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Executive Summary

Updates and changes:
This section has been rewritten.

This document is the final report of the activity undertaken in work-package 5 for training, standardization and technology transfer in the area of device, network and service management. The document is an updated version of the interim report D5.1, and covers the full first 18 month of the EMANICS project.

The objectives of WP5 are:

- the support of tutorial set-up and training initiatives to the outside world,
- the contribution to standardization organizations,
- the organization of Technology Transfer days, and
- the interaction and liaison with other projects.

In the first phase of EMANICS, six tutorials have been developed and presented. The titles of these tutorials are:

- *Theory and Practice of Configuration Management in Decentralized Systems,*
- *Traffic Engineering and QoS Management for IP-based NGNs,*
- *VoIP Management,*
- *Internet Worms,*
- *Internet Management,*
- *The IT Infrastructure Library (ITIL) - An Introduction for Practitioners and Researchers.*

With respect to book publications, many EMANICS members have contributed to the “*Handbook of Network and Systems Administration*”, which will be published by Elsevier in the second half of 2007.

Probably the most important achievement of WP5 is its contribution to Internet standardization. In total EMANICS partners contributed to 26 Internet-Drafts and 1 RFC. Results of the IRTF/NMRG-EMANICS workshop have also been presented at the 68th IETF plenary meeting, which took place in March 2007 in Prague and was attended by around 800 people.

EMANICS partners have contributed to several IETF WGs; the most important ones being: “*Integrated Security Model for SNMP*” (ISMS), “*Network Configuration*” (NETCONF), “*Next Steps in Signaling*” (NSIS) and the “*Transport Area Working Group*” (TSVWG). The ISMS WG is co-chaired by an EMANICS partner (Jürgen Schönwälder, IUB). All IETF meetings, as well as an ISMS Interim Meeting and a three day design team meeting on NETCONF data modeling, were attended by EMANICS members.

EMANICS partners are also very active within the “*Network Management Research Group*” (NMRG) of the “*Internet Research Task Force*” (IRTF). This group is chaired by Jürgen Schönwälder (IUB) and many of its meetings are organized by EMANICS partners. A very successful meeting has been the joint IRTF/NMRG-EMANICS workshop on challenges for future network and service management research; after that workshop authors from six EMANICS organizations wrote a joint paper to present the conclusions. This paper will be published in the October 2007 issue of IEEE Communications Magazine.

Three Technology Transfer (theta) activities have been organized; in Oslo, Nancy and in Utrecht. The idea behind these activities is that (multiple) EMANICS partners interact with industry and exchange ideas and experiences. To train Ph.D. students, EMANICS also organized in July 2007 a five day Summer School in Bremen. Training of Ph.D. students was also an activity during the EMANICS AIMS conference (June 2007, Oslo).

EMANICS partners have interacted with various related projects, including the MOME IST coordination action, the Euro-NGI NoE, CNRS WIDE, the EUNICE Forum and the Grand Colloque STIC. Together with Euro-NGI/FGI, the EMANICS NoE organized the July 2007 EUNICE Summerschool and together with the AGAVE project, EMANICS will organize a joint workshop on the management of virtual networks in November 2007.

The general conclusion is that WP5 is running well and made strong contributions to the IETF and IRTF. A problem, however, is that most WP5 activities must be performed by senior staff members; some partners with an Additional Costs (AC) model have expressed problems justifying time investments and therefore only parts of their activities have been integrated in WP5. Since there has been some confusion within the EMANICS project on where to “register” tutorial and training activities; for Phase II, the decision was taken to concentrate further activities in WP3.

1 Introduction

Updates and changes:
This section has not been changed.

This section has not changed since D5.1

The title of work-package 5 is “training, standardization and technology transfer” for device, network and service management. The objectives of this work-package are:

- The support of tutorial set-up and training initiatives to the outside world.
- The contribution to standardization organizations,
- The organization of Technology Transfer days.
- Interaction with industry and liaison with other projects.

To reach these objectives, three tasks have been defined:

- T5.1: Tutorials and publications
- T5.2: Standardization
- T5.3: Interaction with industry and other research projects

This document is the final report produced after the first eighteen months of the EMANICS project and shows the activities undertaken in Phase 1. Section 2 discusses the tutorials and publications that have been created, Section 3 discusses standardization and Section 4 discusses the interaction with industry and other research projects. Section 5 provides the conclusions.

All tutorial slides, meeting minutes and Internet-Drafts can be downloaded from the EMANICS website; to keep the size of this deliverable reasonable, these have not been attached as annex.

2 Tutorials and Publications

Updates and changes:

The intro of this section has been rewritten, section 2.6 is new.

On April 3, 2006, a tutorial was presented by Mark Burgess (University of Oslo) at the IFIP/IEEE NOMS'2006 conference in Vancouver. For the area of Network and Service Management this was the most important conference of the year. The title of the tutorial was: "Theory and Practice of Configuration Management in Decentralized Systems". On April 7, 2006, another tutorial was presented by George Pavlou (University of Surrey) at the same conference. The title of the tutorial was: "Traffic Engineering and QoS Management for IP-based NGNs". In addition, Radu State (INRIA) presented in May 2006 two tutorials at the University of Pitesti: one on "*VoIP Management*" and one on "*Internet Worms*". In September 2006 Aiko Pras (UT) presented a tutorial on "*Internet Management*" at the University of Nancy. Finally Thomas Schaaf (UniZh) presented a tutorial titled "*The IT Infrastructure Library (ITIL) - An Introduction for Practitioners and Researchers*" at the AIMS conference in Oslo, Norway on June 21, 2007.

It should be noted that some of these tutorials have been presented multiple times and at multiple locations, and that EMANICS partners have also developed and presented additional tutorials for other occasions. Since these tutorials have not been funded by EMANICS, this deliverable reports only the tutorials mentioned above.

With respect to book publications, many EMANICS researchers have contributed to the Handbook of Network and Systems Administration. This book will be published at the end of 2007 by Elsevier. Editors are Jan Bergstra and Mark Burgess (EMANICS), the advisory editors are Rob Kolstad and Morris Sloman (EMANICS). The production of normal research papers will be reported in other WPs.

It should be noted that there has been some confusion in Phase I of the EMANICS project on where to "register" tutorials. In Phase II of the EMANICS project tutorial preparation has therefore been concentrated in WP3 and the electronic publishing of tutorials (including Podcasts) moved to WP4.

2.1 Theory and Practice of Configuration Management in de-centralized Systems

The title of the first tutorial is "*Theory and Practice of Configuration Management in de-centralized Systems*". The tutorial was prepared and presented by Prof. Mark Burgess, University College Oslo, Norway. This subsection provides the text as advertised on the NOMS website. The slides are available from the EMANICS website (WP5).

2.1.1 Abstract

What is configuration management? Often at NOMS we think only of network management — i.e. the management of network devices like routers and switches. Host management, on the other hand, has been studied more in the Unix community. Increasingly we are seeing these two worlds converge, as network devices run embedded GNU/Linux or Free BSD operating systems. So what are the differences? One difference is the file abstraction

— host operating systems have files and databases that contain configuration data. What are the technologies for managing these? Should they be centralized?

Autonomy is a central concept in modern computing technology. Increasingly computers are being managed by their owners rather than by centralized authorities. In the early 1990's the author developed the automation system *cfengine* for configuring and maintaining Unix-like operating systems, based on an arbitrary model of either centralized or decentralized control. It was based on the idea of voluntary cooperation — a topic which is now centre stage in autonomic and pervasive computing. *cfengine* was conceived to be able to run on any device, no matter how large or small. Moreover, it started a field of research into configuration management at the USENIX configuration management workshops and was the proof-of-principle for several key results. Today *cfengine* is used on an estimated million computers around the world, both in large and small companies.

Cfengine is a tool for setting up and maintaining a configuration across a network of hosts. It embodies a very high level declarative language, much higher-level than scripting languages, together with an autonomous, smart agent and machine-learning monitors. The idea behind *cfengine* is to create a single "policy" or configuration specification that describes the setup of as many or as few hosts in a network, without sacrificing their autonomy. *Cfengine* runs on each host and makes sure that it is in a policy-conformant state; if necessary, any deviations from policy rules are fixed automatically. Unlike tools such as *rdist*, *cfengine* does not require hosts to open themselves to any central authority, nor to subscribe to a fixed image of files. It is a modern tool, supporting state-of-the-art encryption and IPv6 transport, that can handle distribution and customization of system resources in huge networks (tens of thousands of hosts).

2.1.2 Outline

The tutorial focuses on the general principles of configuration management and uses *cfengine* as an example which integrates the state of the art research. The list of topics follows the following plan:

- What is configuration management?
- What is a policy?
- States and data models
- Patterns and anomalies - configuration or behavior issues
- The Chomsky hierarchy of languages
- The basic principles of configuration management and *cfengine*
- Autonomy or centralization?
- Syntax and Semantics - is XML important?
- The components of *cfengine* and how they are used
- What does a host policy look like?
- Promise theory as a modelling tool
- The basic *cfengine* operations and semantics
- Convergence
- *Editfiles* - an example sub-language
- The overlapping-set model for classes
- Operator ordering: When does it matter?
- What kind of network models can we use?

- Trust and security model
- Peer model utilities
- Host monitoring and integrating feedback
- *cfenvd* and cyclic time
- Interfacing to *tcpdump*
- Understanding *cfenvgraph* output
- Future developments and discussion

The tutorial ends with a discussion of where *cfengine* is going, and how it can be extended to encompass configuration management, integrating switches and routers with host configuration in data centres.

2.2 Traffic Engineering and QoS Management for IP-based NGNs

The title of the second NOMS tutorial is “*Traffic Engineering and QoS Management for IP-based NGNs*”. The tutorial was prepared and presented by Prof. George Pavlou, Centre for Communication Systems Research, University of Surrey, England. This subsection provides the text as advertised on the NOMS website. The slides are available from the EMANICS website (WP5).

2.2.1 Abstract

Next Generation IP-based Networks will offer Quality of Service (QoS) guarantees by deploying technologies such as Differentiated Services (DiffServ) and Multi-Protocol Label Switching (MPLS) for traffic engineering and network-wide resource management. Despite the progress already made, a number of issues still exist regarding edge-to-edge intra-domain and inter-domain QoS provisioning and management. This tutorial will start by providing background on technologies such as DiffServ, MPLS and their potential combination for QoS support. It will subsequently introduce trends in Service Level Agreements (SLAs) and Service Level Specifications (SLSs) for the subscription to QoS-based services. It will then move to examine architectures and frameworks for the management and control of QoS-enabled networks, including the following aspects: approaches and algorithms for off-line traffic engineering and provisioning through explicit MPLS paths or through hop-by-hop IP routing; approaches for dynamic resource management to deal with traffic fluctuations outside the predicted envelope; a service management framework supporting a “resource provisioning cycle”; the derivation of expected traffic demand from subscribed SLSs and approaches for SLS invocation admission control; a monitoring architecture for scalable information collection supporting traffic engineering and service management; and realization issues given the current state-of-the-art of management protocols and monitoring support. The tutorial will also include coverage of emerging work towards inter-domain QoS provisioning, including aspects such as: an inter-domain business model; customer and peer provider SLSs; an architecture for the management and control of inter-domain services; inter-domain off-line traffic engineering; and QoS extensions to BGP for dynamic traffic engineering. Relevant industrial activities such as *IPsphere* will be also covered. In all these areas, recent research work will be presented, with pointers to bibliography and a specially tailored Web page with additional resources.

2.3 *Practical Voice over IP*

A tutorial “*Practical Voice over IP*” has been presented in May 2006 by Radu State (INRIA) at the University of Pitesti. The purpose of this tutorial was to provide a hands-on approach for VoIP deployment based on open source technology. The tutorial started with an overview on PSTN technologies, and went next into VoIP/PSTN integration, signalling and practical VoIP.

The topics included:

- PSTN networks
- Erlang modelling
- VoIP architecture
- Signalling protocols: SIP/H.323
- VoIP security
- Open source based VoIP with Asterisk

2.4 *Internet Worms*

A tutorial on “*Internet Worms*” has been presented in May 2006 by Radu State (INRIA) at the University of Pitesti. The following topics were addressed:

- Real world examples of worm infections
- Attacks and propagation techniques used by worms
- Mathematical modelling of worm epidemics
- Mitigation and defensive approaches

2.5 *Internet management*

A tutorial on “*Internet Management*” has been presented in September 2006 by Aiko Pras (UT) at the University of Nancy. The tutorial discusses architectures, protocols and techniques to manage Internet systems. The architectures that are discussed range from the simplistic manager-agent model, to more advanced distributed management models. The discussion on protocols includes the Simple Network Management Protocol (SNMP), the Network Configuration (NETCONF) protocol and new approaches based on Web Services technologies. The tutorial gives an overview of the most important MIBs (MIB-2, IF-MIB, IP-MIB, RMON and the Host resources MIB), as well as the syntax to define these MIBs (SMI). All three SNMP versions are discussed. The tutorial concludes with a lab session.

2.6 *The IT Infrastructure Library (ITIL)*

The title of the sixth tutorial is “*The IT Infrastructure Library (ITIL) - An Introduction for Practitioners and Researchers*”. The tutorial was prepared and presented by Thomas Schaaf of the University of Zurich, Switzerland. The tutorial was presented on June 21, 2007 at the AIMS conference in Oslo, Norway.

2.6.1 Abstract

The IT Infrastructure Library (ITIL) is a today widely-used collection of best practices in IT Service Management that has, of all standardization efforts, gained the biggest popularity. Since it combines the principles of service- and process-orientation in IT Management and

is easily accessible, it has become increasingly attractive for IT organizations of almost any size, branch or organizational setup. The scope of ITIL is not limited to technical issues, but also covers the human and economic dimensions (business alignment) of IT Service Management. In this tutorial we give a survey on the ITIL framework structure and its most important concepts and contents, including an outline of five of ITIL's core reference processes. Furthermore, the tutorial discusses some important research topics related to ITIL, in particular Management Information Modelling and Tool Support. The five processes selected for presentation within the tutorial are Incident Management, Problem Management, Change Management, Configuration Management and Service Level Management. Learn how these processes are designed and how they can be implemented. These topics include the exemplary consideration of an IT incident being recorded, classified and investigated, triggering Problem Management and passing Problem and Error Control before creating a Request for Change for the resolution of the incident and its underlying root cause. Learn how ITIL helps the IT organization to deal with unexpected events in a highly dynamic environment on the one hand, and how it supports the continuous improvement and strategic alignment of IT management. We show how the core processes correlate to each other and point out the central role of Configuration Management and the challenge of setting up a Configuration Management Database (CMDB). Find out what makes a CMDB setup so difficult, which requirements a CMDB should fulfil and why the current commercial and scientific efforts address these challenges insufficiently. Adequate tools are vital for a successful deployment of ITIL. But since ITIL is tool-independent and hardly formalized, sufficient and integrated tool support for ITIL is not available today. In the tutorial, we present a taxonomy for ITIL processes under tool support aspects by assessing each ITIL process as to its recurrence, lead time, organizational complexity, service level impact and structure. Finally, we show how ITIL emerged to the ISO/IEC 20000 standard and give an overview of the innovations expected for the next official release ITIL V.3, scheduled for this year.

3 Standardization

Updates and changes:

Sections 3.1.1, 3.1.2 and 3.1.3, as well as Tables 1 & 2 have been extended. Sections 3.2.3 and 3.2.4 are new.

In the first eighteen months of the EMANICS project several partners contributed to the IETF standardization process and joined IRTF “Network Management Research Group” (NMRG) meetings. This chapter provides an overview of these activities; Section 3.1 discusses the EMANICS contributions to the IETF standardization process and Section 3.2 gives an overview of EMANICS contributions to the IRTF-NMRG.

3.1 IETF

This section discusses the EMANICS contributions to the IETF standardization process. Section 3.1.1 gives an overview of the main IETF Working Groups to which contributions have been made; some of the text within that section is copied from the IETF WG pages. Section 3.1.2 mentions the IETF meetings that have been attended and Section 3.1.3 lists the Internet-Drafts and RFCs to which contributions have been made.

3.1.1 Working Groups

EMANICS partners have contributed to many IETF WG, the most important ones being:

- Integrated Security Model for SNMP (ISMS)
- Network Configuration (NETCONF)
- Next Steps in Signaling (NSIS)
- Transport Area Working Group (TSVWG)

In addition, Jürgen Schönwälder (IUB) is member of the IETF MIB Doctors and joined in 2006 the IETF Security Directorate.

ISMS

The *Integrated Security Model for SNMP* (ISMS) WG is co-chaired by Jürgen Schönwälder, who works at IUB and is member of the EMANICS NoE.

The goal of the ISMS working group is to develop a new security model for SNMP that integrates with widely deployed user and key management systems, as a supplement to the USM security model. For this integration the working group will define a standard method for mapping from AAA-provisioned authorization parameter(s) to corresponding SNMP parameters.

In order to leverage the authentication information already accessible at managed devices, the new security model will use the SSH protocol for message protection, and RADIUS for AAA-provisioned user authentication and authorization. However, the integration of a transport mapping security model into the SNMPv3 architecture should be defined such that it is open to support potential alternative transport mappings to protocols such as BEEP and TLS. The ISMS WG covers the following work items [28]:

- Specify an architectural extension that describes how transport mapping security models (TMSMs) fit into the SNMPv3 architecture.

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- Specify an architectural extension that describes how to perform a mapping from AAA-provisioned user-authentication and authorization parameter(s) to *securityName* and other corresponding SNMP parameters.
 - Specify a mapping from RADIUS-provisioned authentication and authorization parameter(s) to *securityName* and other corresponding SNMP parameters.
 - Specify a mapping from locally-provisioned authentication and authorization parameter(s) to *securityName* and other corresponding SNMP parameters.
 - Define how to use SSH between the two SNMP engines
 - Specify the SSH security model for SNMP.

NETCONF

The goal of the NETCONF working group is to produce a protocol suitable for network configuration, with the following characteristics [30]:

- Provides retrieval mechanisms which can differentiate between configuration data and non-configuration data.
- Is extensible enough that vendors will provide access to all configuration data on the device using a single protocol.
- Has a programmatic interface.
- Uses a textual data representation, that can be easily manipulated using non-specialized text manipulation tools.
- Supports integration with existing user authentication methods.
- Supports integration with existing configuration database systems.
- Supports network wide configuration transactions (with features such as locking and rollback capability).
- Is as transport-independent as possible.

The NETCONF protocol uses XML for data encoding purposes, because XML is a widely deployed standard which is supported by a large number of applications. XML also supports hierarchical data structures. The NETCONF protocol should be independent of the data definition language and data models used to describe configuration and state data. It should be possible to transport the NETCONF protocol using several different protocols. The group will select at least one suitable transport mechanism, and define a mapping for the selected protocol(s).

NSIS

The *Next Steps in Signaling Working Group* is responsible for standardizing an IP signaling protocol with QoS signaling as the first use case. The working group concentrates on a two-layer signaling paradigm. The intention is to re-use, where appropriate, the protocol mechanisms of RSVP, while at the same time simplifying it and applying a more general signaling model [31].

The NSIS WG develops a transport layer signaling protocol for the transport of upper layer signaling. In order to support a toolbox or building block approach, a two-layer model will be used to separate the transport of the signaling from the application signaling. This allows for a more general signaling protocol to be developed to support signaling for different services or resources, such as NAT & firewall traversal and QoS resources. The initial NSIS application will be an optimized RSVP QoS signaling protocol. The second application will

be a middle box traversal protocol. An informational document detailing how Differentiated Services can be signaled with the QoS Signaling protocol will be made.

Security is a very important concern for NSIS. The working group will study and analyze the threats and security requirements for signaling. Compatibility with authentication and authorization mechanisms such as those of Diameter, COPS for RSVP and RSVP Session Authorization will be addressed.

TSVWG

The Transport Area receives occasional proposals for the development and publication of RFCs dealing with transport topics that are not in scope of an existing working group or do not justify the formation of a new working group. TSVWG serves as the forum for developing such work items in the IETF [32]. The working group meets if there are active proposals that require discussion. The currently active TSVWG work items mostly fall under the following topics:

- Maintenance of the Stream Control Transmission Protocol (SCTP), which involves bug fixes to the SCTP specifications and their progression along the standards track.
- Maintenance of the Resource Reservation Protocol (RSVP), which involves bug fixes to the RSVP specifications and their progression along the standards track. This work item may also include a small number of extensions to RSVP or advisory documents to address specific application scenarios.
- Maintenance of IP Differentiated Services (DiffServ) mechanisms, which involves mostly advisory documents on the use of DiffServ in specific application scenarios.
- Selected other work items, which are mostly in TSVWG for historic reasons. These include an extended statistics MIB for TCP and the quick-start mechanism for TCP and IP.

IETF SECURITY DIRECTORATE

Jürgen Schönwälder (IUB) is member of the IETF Security Directorate, for which he reviewed the following documents:

- draft-ietf-16ng-ipv6-over-ipv6cs-08.txt
- draft-ietf-16ng-ipv6-over-ipv6cs-09.txt
- draft-ietf-idmr-dvmrp-v3-as.txt
- draft-ietf-idmr-dvmrp-v3.txt
- draft-ietf-ospf-mt-06.txt
- draft-ietf-syslog-protocol-19.txt
- draft-ietf-syslog-transport-udp-08.txt
- draft-narten-ipr-3979-3rd-party-fix-00.txt

3.1.2 IETF Meetings

In Phase I, the following IETF meetings took place:

- ISMS Interim Meeting; February 13-14, 2006, Boston, USA,
- 65th IETF, March 19-24, 2006; Dallas, USA,
- 66th IETF, July 9-14, 2006; Montreal, Canada,
- NETCONF Interim Meeting; July 14-15, 2006, Montreal, Canada,
- 67th IETF, November 5-10, 2006; San Diego, USA,
- 68th IETF, March 18-23, 2007; Prague.

The ISMS Interim Meeting at MIT in Boston was attended and co-chaired by Jürgen Schönwälder from the IUB. The goal of that meeting was to figure out how to send SNMP notification over SSH. The meeting was a success in the sense that it managed to establish a common ground for SNMP experts, SSH experts, and RADIUS experts. The report of this event is available on the EMANICS website.

The 65th IETF meeting in Dallas was attended by Georgios Karagiannis (UT), who participated in the NSIS and TSVWG working groups to investigate (amongst others) interoperation issues between NSIS signaling and the protocols used for policy control and resource configuration, such as SNMP, COPS-PR, NETCONF, ForCES and GSMP. Although not physically present, Jürgen Schönwälder co-chaired the 65th IETF ISMS working group meeting from his office at IUB. The audio stream from Dallas had at least the quality of international conference calls and jabber allowed him to actually participate in the discussion, thanks to the jabber scribes.

The 66th IETF meeting in Montreal was attended by four researchers from three EMANICS organizations (IUB, INRIA and UT). Jürgen Schönwälder (IUB) again co-chaired the ISMS working group and produced the WG minutes, based on the notes made by Olivier Festor (INRIA). After the 66th IETF meeting Jürgen Schönwälder organized an ISMS follow-up conference call on July 27th, and produced minutes of that call.

At the 66th Montreal meeting Olivier Festor, Radu State and Jürgen Schönwälder also contributed to the IETF NETCONF WG and joined the interim meeting immediately afterwards. IUB served as a note taker during that meeting, and contributed ideas on how to handle notification streams which allows simple implementations and more complex implementations in terms of interleaving notification streams and commands streams. Georgios Karagiannis (UT) again joined the NSIS and TSVWG working groups

The 67th San Diego meeting (November 5-10) was attended by Georgios Karagiannis from the University of Twente. He participated in the TSVWG and NSIS working groups, to investigate (amongst others) interoperation issues between NSIS signaling and the protocols used for policy control and resource configuration, such as SNMP, COPS-PR, NETCONF, ForCES and GSMP. At the same IETF meeting a presentation was provided at the ISMS meeting by Vladislav Marinov from the International University of Bremen (IUB).

The 68th IETF meeting, which was held in March 2007, was organized in Prague. The fact that the meeting was organized in Europe allowed many EMANICS members to attend: Alberto Gonzalez Prieto (KTH Stockholm), Georgios Karagiannis (University of Twente), Vladislav Marinov (Jacobs University Bremen), Aiko Pras (University of Twente) and Jürgen Schönwälder (Jacobs University Bremen). At the plenary meeting, which was attended by around 800 people, Aiko Pras presented the results of the IRTF-NMRG Workshop on "Future Direction of Network and Service Management Research". At the same IETF meeting the Integrated Security Model for SNMP (ISMS) Working Group (WG) meeting was

chaired by Jürgen Schönwälder. At that WG meeting presentations were given by Jürgen Schönwälder and Vladislav Marinov. Finally Georgios Karagiannis gave a presentation on RMD-QOSM at the NSIS WG.

Also Jürgen Schönwälder attended in May 2007 a three day design team meeting in London on management data modeling for the network configuration protocol NETCONF, recently standardized by the IETF. This team consists of active IETF members from organizations like Ericsson, Juniper, tail-f, and Jacobs University. The team is working on several Internet-Drafts defining a NETCONF data modeling language and a set of reusable data type definitions. Many language details have been worked out during the meeting and the goal is to have a complete set of specifications ready by the Fall 2007 IETF meeting in Vancouver in order to propose a standardization process within the IETF.

Finally EMANICS has granted funding to Georgios Karagiannis (UT) to participate in the NSIS and TSVWG working groups at the 69th IETF meeting, which takes place in July 2007 in Chicago, USA.

An overview of EMANICS participation to IETF meetings is provided in Table 1.

Meeting	Name	Organization	Role
ISMS interim	Jürgen Schönwälder	IUB	ISMS co-chair Editor of Internet-Drafts
65 th IETF	Georgios Karagiannis	UT	Editor of Internet-Drafts
66 th IETF	Jürgen Schönwälder	IUB	ISMS co-chair Editor of Internet-Drafts
66 th IETF	Olivier Festor	INRIA	
66 th IETF	Radu State	INRIA	
66 th IETF	Georgios Karagiannis	UT	Editor of Internet-Drafts
NETCONF Interim	Jürgen Schönwälder	IUB	
NETCONF Interim	Olivier Festor	INRIA	
NETCONF Interim	Radu State	INRIA	
67 th IETF	Georgios Karagiannis	UT	Editor of Internet-Drafts
68 th IETF	Alberto Gonzalez Prieto	KTH	
68 th IETF	Georgios Karagiannis	UT	Editor of Internet-Drafts
68 th IETF	Vladislav Marinov	IUB	Editor of Internet-Drafts
68 th IETF	Aiko Pras	UT	Plenary Presentation
68 th IETF	Jürgen Schönwälder	IUB	ISMS co-chair Editor of Internet-Drafts
69 th IETF	Georgios Karagiannis	UT	Editor of Internet-Drafts

Table 1: EMANICS participation to IETF meetings

3.1.3 Publications

In the first eighteen months of the EMANICS project 26 Internet-Drafts and 1 RFC were co-authored by EMANICS partners. These documents fall into the following categories:

- SNMP over IEEE 802 Networks
- Transport Subsystem for SNMP
- TLS Transport Model for SNMP
- Mapping SNMP Notifications to SYSLOG Messages
- SNMP Traffic Measurement
- SNMP EngineID Discovery
- DiffServ Resource Management
- DiffServ Resource Unavailability
- InterDomain-QOSM
- NSLP for Quality-of-Service Signaling
- Pre-Congestion Notification Architecture
- Load Control PCN
- NETCONF Access Control Framework
- SMIng

A short description of these drafts can be found in the next subsections; the complete text can be downloaded from the EMANICS website.

SNMP OVER IEEE 802 NETWORKS

In the first eighteen months of the EMANICS project one RFC and three versions of the Internet-Draft “*Simple Network Management Protocol (SNMP) over IEEE 802 Networks*” were produced by EMANICS partners (EMANICS members are indicated in bold):

- **J. Schönwälder**, T. Jeffree: *Simple Network Management Protocol (SNMP) over IEEE 802 Networks*, draft-schoenw-snm-ether-00.txt, May 2006
- **J. Schönwälder**, T. Jeffree: *Simple Network Management Protocol (SNMP) over IEEE 802 Networks*, draft-schoenw-snm-ether-01.txt, July 2006
- **J. Schönwälder**, T. Jeffree: *Simple Network Management Protocol (SNMP) over IEEE 802 Networks*, draft-schoenw-snm-ether-02.txt, September 2006
- **J. Schönwälder**, T. Jeffree: *Simple Network Management Protocol (SNMP) over IEEE 802 Networks*, RFC 4789, November 2006

These documents specify how SNMP messages can be transmitted directly over IEEE 802 networks. It supplement the standard SNMP transport mappings, as defined in RFC 3417. This transport mapping was written in order to help the IEEE 802.1aj working group. A detailed overview of the documents that describe the Internet-Standard management framework is provided in section 7 of RFC 3410. The IESG has approved this work in October 2006 and the RFC appeared in November 2006.

TRANSPORT SUBSYSTEM FOR SNMP

Six versions of the Internet-Draft “*Transport Subsystem for the Simple Network Management Protocol (SNMP)*” were produced by EMANICS partners in Phase I of the EMANICS project:

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- D. Harrington, **J. Schönwälder**: *Transport Mapping Security Model (TMSM) - Architectural Extension for the Simple Network Management Protocol (SNMP)*, draft-ietf-isms-tmsm-03.txt, May 2006
 - D. Harrington, **J. Schönwälder**: *Transport Subsystem for the Simple Network Management Protocol (SNMP)*, draft-ietf-isms-tmsm-04.txt, October 2006
 - D. Harrington, **J. Schönwälder**: *Transport Subsystem for the Simple Network Management Protocol (SNMP)*, draft-ietf-isms-tmsm-05.txt, December 2006
 - D. Harrington, **J. Schönwälder**: *Transport Subsystem for the Simple Network Management Protocol (SNMP)*, draft-ietf-isms-tmsm-06.txt, February 2007
 - D. Harrington, **J. Schönwälder**: *Transport Subsystem for the Simple Network Management Protocol (SNMP)*, draft-ietf-isms-tmsm-07.txt, February 2007
 - D. Harrington, **J. Schönwälder**: *Transport Subsystem for the Simple Network Management Protocol (SNMP)*, draft-ietf-isms-tmsm-08.txt, May 2007

This document describes a Transport Subsystem, extending the Simple Network Management Protocol (SNMP) architecture defined in RFC 3411. It describes a subsystem to contain transport models, comparable to other subsystems in the RFC3411 architecture. As work is being done to expand the transport to include secure transports such as SSH and TLS, using a subsystem will enable consistent design and modularity of such transport models. This document identifies and discusses some key aspects that need to be considered for any transport model for SNMP. It also defines a portion of the Management Information Base (MIB) for managing models in the Transport Subsystem.

TLS TRANSPORT MODEL FOR SNMP

In Phase I EMANICS partners produced the following Internet-Draft:

- **V. Marinov, J. Schönwälder**: *Transport Layer Security (TLS) Transport Model for the Simple Network Management Protocol (SNMP)*, draft-marinov-isms-tlstm-00.txt, February 2007

This draft defines a Transport Model for the Simple Network Management Protocol which utilizes the Transport Layer Security (TLS) security protocol and the X.509 key management infrastructure.

MAPPING SNMP NOTIFICATIONS TO SYSLOG MESSAGES

In Phase I EMANICS partners produced the following Internet-Draft:

- **V. Marinov, J. Schönwälder**: *Mapping Simple Network Management Protocol (SNMP) Notifications to SYSLOG Messages*, draft-marinov-syslog-snm-00.txt, February 2007

This draft defines a mapping from Simple Network Management Protocol (SNMP) notifications to SYSLOG notifications.

SNMP TRAFFIC MEASUREMENT

In Phase I three versions of the Internet-Draft “*SNMP Traffic Measurements and Trace Exchange Formats*” were produced by EMANICS partners:

- **J. Schönwälder**: *SNMP Traffic Measurement*, draft-schoenw-nrmg-snm-measure-01.txt, March 2006

- **J. Schönwälder:** *SNMP Traffic Measurement*, draft-irtf-nmrg-snmp-measure-00.txt, May 2006
- **J. Schönwälder:** *SNMP Traffic Measurements and Trace Exchange Formats*, draft-irtf-nmrg-snmp-measure-01.txt, January 2007

The Simple Network Management Protocol (SNMP) is widely deployed to monitor, control and configure network elements. Even though the SNMP technology is well documented, it remains relatively unclear how SNMP is used in practice and what typical SNMP usage patterns are. This Internet-Draft proposes to carry out large scale SNMP traffic measurements in order to develop a better understanding how SNMP is used in real world production networks. It describes the motivation, the measurement approach, and the tools and data formats needed to carry out such a study.

SNMP ENGINEID DISCOVERY

In Phase I three versions of the Internet-Draft “*Simple Network Management Protocol (SNMP) EngineID Discovery*” were produced by EMANICS partners

- **J. Schönwälder:** *Simple Network Management Protocol (SNMP) EngineID Discovery*, draft-schoenw-snmp-discover-00.txt, December 2006
- **J. Schönwälder:** *Simple Network Management Protocol (SNMP) EngineID Discovery*, draft-schoenw-snmp-discover-01.txt, March 2007
- **J. Schönwälder:** *Simple Network Management Protocol (SNMP) EngineID Discovery*, draft-schoenw-snmp-discover-02.txt, April 2007

The third version of the Simple Network Management Protocol (SNMP) assumes that a manager knows the identifier of a remote SNMP protocol engine (the so called snmpEngineID) in order to retrieve or manipulate objects maintained locally on the remote engine. These Internet-Drafts introduce a well-known localEngineID and a discovery mechanism which can be used to learn the engine identifier of a remote SNMP protocol engine. The proposed mechanism is independent of the features provided by SNMP security models and may also be used.

DIFFSERV RESOURCE MANAGEMENT

The following Internet-Draft has been produced in 2006:

- A. Bader, L. Westberg, **G. Karagiannis**, C. Kappler, T. Phelan: *RMD-QOSM - The Resource Management in Diffserv QOS Model*, draft-ietf-nsis-rmd-09.txt, March 2007

This document describes an NSIS QoS Model for networks that use the Resource Management in Diffserv (RMD) concept. RMD is a technique for adding admission control and preemption function to Differentiated Services (Diffserv) networks. The RMD QoS Model allows devices external to the RMD network to signal reservation requests to edge nodes in the RMD network. The RMD Ingress edge nodes classify the incoming flows into traffic classes and signals resource requests for the corresponding traffic class along the data path to the Egress edge nodes for each flow. Egress nodes reconstitute the original requests and continue forwarding them along the data path towards the final destination. In addition, RMD defines notification functions to indicate overload situations within the domain to the edge nodes.

DIFFSERV RESOURCE UNAVAILABILITY

The following Internet-Draft has been produced in 2006:

- **G. Karagiannis**, L. Westberg, A. Bader, Hannes Tschofenig: *Resource Unavailability (RU) Per Domain Behavior*, draft-karagiannis-ru-pdb-02.txt, June 2006

The draft specifies a Per Domain Behavior (PDB) that provides the ability to Diffserv nodes located outside Diffserv domain(s), e.g., receiver or other Diffserv enabled router to detect when the resources provided by the Diffserv domain(s) are not available. This PDB is used when the negotiated Service Level Specification (SLS) is associated to throughput (or bandwidth) and when the SLS agreed throughput bound is not statically but loosely defined in order to allow a more efficient utilization of the Diffserv domain(s) and a simpler network management operation. This PDB can be applied in association with either a single Diffserv domain or multiple neighboring Diffserv domains. This specification is denoted as Resource Unavailability (RU) PDB and it follows the guidelines given in RFC 3086.

INTERDOMAIN-QOSM

The following Internet-Draft has been produced in Phase I:

- J. Zhang, E. Monteiro, P. Mendes, **G. Karagiannis**: *InterDomain-QOSM: The NSIS QoS Model to Fulfill the E2E QoS Control in the ITU-T RACF Functional Architecture*, draft-zhang-nsis-interdomain-qosm-04.txt, March 2007

This document has three goals. First of all, it presents an analysis of how to use the NSIS signaling (inter-domain QOSM and intra-domain QOSM) to fulfill the QoS control in accord with the ITU-T RACF functional architecture. For this goal, the document discusses how the ITU-T RACF entities in the ITU-T RACF functional architecture can be mapped to the NSIS entities and how the RACF reference points can be implemented by using the NSIS protocol suites and QOSMs. Secondly, the document aims at specifying an NSIS Inter-domain QOSM for E2E QoS control across heterogeneous IP networks and applying this Inter-domain QOSM to the e2e QoS control in the ITU-T RACF functional architecture based on the above ITU-T RACF analysis. The detailed description of the NSIS Inter-domain QOSM are given and the e2e QoS control scenarios in the ITU-T RACF architecture (including RACF Push and Pull resource control modes), which will be covered by the NSIS Inter-domain QOSM are described and implemented. Thirdly, the document specifies and implements those QSPECs that will be used by the Inter-domain QOSM for the e2e QoS control in the ITU-T RACF architecture.

NSLP FOR QUALITY-OF-SERVICE SIGNALING

The following Internet-Draft has been produced in Phase I:

- J. Manner, **G. Karagiannis**, A. McDonald: *InterDomain-QOSM: NSLP for Quality-of-Service Signaling*, draft-ietf-nsis-qos-nslp-13.txt, March 2007

This specification describes the NSIS Signaling Layer Protocol (NSLP) for signaling QoS reservations in the Internet. It is in accordance with the framework and requirements developed in NSIS. Together with GIST, it provides functionality similar to RSVP and extends it. The QoS NSLP is independent of the underlying QoS specification or architecture and provides support for different reservation models. It is simplified by the elimination of support for multicast flows. This specification explains the overall protocol approach, design decisions made and provides examples. It specifies object, message formats and processing rules.

PRE-CONGESTION NOTIFICATION ARCHITECTURE

The following Internet-Draft has been produced in Phase I:

- P. Eardley, J. Babiarz, K. Chan, A. Charny, R. Geib, **G. Karagiannis**, M. Menth, T. Tsou: *Pre-Congestion Notification Architecture*, draft-eardley-pcn-architecture-00.txt, June 2007

The purpose of this document is to describe a general architecture for flow admission and termination based on aggregated (pre-)congestion information in order to protect the quality of service of established inelastic flows within a single DiffServ domain.

LOAD CONTROL PCN

The following Internet-Draft has been produced in Phase I:

- L. Westberg, A. Bader, D. Partain, **G. Karagiannis**: *LC-PCN - The Load Control PCN solution*, draft-westberg-pcn-load-control-00.txt, May 2007

There is an increased interest of simple and scalable resource provisioning solution for Diffserv network. The Load Control PCN (LC-PCN) addresses the following issues:

- ◆ Admission control for real time data flows in stateless Diffserv Domains
- ◆ Flow termination: Termination of flows in case of exceptional events, such as severe congestion after re-routing.

Admission control in a Diffserv stateless domain is a combination of:

- ◆ Probing, whereby a probe packet is sent along the forwarding path in a network to determine whether a flow can be admitted based upon the current congestion state of the network
- ◆ Admission control based on data marking, whereby in congestion situations the data packets are marked to notify the egress node that a congestion occurred on a particular ingress to egress path.

The scheme provides the capability of controlling the traffic load in the network without requiring signaling or any per-flow processing in the core routers. The complexity of Load Control is kept to a minimum to make implementation simple.

NETCONF ACCESS CONTROL FRAMEWORK

The following Internet-Draft has been produced in Phase I:

- **V. Cridlig**: *NETCONF access control framework*, draft-cridlig-netconf-rbac-00.txt, November 2006

This document defines a role-based access control framework for the NETCONF configuration protocol.

SMING

In Phase I the following Internet-Draft has been produced by EMANICS partners:

- **J. Schönwälder**: *Lessons Learned from the SMIng Project*, draft-schoenw-sming-lessons-00.txt, June 2007

A data modeling language for network management protocols called SMIng was developed within the IRTF-NMRG over a period of several years. This memo documents some of the lessons learned during the project for consideration by designers of future data modeling languages for network management protocols.

3.2 IRTF

In the first phase of the EMANICS project four Internet Research Task Force (IRTF) Network Management Research Group (NMRG) [33] meetings were organized. The IRTF-NMRG is chaired by Jürgen Schönwälder (IUB). Table 2 gives an overview of the EMANICS participation to these IRTF-NMRG meetings.

Meeting	Name	Organization	Role
Stockholm	Olivier Festor	INRIA	
Stockholm	Rolf Stadler	KTH	Organizer
Stockholm	Aiko Pras	UT	
Stockholm	Kyrre Begnum	HIO	
Stockholm	Mark Burgess	HIO	Organizer
Stockholm	Siri Fagernes	HIO	
Stockholm	Guillaume Doyen	INRIA	
Stockholm	Laurent Andrey	INRIA	
Stockholm	Radu State	INRIA	
Stockholm	Jürgen Schönwälder	IUB	NMRG chair
Stockholm	Alberto Gonzalez Prieto	KTH	
Stockholm	Fetahi Wuhib	KTH	
Montreal	Jürgen Schönwälder	IUB	NMRG chair
Montreal	Radu State	INRIA	
Montreal	Olivier Festor	INRIA	Minute taker
Utrecht	Olivier Festor	INRIA	
Utrecht	Aiko Pras	UT	Organizer
Utrecht	Rolf Stadler	KTH	
Utrecht	Burkhard Stiller	UNIZH	
Utrecht	Mark Burgess	HIO	
Utrecht	Jürgen Schönwälder	IUB	NMRG chair / organizer
Prague	Alberto Gonzalez Prieto	KTH	Presentation
Prague	Georgios Karagiannis	UT	
Prague	Vladislav Marinov	IUB	
Prague	Aiko Pras	UT	Presentation
Prague	Jürgen Schönwälder	IUB	NMRG chair / Presentation

Table 2: EMANICS participation to IRTF-NMRG meetings

3.2.1 19th NMRG meeting - Stockholm

The 19th NMRG meeting focused on *Promise Theory* and *New Approaches to Distributed Management*. The meeting took place on January 13 and 14 2006, and was attended by 21 people, of which 12 came from EMANICS institutes.

The part on *Promise Theory* was organized by Mark Burgess (HIO). At DSOM 2005 he presented a paper in which he introduced a model where nodes in a network cooperate based on promises they make to other nodes. Nodes are considered to be highly autonomous in their decisions but they might promise a certain behavior to others and take benefits of the promises made by other nodes. This model leads to a different view at policies.

The part on *New Approaches to Distributed Management* was organized by Rolf Stadler (KTH). The need for network management in large-scale and dynamic network environments calls for solutions beyond traditional management paradigms. Approaches based on network programming, management overlays, p2p computing, as well as distributed aggregation and control schemes, have been recently proposed to engineer management systems that scale beyond 1000s of nodes and are robust regarding topology changes and failures. The second day of the workshop explored this issue further, investigated whether there are any management-specific building blocks missing, and how massively distributed approaches relate to conventional ones developed in the past. The workshop included presentations and demonstrations by the management research group at KTH.

3.2.2 20th NMRG meeting - Montreal

The 20th NMRG meeting was held on July 10th in conjunction with the 66th IETF meeting. The focus of the meeting was on the network management traffic measurement activities of the NMRG. The meeting was attended by about 40 people, mostly from outside EMANICS. The meeting was chaired by Jürgen Schönwälder (IUB); the minutes were made by Olivier Festor (INRIA). Two presentations (slides only) were provided by Jürgen Schönwälder.

3.2.3 21th NMRG meeting - Utrecht

On October 19-20 the 21th IRTF-NMRG meeting was held in cooperation with EMANICS in Utrecht (Netherlands). The organizers of this meeting were Aiko Pras (UT), Jürgen Schönwälder (IUB), and Gabi Dreo Rodosek (CETIM). The goal of the meeting was to discuss the *Future Direction of Network and Service Management Research*. In the last decade this area has undergone several changes. While some research topics have matured over the years into their own little areas (e.g. policy-based management or fault management), there are other areas that are more driven by advances in technologies. This includes technologies that need new management approaches but also technologies that can be utilized for more effective management. The purpose of this jointly organized workshop was to bring together researchers, operators, vendors and technology developers to identify promising future directions of network and service management research. The outcome produced by the workshop is a description of research directions that is felt worthwhile to explore in a time frame of the next 5 years. The results of the workshop will be included in a Communications Magazine paper, which will be published in October 2007. A short overview has also been included in the Handbook of Network and System Administration. It is the intention to document the outcome also as an Internet-Draft. The detailed minutes of this workshop can be downloaded from the IRTF-NMRG website (<http://www.ibr.cs.tu-bs.de/projects/nmrg/minutes/minutes-021.txt>)

3.2.4 22th NMRG meeting - Prague

In March 2007 the 22nd IRTF-NMRG meeting was held in conjunction with the 68th IETF meeting in Prague. The NMRG meeting was chaired by Jürgen Schönwälder and further attended by Alberto Gonzalez Prieto, Georgios Karagiannis, Vladislav Marinov and Aiko Pras. Presentations were given by Jürgen Schönwälder (review of draft-irtf-nmrg-snmp-measure-01.txt / SNMP trace collection/analysis update), Aiko Pras (Report from the NMRG meeting in Utrecht) and Alberto Gonzalez Prieto (Distributed monitoring algorithms). The agenda and minutes can be downloaded from <http://www.ibr.cs.tu-bs.de/projects/nmrg>.

4 Interaction with industry & other research projects

Updates and changes:
Sections 4.2.6 - 4.2.9 are new.

4.1 *Theta days*

In the first phase of EMANICS three theta days have been organized.

4.1.1 Oslo

On April 20, 2006, a first theta day was organized by HIO in Oslo. This day was a big success. In the morning there was a Distinguished panel debate on “The technical and legal challenges of global network services”; panelists were Inger Marie Sunde (UIO), Christian With (Datatilsynet/Data Inspectorate), Helge Skrivervik (Team Mellvik) and Geir Isene (Freecode AS). In the afternoon there were three tutorials on “Automated Configuration with Cfengine”, “Basic Networking Concepts” and “Virtual Linux Management with MLN”.

4.1.2 Nancy

On October 6, 2006 a half day theta day on network monitoring was organized at the headquarters and NOC of the CIRIL, the operator of the research network in the north-east of France. From EMANICS there were partners from UT (Aiko Pras, Tiago Fioreze) and INRIA (Isabelle Chrisment, Laurent Andrey, Radu State). Several people from CIRIL attended, including Carol Proc and Francois Schwaab.

The objective of this theta day was to establish a first contact and to provide a mutual bilateral exchange of ideas and problems between the CIRIL team and the EMANICS consortium. The meeting started with two presentations. The first presentation offered an overview of the network infrastructure managed by CIRIL. CIRIL is a regional ISP and service provider for all academic institutions, ranging from research lab, universities and regular schools in the Lorraine region. This overview covered the architecture, topology, technologies, and future evolutions of the CIRIL network. A second presentation was concerned with intra-network flow monitoring and the *netMAT* package. The CIRIL team identified the need and problems that they had to address in order to leverage the Netflow supporting monitoring platform towards a fine grained and accurate tool, capable to monitor flows that are sourced and addressed to entities within the CIRIL network. This topic is of particular interest in the EMANICS consortium, where self-management for optical networks is mainstream research at UT. Additional discussions covered SNMP and difficulties/problems related to the integration of vendor specific management platforms.

4.1.3 Utrecht

A joint EMANICS / IRTF-NMRG Workshop on “Future Direction of Network and Service Management Research” was organized on 19-20 October 2006. Organizers were UT, IUB and CETIM. The workshop was hosted by SURFnet, and attended by world-wide leading researchers from industry, operators and academia. From industry there were participants from HP, Cisco, Ericsson, Huawei, NEC, Technion, Avaya and Lucent. Operators came from Orange France Telecom, Switch, Tiscali and Korea Telecom. From outside EMANICS researchers came from Pohang University of Science and Technology and University of Murcia; from within EMANICS researchers came from University College Oslo, LORIA -

INRIA, University of Twente, International University Bremen, KTH and the University of Zurich.

A description of this workshop can be found on the EMANICS website and the NMRG site.

4.2 Cross-project interaction

4.2.1 MOME

On February 27, 2006, Aiko Pras (UT) attended in Salzburg the MOME [34] Workshop. MOME was an IST coordination action that offered a platform for knowledge and tool exchange, and for coordinating activities in the field of IP monitoring and measurement between IST projects and other European partners. The platform provided information on the interoperability of monitoring and measurement tools, as well as measurement data in a common format. The MOME project concluded on 31 March 2006, although the MOME database is still maintained. Within EMANICS, the MOME results are used in WP6 for the creation of a database of network management software.

4.2.2 EURO-NGI

On April 6, 2006, Jürgen Schönwälder (IUB) attended in Valencia, Spain, a conference organized by the related Euro-NGI NoE [35]. He gave an invited talk, called “Perspectives on Network Management”.

Both Euro-NGI and EMANICS are very positive about future collaboration; it was therefore agreed to organize two joint events, one associated with the EMANICS AIMS conference in 2007 and a second associated with the EuroFGI conference that will also be organized in 2007.

4.2.3 CNRS WIDE

On September 18-19, 2006 Olivier Festor (INRIA) attended the CNRS WIDE meeting, which was held in Paris.

4.2.4 EUNICE

On September 18-20, 2006, Aiko Pras (UT) attended the EUNICE [36] 2006 Summerschool, which was organized in Stuttgart, Germany. This Summerschool is generally attended by many researchers from EMANICS, EURO-NGI and E-Photon. At the Steering Committee meeting of this Summerschool it was decided to investigate the possibility to organize the EUNICE Summerschool next year in Twente (the Netherlands) as a joint EMANICS - EURO-NGI activity.

4.2.5 Grand Colloque STIC

On November 16-17, Olivier Festor (INRIA) gave a presentation on “The Management Plane in Autonomic Networks” at the french TIC (Technologies de l'Information et de la Communication) colloquium to which close to 1000 participants from academia and industry did participate. The presentation is available on the EMANICS web portal.

4.2.6 NAVS Spring 2007 concertation meeting

On March 14, 2007 Aiko Pras gave two presentations at the NAVS Spring 2007 concertation meeting, which took place at INRIA Rocquencourt, France. The first presentation, which was given at the plenary meeting, discussed the EMANICS

standardization activities as well as lessons learned. The second presentation was given at Media Delivery Platform cluster and discussed EMANICS Podcast creation experiences. Slides are supposed to be available from <http://forum.europa.eu.int/Members/irc/infso/navs/home>.

4.2.7 TERENA Workshop on Future Networking Initiatives

On February 22, 2007 Jürgen Schönwälder and Aiko Pras attended the TERENA European Future Networking Initiatives Workshop in Amsterdam. Information on this workshop can be found at http://www.terena.org/events/details.php?event_id=911

4.2.8 Joint EMANICS-EuroFGI EUNICE 2007 Summer School

As a joint activity, EMANICS and EuroFGI organized the 13th EUNICE Open European Summer School and IFIP TC6.6 Workshop on Dependable and Adaptable Networks and Services. This workshop took place between July 18-20, 2007 at the University of Twente, the Netherlands. This Summer School is sponsored by IFIP TC6.6, IEEE ComSoc and the Netherlands Organization for Scientific Research (NWO). Proceedings are published as part of the Springer LNCS series. The number of participants was 64.

4.2.9 Joint EMANICS-AGAVE Workshop on Future Networking Initiatives

After the review meeting in Brussels discussions and email exchanges started to prepare a joint AGAVE/EMANICS workshop. Currently work is performed to create the program committee.

5 Conclusions

Updates and changes:
This section has been rewritten.

WP5 is structured within three tasks:

- T5.1: Tutorials and publications
- T5.2: Standardization
- T5.3: Interaction with industry and other research projects

In the first phase, six tutorials have been funded by EMANICS; in April 2006 two at the NOMS 2006 conference in Vancouver, in May 2006 two at the University of Pitesti, in September 2006 one at the University of Nancy and in June 2007 one at the AIMS conference in Oslo. These tutorials can be downloaded via the EMANICS website. It should be noted that some of these tutorials have been presented multiple times and at multiple locations, and that EMANICS partners have also developed and presented additional tutorials for other occasions. Since these tutorials have not been funded by EMANICS, this deliverable has not reported on these additional tutorials.

With respect to book publications, many EMANICS researchers have contributed to the Handbook of Network and Systems Administration. This book will be published at the end of 2007 by Elsevier. Editors are Jan Bergstra and Mark Burgess (EMANICS), the advisory editors are Rob Kolstad and Morris Sloman (EMANICS).

Within Internet management standardization, EMANICS partners hold strong positions within IETF WGs and the IRTF-NMRG. In the first phase, 26 Internet-Drafts and 1 RFC were (co-)authored by EMANICS partners. The chairs of the IETF-ISMS and the IRTF-NMRG are EMANICS members. EMANICS partners contributed to several IETF WGs, in particular the Integrated Security Model for SNMP (ISMS), Network Configuration (NETCONF), Next Steps in Signaling (NSIS) and the Transport Area Working Group (TSVWG). EMANICS members have organized four highly successful IRTF-NMRG meetings, are members of the IETF MIB Doctors and the IETF Security Directorate.

EMANICS partners have interacted with various related projects, including the MOME IST coordination action, the Euro-NGI NoE, CNRS WIDE, the EUNICE Forum and the Grand Colloque STIC. Together with Euro-NGI/FGI, the EMANICS NoE organized the July 2007 EUNICE Summerschool and together with the AGAVE project, EMANICS will organize a joint workshop on the management of virtual networks in November 2007.

The general conclusion is that WP5 is running well and made strong contributions to the IETF and IRTF. A problem, however, is that most WP5 activities must be performed by senior staff members; some partners with an Additional Costs (AC) model have expressed problems justifying time investments and therefore only parts of their activities have been integrated in WP5. Since there has been some confusion within the EMANICS project on where to “register” tutorial and training activities; for Phase II, the decision was taken to concentrate further activities in WP3.

6 References

Updates and changes:
This section has been extended.

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7 Abbreviations

Updates and changes:
This section has not been changed.

AAA	Authentication, Authorization, and Accounting
BGP	Border Gateway Protocol
CETIM	University of Federal Armed Forces Munich
COPS	Common Open Policy Service
DiffServ	Differentiated Services
DSOM	Distributed Systems, Operations and Management
HIO	Oslo University College
IETF	Internet Engineering Task Force
INRIA	Institut National de Recherche en Informatique et Automatique
IRTF	Internet Research Task Force
ISMS	Integrated Security Model for SNMP
IUB	International University Bremen
KTH	Royal Institute of Technology
LMU	Ludwig-Maximilian University Munich
MIB	Management Information Base
MPLS	Multi-Protocol Label Switching
NETCONF	Network Configuration
NGN	Next Generation Network
NMRG	Network Management Research Group
NOMS	Network Operations and management Symposium
NSIS	Next Steps in Signaling
PDB	Per Domain Behavior
PSNC	Poznan Supercomputing and Networking Center
PSTN	Public Switched Telephone Network
QoS	Quality of Service
RMON	Remote Monitoring
RSVP	Resource Reservation Protocol
SCTP	Stream Control Transmission Protocol
SLA	Service Level Agreements
SLS	Service Level Specifications
SMI	Structure of Management Information
SNMP	Simple Network Management Protocol
SSH	Secure SHell
TIC	Technologies de l'Information et de la Communication
TLS	Transport Layer Security
TMSM	Transport Mapping Security Model
TSVWG	Transport Area Working Group
UniS	University of Surrey
UniZH	University of Zürich
upc	Universitat Politècnica de Catalunya
UPI	University of Pitesti
UT	University of Twente
VoIP	Voice over IP
WG	Working Group

