Objective-Driven Adaptive SON Management

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Outline

- Storyline
- Policy-Based SON Management
  - Operator Input
  - Vendor Input
  - SON Objective Manager
- Objective-Driven Adaptive SON Management
  - Adaptation Process
- Conclusions and Achievements
UNIFIED SELF-MANAGEMENT SYSTEM

Integrated SON Management

Policy-Based SON Management

Operational SON Coordination

Multi-RAT / Multi-layer SON

WLAN Mgmt.

2G / 3G SON

LTE SON

Physical Network Resources

Physical Network Resources

Physical Network Resources

HETEROGENEOUS NETWORK

Decision Support System

General Network-Oriented Objectives

Network Status related to General Network-Oriented Objectives

NETWORK OPERATOR

SERVICE PROVIDER
- **Policy-based** only describes the technology used for configuring SON functions according to current **network context** and **operator-defined objectives**

- From the operator perspective, the SON Management is
  - Driven by the **objectives** (i.e., context dependent KPI targets)
  - **Adaptive** to actual network deployment
Overview of Policy-Based SON Management

NETWORK OPERATOR

Context Model

Technical Objectives

SON MANAGEMENT

SON Objective Manager

SON Policy

Policy System

Policy decision

Policy enforcement

SON Function Model

SON FUNCTION VENDOR

NETWORK

Son 1  Son 2  ...  Son N

Monitoring & Diagnosis

FM Data

CM Data

PM Data

Current Context

Objectives Achievement

Supervision
Operator Input

**Context Model**
- Abstract description of context attributes, i.e., cell’s properties and the environment it operates in
- Partitioning of context into context classes by combining context attributes

**Objective Model**
- Description of KPI targets the operator wants to achieve in the network
- Objectives are weighted and depend on the cell’s context
- Assumption: Cells with the same context have similar behaviour → one objective per cell class

**Example:**

<table>
<thead>
<tr>
<th>Available Technology</th>
<th>Cell Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTE-1800</td>
<td>Macro</td>
</tr>
<tr>
<td>LTE-2600</td>
<td>Pico</td>
</tr>
<tr>
<td>UMTS-2100</td>
<td>Micro</td>
</tr>
<tr>
<td>GSM-900</td>
<td>Micro</td>
</tr>
</tbody>
</table>

Example:

- **IF** cell class = CLASS_A  
  **THEN** Call Drop Rate < 5%  
  **WITH** weight = 0.4

- **IF** cell class = CLASS_B  
  **THEN** Handover Success Rate > 96%  
  **WITH** weight = 0.2
SON Function Model

• Delivers insight into the „Black-Box“
• Based on simulations done by the vendor of a SON Function
• Predicts the expected network behaviour in terms of KPIs for a specific SON Function Configuration Value (SCV) Set
• Assumption: Behaviour depends on cell context and the environment → context dependent effects in the SON Function Model

Example:

- KPI Impact +
- KPI Impact -

SCV Sets

Handover Success Rate

Call Drop Rate

Cell Load

• IF scv set = MLB_12
  AND cell class = CLASS_B
  THEN Call Drop Rate < 6%
  AND Handover Success Rate > 94%
  AND Cell Load < 75%
  AND …
SON Objective Manager

- Performs a **mapping process** of operator objectives and effects in the SON Function Model
- Determines the **appropriate objective** for a cell under a given condition based on the **cell class definition**
- **Selects suitable SCV Sets** that are in line with the given operator objectives based on behaviour prediction in the SON Function Model
- **Derives a SON Policy** containing best possible SCV Sets for each SON Function and each cell class

**Output Policy:**

- **IF** cell class = CLASS_A  
  **THEN**  
  MLB = 7  **AND** MRO = 12  **AND** …
- **IF** cell class = CLASS_B  
  **THEN** MLB = 4  **AND** MRO = 2  **AND** …
- **IF** cell class = CLASS_C  
  **THEN** MLB = 15  **AND** MRO = 5  **AND** …
First Step

- **Automation gap** has been overcome, i.e., network adapts itself to best fulfill operator objectives
- **Dynamics gap** has been overcome, i.e., network is able to react to changes in the environment

Second Step

- SON Function Model only based on simulations
- Concept to adapt and extend the SON Function Model by measurements coming from the real network
Overview of Objective-Driven Adaptive SON Management

NETWORK OPERATOR
- Context Model
- Technical Objectives

SON MANAGEMENT
- SON Objective Manager
- SON Policy
- Policy System
  - Policy decision
  - Policy enforcement

SON FUNCTION VENDOR
- SON Function Model
- Real network KPI measurements

Monitoring & Diagnosis
- FM Data
- CM Data
- PM Data

Current Context

Objectives Achievement Supervision

SON 1
SON 2
SON N

NETWORK

KPI Measurements
Adaptation Process

KPI Processing

- Database with real KPI measurements which is filled over time as **further input** to the SON Objective Manager
- SON Objective Manager selects **suitable measurements** for each cell class and **compares** this SCV Set Statistics with the **currently active** SCV Set → impression about the **impact** of changing from one SCV Set to another

Impact of SCV Sets on KPIs:

SCV Set Selection:

- **Filtering** of SCV Sets that deteriorate each KPI compared to the currently active SCV Set
- Selection of best possible SCV Sets depending on **operator objectives** and based on **comparison** between active SCV Sets and measurements
- **SON Function Model** serves as **starting point** until a sufficient number of real measurements is available

SCV Set Processing
Overview of Adaptation Process

SON Objective Manager

KPI Processing
- KPI Measurements Selection
- SCV Set Statistics

SCV Set Processing
- Delta Determination
- SCV Set Filtering
- KPI Target – Performance Comparison
- Performance Indication
- SCV Set Selection

Real network KPI measurements

SON Policy

Policy System

NETWORK

SON 1
SON 2
SON N
Conclusions and Achievements

Conclusions

- PBSM is an approach that enables the network to **automatically** adjust itself to best **fulfill given operator objectives** and thereby overcomes the automation and dynamicity gap.
- By extending the PBSM process with the **ability to adapt itself**, the network is no longer dependent on a simulation based and vague SON Function Model coming from the vendor, but it can now **constantly improve** itself based on **real measurements** coming from the network.

Achievements

- **Implementation** of objective-driven adaptive SON Management approach
- **Evaluation** by means of four different cases:
  - No SON
  - Default SON
  - Managed SON with focus on robustness
  - Managed SON with focus on performance
- It could be shown that: **default SON performs better than no SON** and **managed SON performs better than default SON**
Don’t miss!

**DEMONSTRATOR** on Policy-based SON Management

**POSTERS** on the SEMAFOUR use cases
Thank you for your attention

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