

A MANAGEMENT AUTOMATION FRAMEWORK FOR MOBILE NETWORKS



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Outline

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- Conclusions

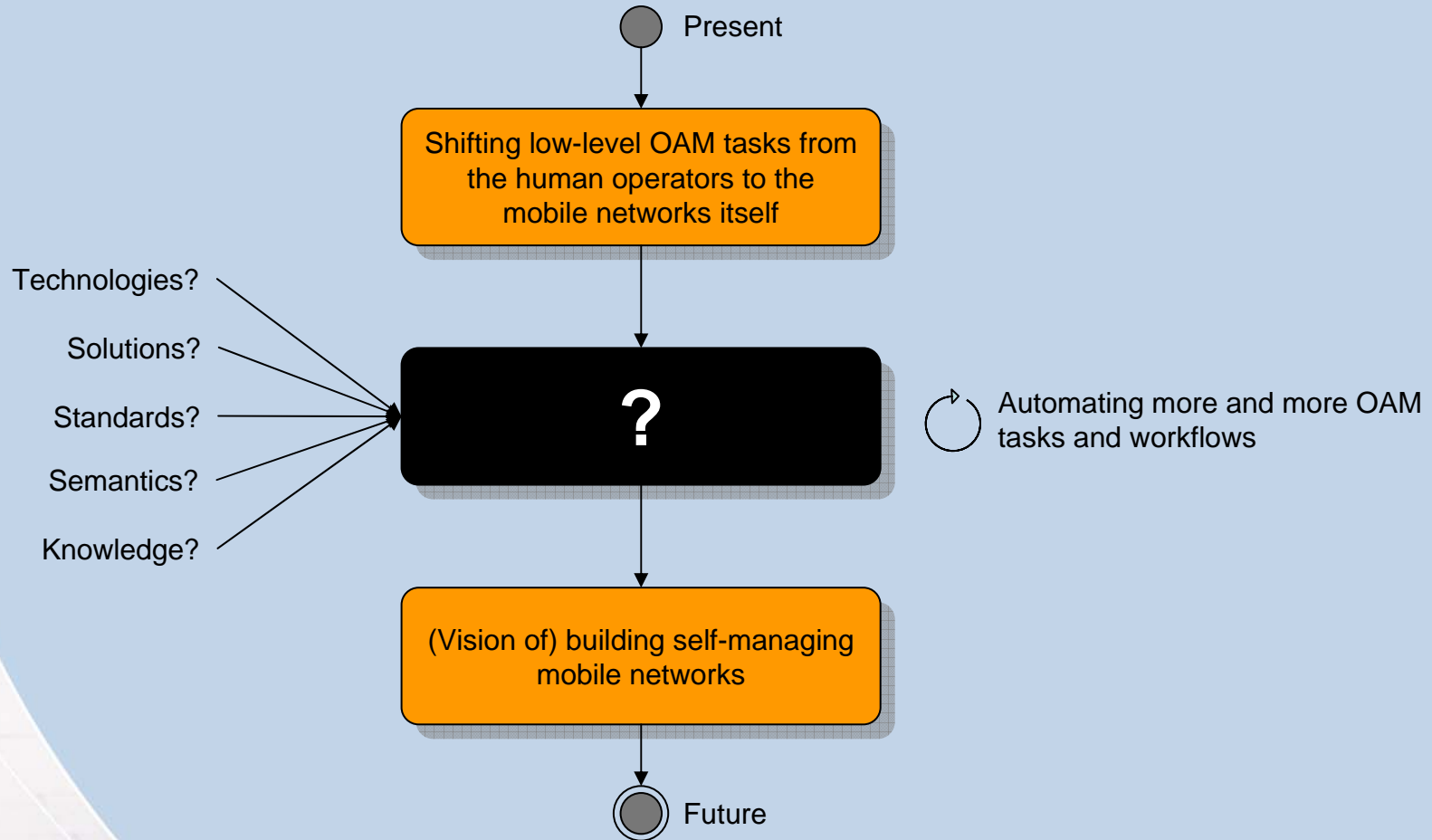
Introduction and Motivation

- Characteristics of future mobile networks
 - Distributed and decentralized network architectures
 - Large numbers of specialized network elements (NEs)
 - High diversity due to heterogeneous NEs
 - More frequent (re)-configurations of NEs
- Resulting challenges for MNOs
 - Requires specialized, real-time management solutions
 - Requires faster processing of more management data and tasks
 - Need for operational expenditures (OPEX) reduction
- Common course of action
 - Management automation



Introduction and Motivation

- Abstract management automation process model



Introduction and Motivation

- Proposed Management Automation Framework (MAF) ...
 - is intended
 - to enable the classification of any management automation technology, solution, or standard, proposed to converge to the vision of self-managing mobile networks
 - to identify the contribution of a management automation technology or solution to this vision
 - helps
 - to detect a strategic way for coping with the human challenges constraining the operational integration of possibly new management automation technologies and solutions



Human challenges for management automation

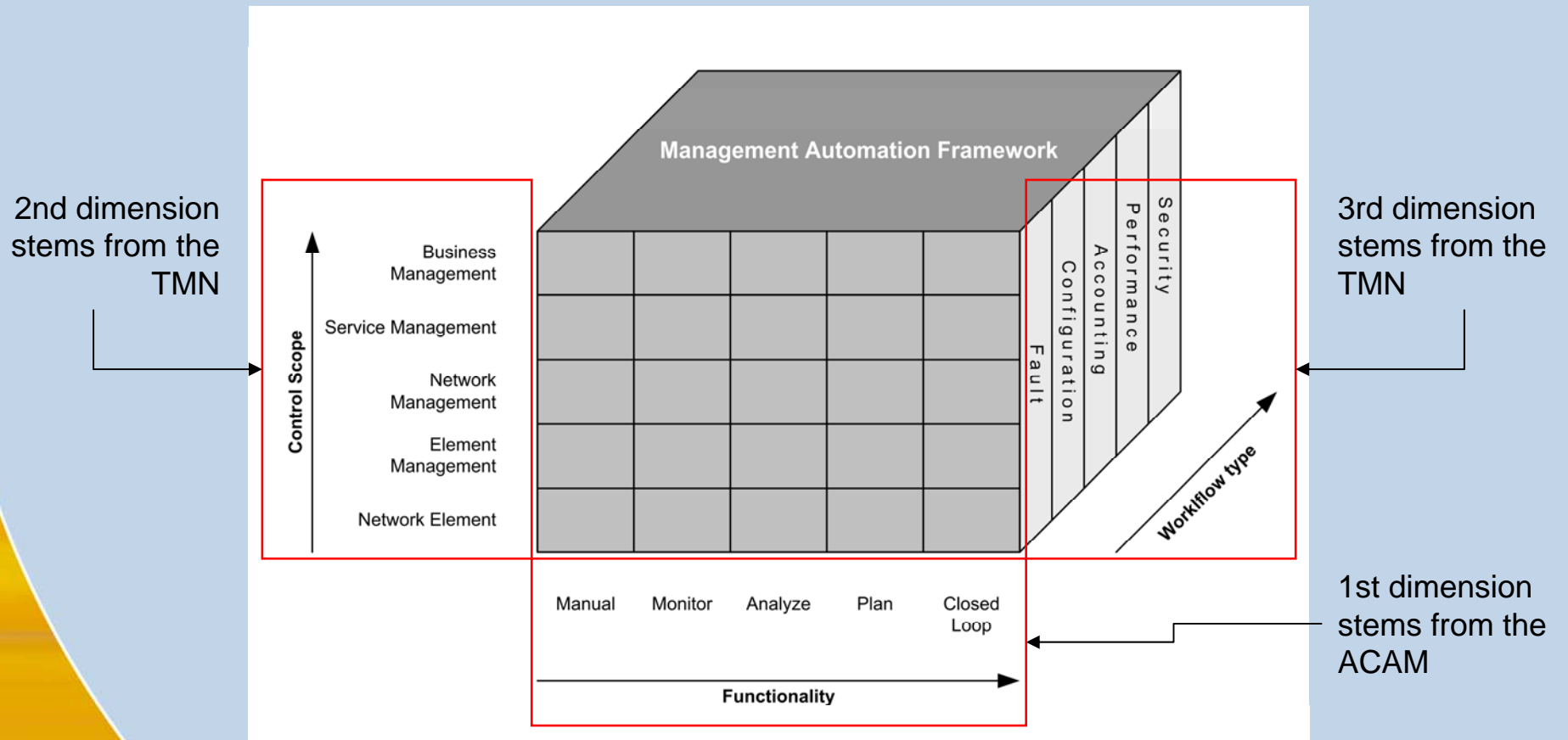
- Knowledge acquisition
 - Ways have to be found to acquire and capture OAM knowledge held by human operators instead of starting from scratch again
- Operator acceptance
 - Management automation is commonly considered as job killers rather than job shifters
- Ensuring of operator control
 - Human operators must have confidence in a self-managing network and have to be kept informed about the autonomous decisions
- Liability
 - Certain guarantees on the behavior of an autonomous system have to be delivered by hardware and software vendors

Management Automation Framework

- Framework is built up on two well accepted models of participating areas
 - Telecommunications area
 - Telecommunications Management Network (TMN) model
 - Information technology area
 - Autonomic Computing adoption model (ACAM)
 - Originally provides a methodology for IT-businesses to calibrate the degree of autonomic capability that their current infrastructure has
 - Helps to develop action plans to increase the autonomic potential of these infrastructures

Management Automation Framework

- Three-dimensional cube

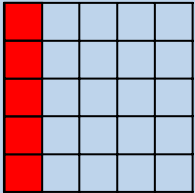


Management Automation Framework

- Workflow type dimension
 - See TMN ...
- Control scope dimension
 - See TMN ...

Management Automation Framework

- Functionality dimension
 - *Manual level (Basic level)* characteristics
 - All parameters of every control scope layer changed and adjusted manually
 - Every management process and task initiated and executed by operators
 - Management automation may only take place by proprietary scripts selected by operators as the case arises
 - Network for itself has no intelligence at all
 - Evokes highest OPEX

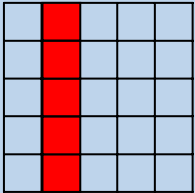


Management Automation Framework

- Functionality dimension

- *Monitor level (Managed level)*

- Management technologies can be used to collect detailed data from the network
- Reduces the time it takes human operators to collect, aggregate, and link information from one or multiple NEs or to recognize symptoms
- Reduces OPEX as the network increases and becomes more complex

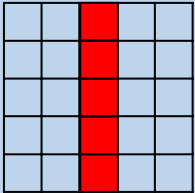


Management Automation Framework

- Functionality dimension

- *Analyze level (Predictive level)*

- Further management technologies are introduced to provide correlation among the monitored data of several NEs
- Management functions begin to preprocess data, correlate symptoms, and recognize patterns itself
- Planning and execution of necessary actions remain in the hand of operators
- OPEX reduction is achieved mainly by a useful data reduction

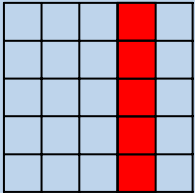


Management Automation Framework

- Functionality dimension

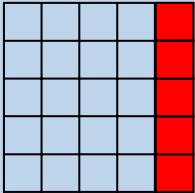
- *Plan level (Adaptive level)*

- Management functions predict the optimal configuration and offer advice about what course of action the operator should take
 - Decision of what action will be taken in reality remains to the operators
 - OPEX are reduced by the time it takes the operators to plan appropriate configurations and actions



Management Automation Framework

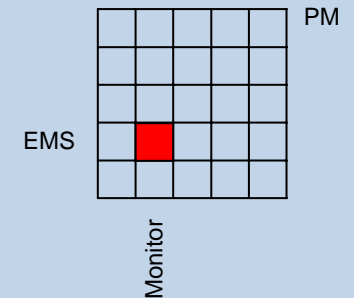
- Functionality dimension
 - *Closed loop level (Autonomic level)*
 - Network and its elements can automatically take actions based on
 - the available information
 - the knowledge about what is happening in the environment
 - Policies and objectives govern network OAM
 - Operators interact with autonomic technology tools to monitor the processes, alter the objectives, or both
 - Yields the highest OPEX reduction as it reduces the time and effort spent by human operators for OAM at most



MAF - Semantics

- Management automation solution “A”
 - Primarily intended for “traffic balancing” on a single NE
 - Supports/enables automatic monitoring of traffic data

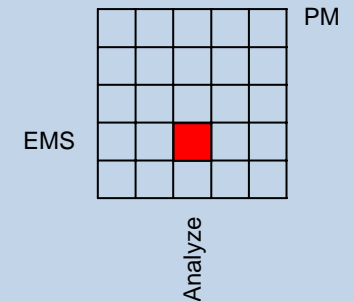
- Classification of “A”
 - Workflow type: PM area
 - Control scope: EMS layer
 - Functionality: Monitor level / Managed level



MAF - Semantics

- Management automation solution “B”
 - Primarily intended for “traffic balancing” on a single NE
 - Already uses key performance indicators (KPIs) on the NEs and sends an alarm if the traffic on a NE exceeds a certain threshold

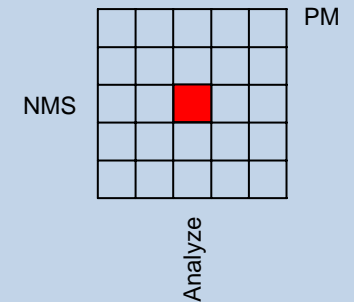
- Classification of “B”
 - Workflow type: PM area
 - Control scope: EMS layer
 - Functionality: **Analyze level / Predictive level**



MAF - Semantics

- Management automation solution “C”
 - Applies solution “B” to a group of NEs within a subnetwork
 - No further functionality improvement

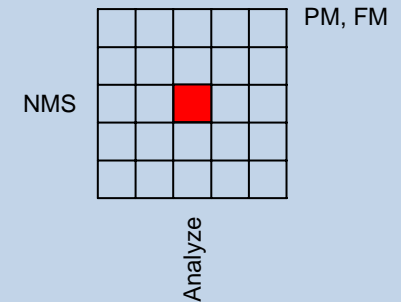
- Classification of “C”
 - Workflow type: PM area
 - Control scope: **NMS layer**
 - Functionality: Analyze level / Predictive level



MAF - Semantics

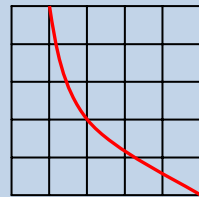
- Management automation solution “D”
 - Uses the solution “C” also for traffic backhauling on a group of NEs
 - No further functionality improvement

- Classification of “D”
 - Workflow type: PM, **FM area**
 - Control scope: NMS layer
 - Functionality: Analyze level / Predictive level



Conclusions

- The MAF enables the classification of any management automation technology or solution
 - Identifies the contribution of such an approach to the vision of self-managing mobile networks
 - Estimation of current management automation state



Workflow type priority: CM > PM > FM > SM

- The MAF enables the guidance of human operators to the vision of self-managing mobile networks
 - Tackles the human challenges for management automation

Conclusions

- Strategic way of integrating new management automation technologies and solutions
 - Important to integrate new solutions only stepwise
 - Every step should demonstrate the value added of a new solution
 - As soon as operators become more comfortable with them, the solutions can progress to the next level
 - Finally the solutions will converge to the “closed loop” level
- By the classification of a management automation solution it can be determined, if this or the prior classification level is already reached by previous integrated solutions
 - If not, it might be too early for the operational integration of a new management automation solution

The end

- Thank you for your attention!