Software self-management for IP based Networks
E. Scotto, E. Troch, C. Herssens
Com MN PG NT MN, 14.07.2005
Contents

1. Introduction to self-management
   Main requirements, benefits, migration

2. Proposed solution
   Fundamental concepts and function overview, further enhancements

3. Outlook
   Further extensions and research issues

4. Conclusions
Motivation

Software management in mobile networks today is a major Operation cost (OPEX) issue

- Manpower intensive
- High hourly cost

The tendency is towards a tougher situation

- Increasing network and software complexity
- Tighter time to market and broader feature offer

The answer

**self-management**

i.e. shifting tasks from humans to machines!
Requirements and benefits

**Autonomic** management
- NE defines when, what and how upgrade

**Automatic** management
- Preparation, execution, verification, fallback

Software self management allows to manage large networks by reducing OPEX and increasing network reliability
- Reduced manpower effort
- Less frequent failures
- New features faster and cheaper in operation
Today: semi-automated SW management

- State-of-the-art in IT world, but telecom specific requirements have to be considered

Step 1: semi-autonomic SW management

- Including pre-and post installation actions.
- Workflow customised for the NE by the agents.

Step 2: autonomic SW management

- System can compile the workflow itself
- Scalability by NE clustering.
**The proposed solution: fundamental concepts**

**Distributed** SW management (in Network Element)

**Logically** centralised control (in Element Manager)

The execution of the software management procedure is controlled by **XML** based workflow and control files
1. Trigger from the Element Manager, which downloads workflows and control files

2. The Agent customizes the workflow and executes it

3. Configuration will be updated and report sent

The proposed solution: details

Abstract state machine (workflow)

Control files

Actual upgrade workflow

Pre-checks...
Update........
Verification..
The proposed solution: the agent framework

- **Framework**
- **Bootstrap and loader**
- **JMX**
  - SW mgmt
  - Agent version n.n
  - Agent X
    - version n.n
  - Agent Y
    - version n.n
  - Agent Z
    - version n.n

- **DM**

- **Network Element**
  - **HTTP**
  - **JNLP**

- **Element Manager**
  - **SW Management Server**
  - **Agent Server**
    - **Resources**
    - **XML configuration**
    - **SW agent**

- **Introduction**
  - Proposed solution
  - Outlook
  - Conclusions
The extended solution: desired state

Desired state and workflow based on meta-data

Introduction
- Proposed solution
- Outlook
- Conclusions

Desired state and workflow based on meta-data

Software Management Agent (NE)

SW Server

- Packages
- Install criteria
- Install instructions

Desired state

Delta list:
- Install P1
- Uninstall P5

Delta generation

Install instructions

Installed packages

Workflow

update
**Outlook (1)**

**Introduction**

**Proposed solution**

**Outlook**

**Conclusions**

---

**Synchronised updating** in a distributed solution: inter-agent co-ordination mechanism requires

- efficiency: limited additional communication traffic,
- reliability (e.g. no deadlock)

⇒ Topic fur basic research and simulation.

**Optimised update scheduling** taking into account the network situation and operator policies.

⇒ Mechanism for consolidated centralised and distributed decision making needed.
Self-healing SW management to reduce manual interventions and improve update success rate.

Progress in “autonomic computing” technology is needed:

- Efficient methods for expressing rules and ontologies for decision making.
- Self-learning systems, collecting intelligence from manual interventions.
Conclusions

Introduction of autonomic decisions and high automation

- reduces OPEX
- improves reliability of installed SW,

Self-management can be deployed for almost any SW management task: first installation, new releases, updates & patches

First solutions can be adopted from the IT industry, but further research will be needed.