

Managing Network Management Complexity

Michael Smirnov, Fraunhofer FOKUS,
Kaiserin-Augusta-Allee 31, Berlin 10589 Germany
smirnow@fokus.fraunhofer.de

*Draft (!) abstract of the presentation at Broadband For All, WP 2004-2005
Consultation Meeting, Thursday, 1 April 2004, Brussels*

The three most often over-looked issues in system design are known to be testing, security and management. Why? These otherwise very important requirements are *non-functional*. Traditionally engineers tend primarily to figure out how to meet functional requirements, and as a result of Parkinson's law¹, no resources are left to do serious work on non-functional requirements. Yet, to meet non-functional requirements - generic or commercial of the shelf tools are usually used. In certain sense newly designed functional systems are becoming victims of legacy management approaches.

Can we do better? Can *One Size Fits All* management solution be designed for many networks to come? How then this generic managements needs to scale in all dimensions to fit all and yet unknown functional requirements? What kind of research is needed? Who is best positioned to carry out this research?

A quick look at the management community. Engineering of management for IP networks is concentrated in IETF, and partly in DMTF and NMF (MTMN); solutions are SNMP based management, trend to move to policy-based management that is significantly complicated by CIM - related obstacles. NMF as such is more concentrated on service management (network is just another resource), defining right management processes - inevitably generic, however then requiring complicated tailoring to particular networks. Middleware community is favouring CORBA/CMIP solutions, tending to adopt Web Services architecture for management. The most radical thinking is towards self-management often expressed by Academia, however since IBM announced its Autonomic Computing programme where self-management is the goal it is clear also an industry trend. However, in Autonomic Computing, there is no networking per se, AC is about systems, so network is invisible.

There is probably hardly an IST networking project that is not concerned with management. The talk will compare two extreme cases²: IST Daidalos - an Operator driven project, and IST Ambient-Networks - a vendor driven project, showing how different are approaches to network management, though both approaches are complementing each other.

Outcome 1 (Self-management as a business): Conclusion from the overview: network level self-management is a gap in current R&D funded by IST, as well as a gap internationally; the same way presenting an opportunity. The talk will propose a system model for network self-management and shall argue that this system model is the natural one for Internets because it is

-
1. Parkinson's Law: "Work expands to fill the time available." Initially postulated to explain workload and time, Parkinson's Law has been applied to and found valid in many realms. "The amount of stuff one has expands to fill available cupboard space" is one familiar application. Information technology also has its applications. Parkinson's Law of data: "Data expands to fill the space available for storage". Parkinson's Law of Bandwidth Absorption: "Network traffic expands to fill the available bandwidth".
 2. Permission from both project managers to use specific statements in this presentation are pending

derived from the most grounding principles of the Internet. The system model will be shown to add value to all the players in the networking marketplace, it will also facilitate (as expected) creation of new and growing markets, where building blocks of future self-managed systems will be traded, and, notably, without any limitation to a number of players

The rest of talk will be devoted to a novel paradigm for self-management within the Autonomic Communication initiative.

Outcome 2 (Next generation of policy based management): We start with requirements (highlighted in questions to solve above), the major two are:

- the need to create management infrastructure dynamically;
- increasing role of management delegation, if you wish distributed and/or deregulated management.

We then introduce a notion of Composite Functional System (CFS) - an Autonomic Communication principle that postulates the role for management - to say *What* letting a system to figure out *How*. The management framework for CFS is essentially policy-based, however today's interpretation of policy needs to be extended in many directions - the talk will speculate on potential R&D agenda in this area.

Outcome 3 (Evolvability of network management): Based on the above we present a bird's view of future network control and management system; we show that it is essentially self-similar, that is recursively repeats a small set of basic primitives exhibiting unlimited variations of management behaviours. Because the network and the management systems are indistinguishable, we can keep complexity at constant level throughout the evolution of the system. Thus, we suggest the R&D community has to concentrate on the design for evolvability.

If time permits:

- Complexity measures (Kolmogorov complexity estimation for the Internet)
- Long term research in networking (highlights from the two NSF and IST strategic workshops in 2003)
- Examples of self-management in Autonomic Communication