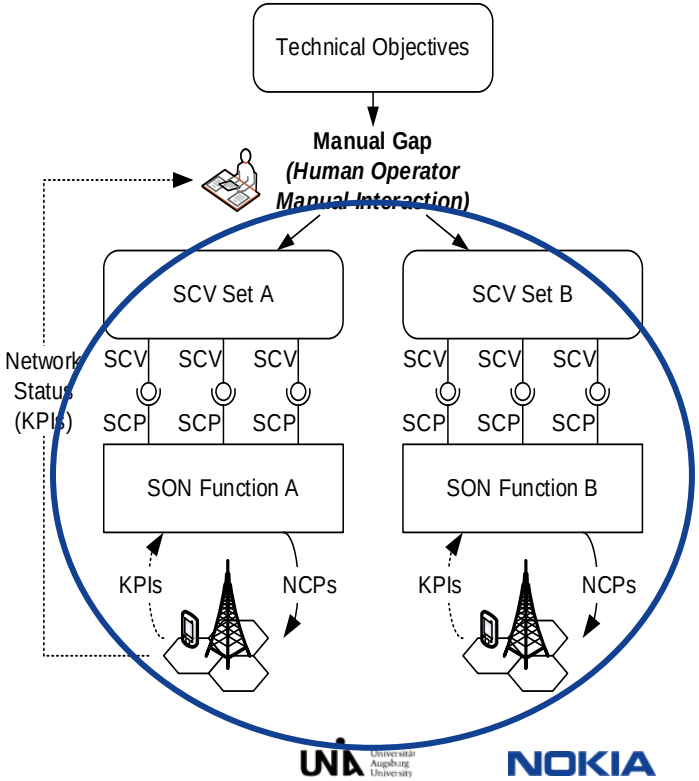
Manual Gap between Operator Objectives and SON Configuration



Problem
Manual Gap between Operator Objectives and SON Configuration

SON Function Configuration

- SON Functions are black boxes that adapt *Network Configuration Parameters (NCPs)* in order to optimize dedicated *Key Performance Indicators (KPIs)*
- *SON Function Configuration Parameter Value (SCV)* Sets configure the SON function behavior
- Depending on the SCV Set, the SON function adapts the network to optimize specific KPIs, e.g., MLB can be configured to optimize cell load or handover settings

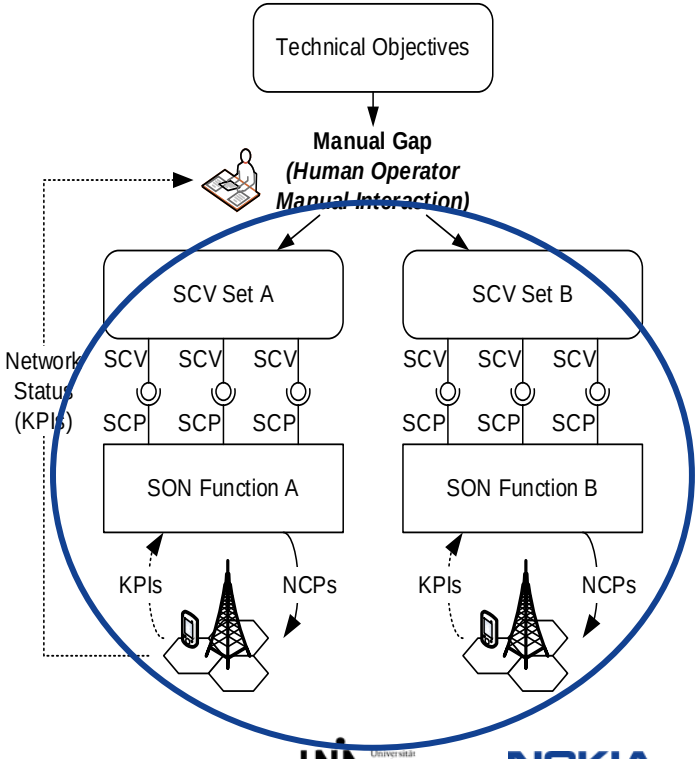


Problem

Manual Gap between Operator Objectives and SON Configuration

Example SCV Set for MLB

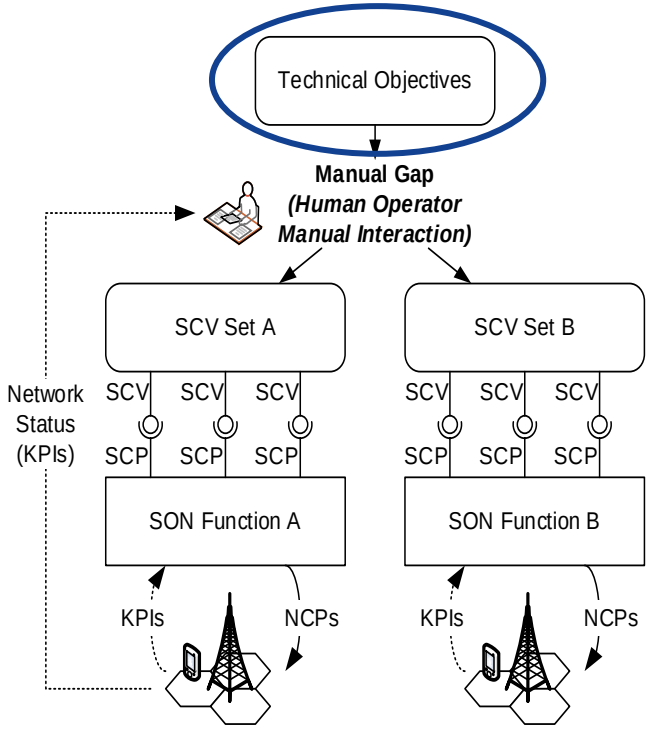
- Upper Cell Individual Offset (CIO) limit = +6dB
- Lower CIO limit = -6dB
- Step size: 1dB
- Upper cell load threshold = 50%
- Lower cell load threshold = 30%
- Load averaging time: 60 seconds



Problem
Manual Gap between Operator Objectives and SON Configuration

Technical Objectives

- Context-dependent, prioritized targets for KPIs
  - Context like time, cell location, and cell type
  - Priorities allow to make a decision between competing KPI targets
  - KPI targets are minimization or maximization of KPI values
- Defined by operator

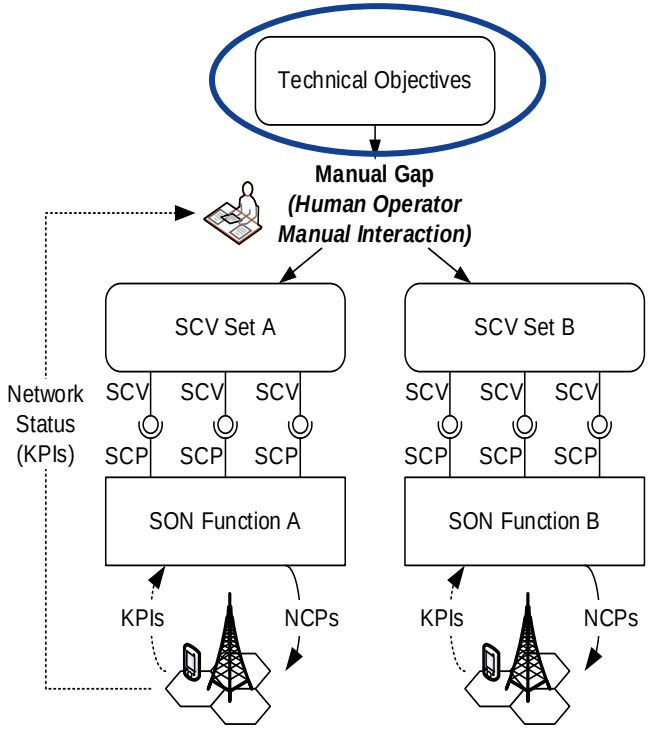


Problem

Manual Gap between Operator Objectives and SON Configuration

Technical Objective Examples

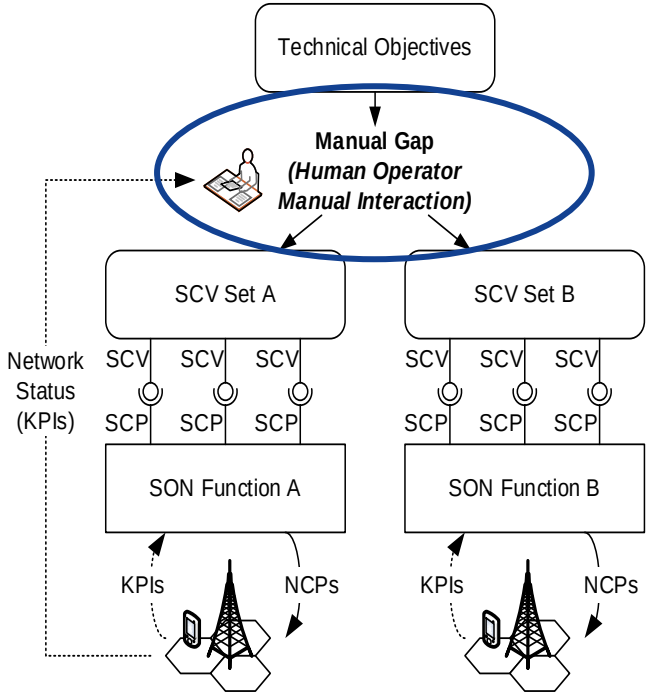
- With a very high priority, the cell load in an urban location during peak hours should be minimized.
- With a high priority, the dropped call rate in an urban location should be minimized.
- With a very low priority, energy consumption during periods with low traffic should be maximized.



Problem
Manual Gap between Operator Objectives and SON Configuration

Manual Gap

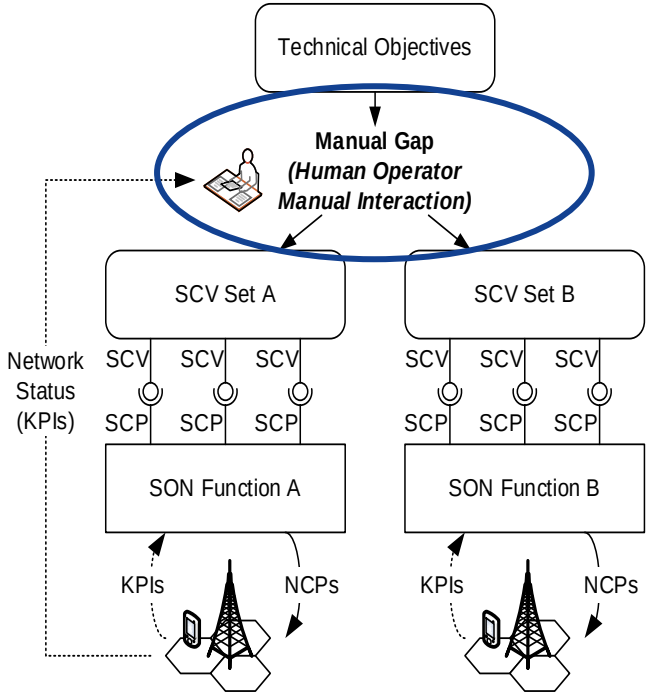
- *Automation gap*
  - Technical objectives need to be manually transformed to SCV Sets
  - Mapping requires technical knowledge usually only available at the manufacturer
- *Dynamics gap*
  - SCV Sets for SON functions need to be set depending on the operational context



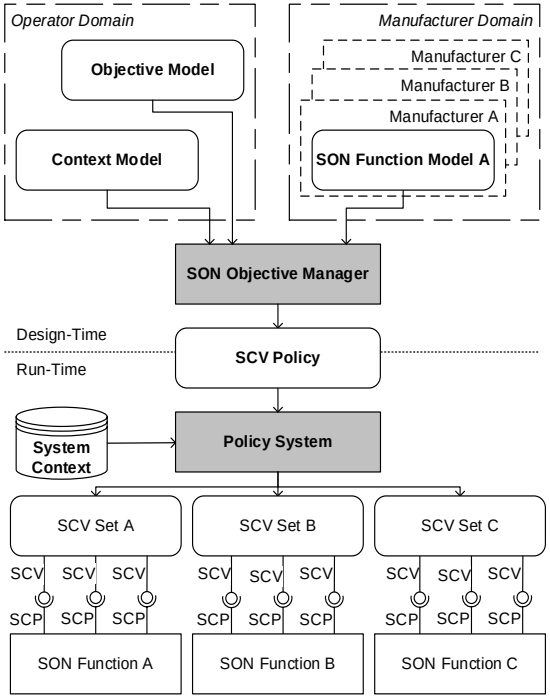
Problem
Manual Gap between Operator Objectives and SON Configuration

Current Solution

- One default SCV Set
  - Per SON function type
  - Valid for all instances of the SON function in the whole network
- Uniform, non-optimal static configuration without context-specific adaptation



Solution Concept
Automatic Transformation & Dynamic, Policy-based Selection



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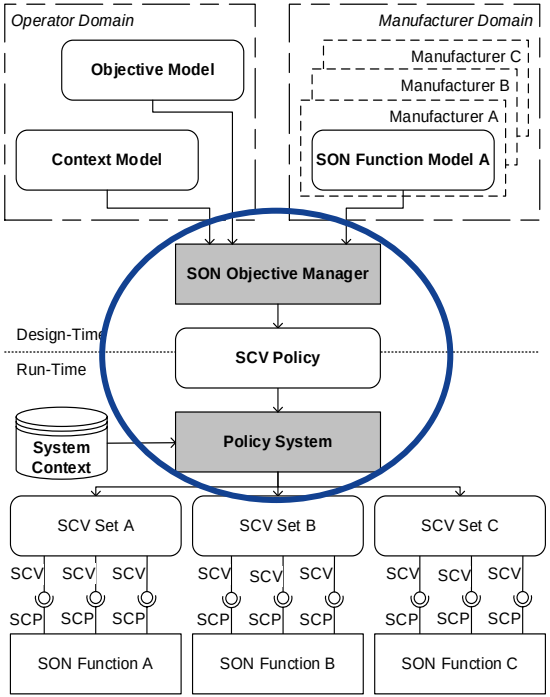


SON Objective Manager

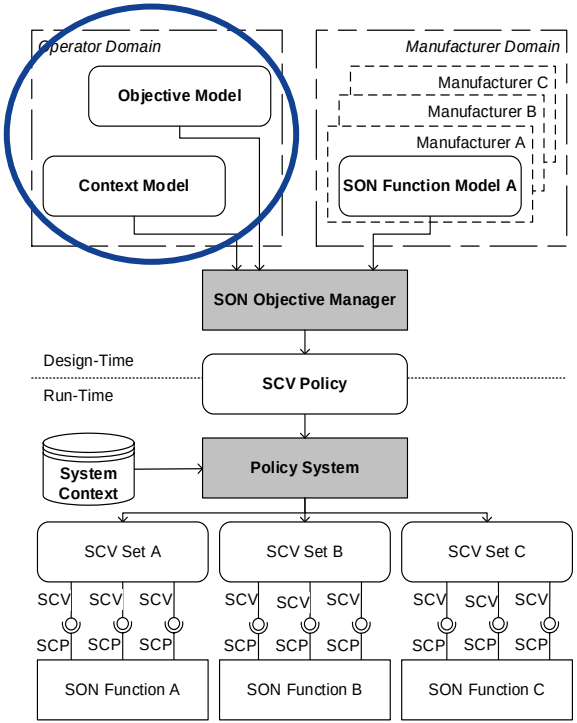
- Overcomes automation gap
- Transforms technical objectives into SCV Policy
- Executes at design time

Policy

Policy System

- Overcomes dynamics gap
- Evaluates the SCV Policy in concrete context and applies SCV Sets
- Executes at run time

Solution Concept
SON Objective Manager



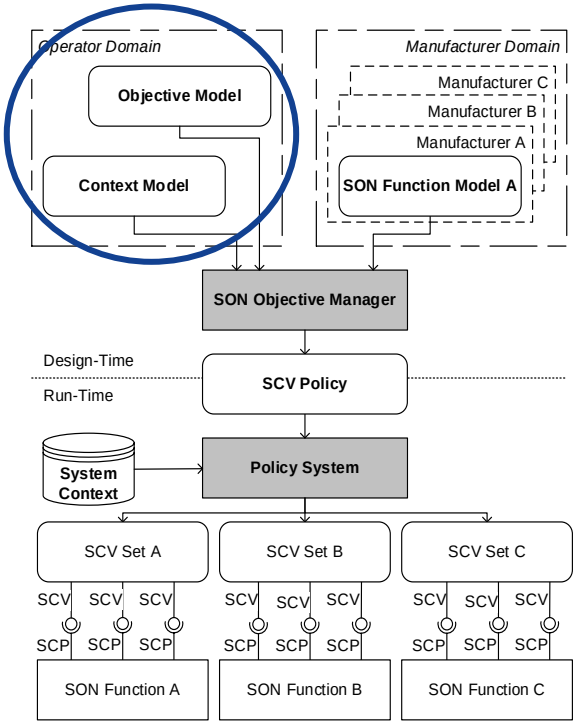
Objective Model

- Machine readable model of objectives, e.g., rules
- Provided by operator

Examples

- IF time in [08:00, 17:59] AND location = urban
  THEN min cell load WITH priority = 1
- IF location=rural
  THEN min energy consumption WITH priority = 4

Solution Concept
SON Objective Manager



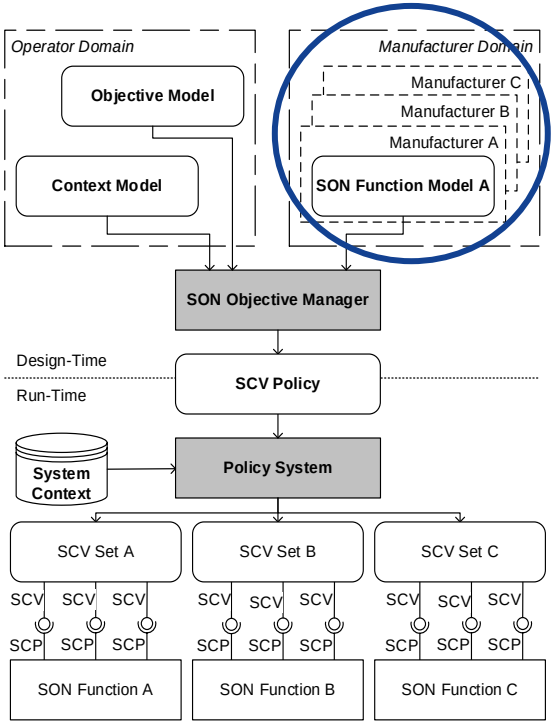
Context Model

- Domains of context variables
- Necessary for computation
- Provided by operator

Examples

- location : {rural, urban}
- time : [00:00, 23:59]

Solution Concept
SON Objective Manager



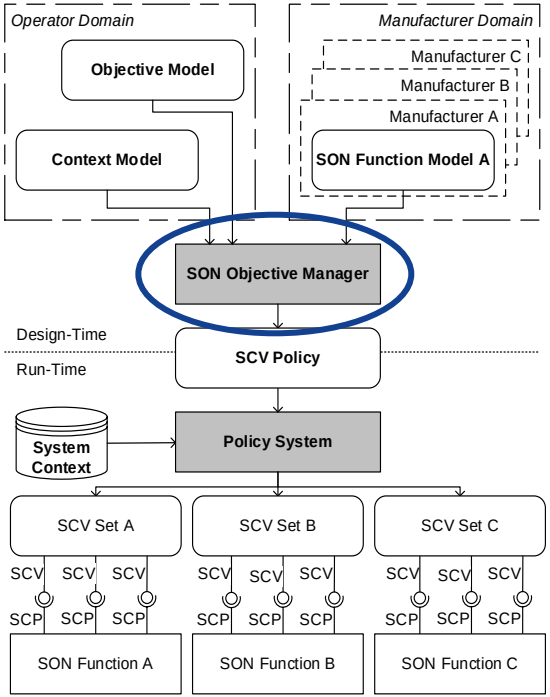
SON function Model

- Machine readable model how SCV Sets satisfy technical objectives, e.g., mapping between technical objective and SCV Set
- Provided by manufacturer

Example for MLB Model

- Minimize cell load → (4, -2, 1, 0.8, 0.5, 30)
- Maximize HOSR → (6, -6, 1, 0.5, 0.3, 60)
- Default → (6, -6, 1, 0.5, 0.3, 60)

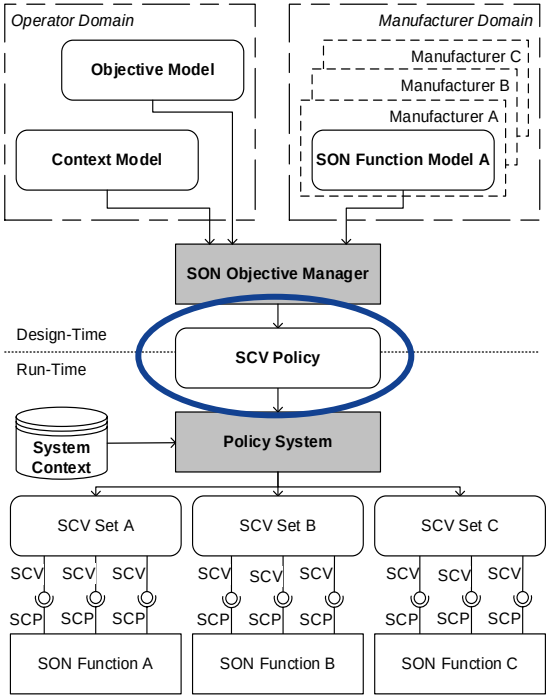
Solution Concept
SON Objective Manager



SON Objective Manager

- 3-step transformation process
  1. Build up state space of all possible system contexts
  2. Assign objectives to system states
  3. Determine SCV Sets which satisfy highest priority

Solution Concept
SON Objective Manager



SCV Policy

- Conflict-free and complete rules defining SCV Sets for all defined context

Example

- IF ((time in [00:00, 07:59]OR time in [18:00, 23:59])
  AND location = urban)
  OR (time in [08:00, 17:59] AND location = rural)
  THEN MLB = (6, -6, 1, 0.5, 0.3, 60)

Conclusion
Achievements

Approach for Overcoming the Manual Gap

- Automation gap → transformation of technical objectives into SCV Sets
- Dynamics gap → configuration of SON functions according to context

Structured Description of Knowledge in Models

- Description of prioritized, context-specific KPI targets in objective model
- Mapping between KPI targets and SON function configuration in SON function model
- Clear separation between operator and manufacturer knowledge

Conclusion
Impact & Next Steps

Impact: Objective-driven network operation

- Relieves operator from repetitive, low-level configuration tasks
- Allows optimized operation of the SON system

Next Steps:

- Making the SON function model context-specific
- Learning of SON function model
- More expressive objective model
- Derivation of technical objectives from high-level business goals