Workshop on Business Applications and Potential of Self-Adaptive and Self-Organizing Systems

Self-* Technologies in Industry: Niche Market Today, Mass Market Tomorrow?

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Networking Perspective

1/7 – Why do we need Self-* Networks?

Airliner	Router	Network
8‘000 instruments	MIB OIDs	Routers
21‘000 cables		Links

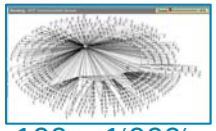
- With increasing complexity, things are very hard to control entirely from the outside (ie. from outside the network)
  (hard = inaccurate, time- or resource-consuming, otherwise expensive)

From: Full control by a single central authority

To: Operating a system of self-managing components

Networking Perspective
2/7 – Bridging the Chasm ...

10‘s



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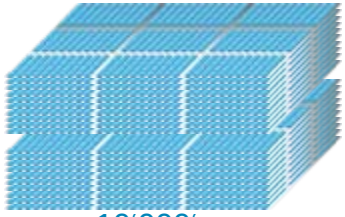


10‘000‘s

From

Full Control, Full Visibility by a single central Authority

To

Appropriate mix of distributed (self-*) vs. central Control and Visibility depending on situation, role, responsibility

Networking Perspective

3/7 – What is the Vision ?

(Use &) Manage the Communication Infrastructure Intuitively

6 Steps towards this vision:

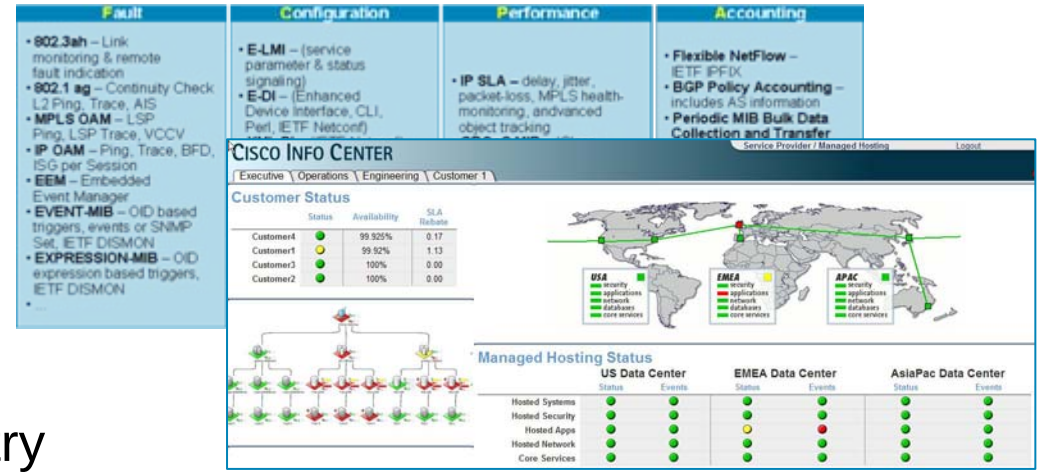
1. **Define business objectives (in business language)**
   → *Unambiguousness*
2. **Translate these objectives into technical terms**
   (SLA, SLC, KPI, KQI, …)
3. ***Automatically* derive rules and policies for systems**
4. ***Automatically* breakdown into specific goals per device**
5. **Enable devices to interpret, deploy, and comply to these goals**
6. **Develop a global standard for #1-5**

Networking Perspective

4/7 – Existing Building Blocks and Gaps

Main existing building blocks:

- An entire Industry‘s experience with deployment and evaluation of detailed technical metrics
- Today‘s network elements can detect a plethora of conditions and adjust their entire configurable behaviour
- Service componentization IS starting to happen in SP Industry

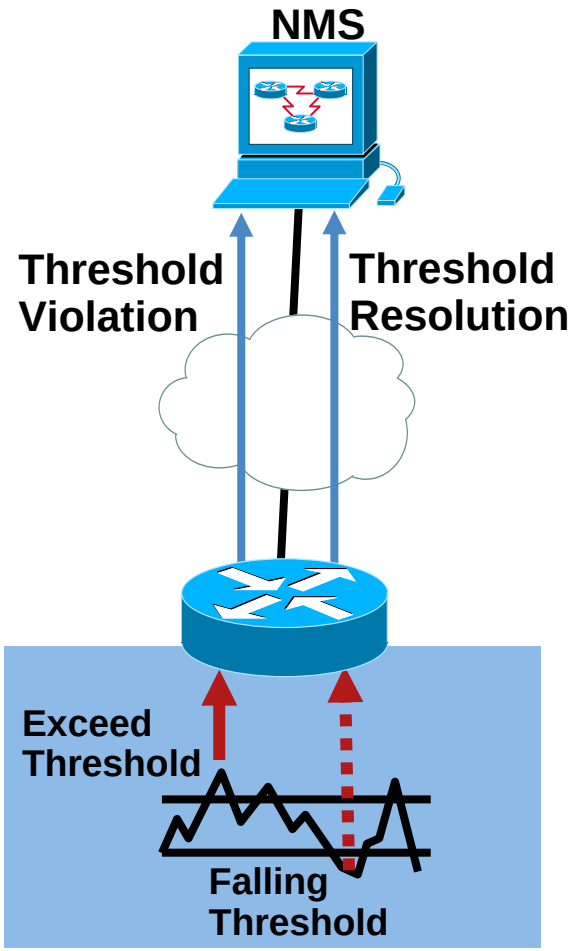


Main gaps, areas of future works

- Models and methods to derive, breakdown, decompose rules down to metrics on a per device level – in a deterministic and automatable way
- Abstractions to provide visibility over a large number of distributed devices with self-* capabilities

5/7 – Embedded Device Manageability: Some Existing Components

- **Self-Monitoring:**
  - RMON, EVENT/EXPRESSION-MIB,
  - IP SLA
  - Embedded Event/Resource Manager
- **Self-Healing:**
  - Fast Routing Algorithms
  - Fast Convergence
  - HA, failover, HSRP, etc.
- **Self-Optimizing:**
  - Performance Routing (PfR) (aka Optimized Edge Routing)
  - IP SLA Enhanced Object Tracking
- **Self-Configuration:**
  - Zero-Touch Deployment
- **Self-Protecting:**
  - Intrusion Detection Systems
  - Network Access Control



6/7 – Future Ideas for Research

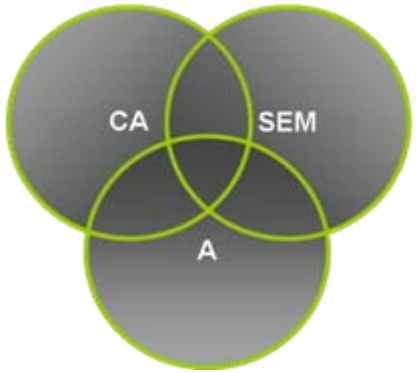
- Devices need to understand their “purpose in life” – how do we do that?
- Use sensors for intelligent Network Management?
- How to apply self-management for out-of-policy behavior (worst case scenario, undefined situations)
- Development of multi-purpose devices (e.g. load-balancer wasn’t designed for IDS&DPI)
- Develop concepts and models to link a self-managed (network) element to the management applications.

Networking Perspective

7/7 – How to Engage

- Cisco Portal for Research Collaboration
  - www.cisco.com/go/research
- Conferences
  - ICAS
  - IM / NOMS
- Workshops
  - CASEMANS

    Stimulate combined work in the fields of Context-Awareness, Self-Management (2007) and Autonomic Computing (new in 2008)



Networking Perspective
Summary

- Scale and Complexity of todays network based services require more self-* functions
- Many of the building blocks inside network elements are there today
- How much central control and visibility is right ?
- What is the decomposition method to define rules and metrics based on business objectives down to a per device level ?
- What is the appropriate abstraction to provide visibility over a large distributed deployment

➔How can we advance in steps digestable by today‘s typical network operator ?

- It only happens with customer’s buy-in ☺

Food for thought ?

“**Plan** [noun]

A set of decisions about how to do something in the future.”

Cambridge Dictionary
http://dictionary.cambridge.org

… thank you …

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