



European Sixth Framework Network of Excellence FP6-2004-IST-026854-NoE

Deliverable D3.4 **Conference and Event Report**

The EMANICS Consortium

Caisse des Dépôts et Consignations, CDC, France
Institut National de Recherche en Informatique et Automatique, INRIA, France
University of Twente, UT, The Netherlands
Imperial College, IC, UK
Jacobs University Bremen, IUB, Germany
KTH Royal Institute of Technology, KTH, Sweden
Oslo University College, HIO, Norway
Universitat Politècnica de Catalunya, UPC, Spain
University of Federal Armed Forces Munich, CETIM, Germany
Poznan Supercomputing and Networking Center, PSNC, Poland
University of Zürich, UniZH, Switzerland
Ludwig-Maximilian University Munich, LMU, Germany
University College London, UCL, UK
University of Pitesti, UniP, Romania

© **Copyright 2008 the Members of the EMANICS Consortium**

For more information on this document or the EMANICS Project, please contact:

Dr. Olivier Festor
Technopole de Nancy-Brabois - Campus scientifique
615, rue de Jardin Botanique - B.P. 101
F-54600 Villers Les Nancy Cedex
France
Phone: +33 383 59 30 66
Fax: +33 383 41 30 79
E-mail: <olivier.festor@loria.fr>

Document Control

Title: Conference and Event Report
Type: Public
Editor(s): David Hausheer
E-mail: hausheer@ifi.uzh.ch
Author(s): WP3 Partners
Doc ID: D3.4

AMENDMENT HISTORY

Version	Date	Author	Description/Comments
0.1	2008-07-21	D. Hausheer	Initial version
0.2	2008-10-07	D. Hausheer	Updates and refinements
1.0	2008-12-31	D. Hausheer	Final version

Legal Notices

The information in this document is subject to change without notice.

The Members of the EMANICS Consortium make no warranty of any kind with regard to this document, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. The Members of the EMANICS Consortium shall not be held liable for errors contained herein or direct, indirect, special, incidental or consequential damages in connection with the furnishing, performance, or use of this material.

Contents

1	Executive Summary	1
2	Introduction	2
3	Workshop on Autonomic Management in the Future Internet	3
3.1	Workshop Scope	3
3.2	Programme	3
3.3	Local Arrangements and Costs	4
3.4	Evaluation	4
4	International Summer School on Network and Service Management (ISSNSM)	5
4.1	Content	5
4.2	Schedule	6
4.3	Evaluation	6
4.4	Conclusion	6
5	Autonomous Infrastructure, Management, and Security (AIMS)	8
5.1	Keynote	8
5.2	Technical Paper Sessions	9
5.3	PhD Workshop	9
5.4	Tutorials	10
5.5	Technical Program Chairs	10
5.6	Conclusions	11
6	Workshop on Vision and Management of the Future Internet	12
6.1	Workshop Scope	12
6.2	Programme	12
6.3	Local Arrangements and Costs	13
6.4	Evaluation	13
7	Workshop on Economic Traffic Management (ETM)	14
7.1	Programme	14
7.2	Local Arrangements and Costs	15
7.3	Evaluation	15

8	Workshop on Netflow/IPFIX Usage in Network Management	16
8.1	Workshop Scope	16
8.2	Programme	16
8.3	Local Arrangements and Costs	17
8.4	Documents	17
8.5	Evaluation	18
9	Dissemination Management	19
10	Conclusions and Future Events	24
11	Acknowledgement	25
A	Appendices	25

1 Executive Summary

The overall objective of work-package 3 of EMANICS is to encourage and support the integration and dissemination of scientific research and education through workshops, conferences, special summer- or winter-schools, and educational resource development.

In the reporting period between April and December 2008 this objective was achieved on one hand through the organization of a number of events, including the 2nd EMANICS summer school and the 2nd AIMS conference, as well as four scientific workshops including the Workshop on Autonomic Management in the Future Internet, the Workshop on Vision and Management in the Future Internet, the Workshop on Economic Traffic Management, and the Workshop on Netflow/IPFIX Usage in Network Management. It is worth noting that all these events were very successful, with many participants from both industry and academia. Partially, reports about these successful events have even been accepted for publication in the Journal of Network and Systems Management.

On the other hand, EMANICS did financially support scientific dissemination through a number of 83 attendances to major conferences and workshops worldwide and the building of 5 new tutorials. EMANICS did also support the IFIP/IEEE Manweek 2008 conference through the sponsorship of 3 travel grants for EMANICS members. In return, the EMANICS logo was put on the Manweek website. In addition, EMANICS encouraged and supported the involvement of EMANICS members in leading a number of activities in the area of network and service management.

Given the success of EMANICS events, the organization and hosting of AIMS 2009 and the 3rd summer school have already been settled. To this end, the new domain aims-conference.org has been setup, which will be used from now on to host the websites of future AIMS conferences and summer schools beyond the project lifetime. In addition, at least three scientific workshops are planned to take place again in 2009, as follow-ups of the successful events in 2008.

2 Introduction

This deliverable reports on the events organized under the Work-Package 3 umbrella of EMANICS in the second half of phase 2 (April 2008 - December 2008). Six events are presented here:

- the Workshop on Autonomic Management in the Future Internet, that took place in Barcelona, May 2008;
- the 2nd International Summer School on Network and Service Management (ISSNSM) which took place in Zurich, June 2008;
- the 2nd International Conference on Autonomous Infrastructure, Management and Security (AIMS 2008) which was held in Bremen, July 2008;
- the Workshop on Vision and Management of the Future Internet, that took place in Bremen, July 2008;
- the Workshop on Economic Traffic Management (ETM), that took place in Zurich, August 2008;
- and the Workshop on Netflow/IPFIX Usage in Network Management, that took place in Munich, October 2008.

In addition, the deliverable provides an overview of scientific dissemination activities performed since April 2008.

3 Workshop on Autonomic Management in the Future Internet

Organized by UPC and sponsored by EMANICS, the joint ACF, AUTOI, EMANICS Workshop on Autonomic Management in the Future Internet¹ took place on May 14th 2008 at the UPC premises in Barcelona. The local co-chair of the workshop was Joan Serrat from Universitat Politecnica de Catalunya.

3.1 Workshop Scope

The objective of this workshop was to make the three communities involved - the Autonomic Communications Forum (ACF), the IST project Autonomic Internet (AUTOI), and the EMANICS NoE - aware about their current ideas and problems in the area of autonomic management. Although specially addressed to the ACF, AUTOI and EMANICS, the workshop was open to the public. The day of the event was selected in between the plenary meetings of the ACF and the AUTOI project to facilitate the participations of both organizations. In total it received almost 40 registrations, of which some were from external people.

3.2 Programme

A total of 9 presentations were invited to participate. The opening consisted in an introduction of the respective organizations (ACF, AUTOI and EMANICS). The morning session presented four contributions around context modelling and context usage in autonomic communications. Each contribution was allowed for 25 minutes presentation and 15 minutes for questions and discussion. With the same structure, the afternoon session presented two works around modelling issues. Finally, the evening session presented three papers on miscellaneous topics like virtualization challenges, security management and traceability maps.

The detailed programme of the one-day workshop is shown below:

09:00 Welcome

09:15 ACF presentation, Joel Fleck, Hewlett-Packard
AUTOI presentation, Alessandro Bassi, Hitachi Europe
EMANICS presentation, Joan Serrat, UPC

10:00 Coffee break

10:30 Context Information Service Network, Alex Galis, University College London, UK

11:10 Towards an Architecture for Context-Driven Self-Management of Services, Iris Hochstatter, University of Federal Armed Forces, Germany

¹http://emanics.org/component/option,com_openwiki/Itemid,144/id,acf_workshop/

- 11:50 SLA Modeling for E-negotiations, Enforcement and Management in an Autonomic Environment, Giannis Koumoutsos, University of Patras
- 12:30 Engineering Semantic Mappings for Autonomic Management, Declan OSullivan, Trinity College Dublin, Ireland
- 13:10 Lunch break
- 14:30 Using an Information Model for Network Configuration and Management via Domain Specific Languages, Steven Davy, Waterford Institute of Technology, Ireland
- 15:10 Modelling Support for Autonomic Communications, John Strassner, Motorola Labs, USA
- 15:50 Coffee break
- 16:30 Traceability Maps: A Tool for Managing Highly Distributed Service Environments, Joel Fleck, Hewlett-Packard Company, USA
- 17:10 Virtualization in AutoI, Hermann de Meer, University of Passau, Germany
- 17:50 Security Management in Dynamic Communities, Alberto Schaeffer-Filho, Imperial College London, UK
- 20:30 Social event

It is worthy to mention the high level of participation of the attendants that motivated in most of the cases the interruption of the discussion by the chairman to allow the following presentation.

3.3 Local Arrangements and Costs

The organizational and hosting costs of the workshop were of 3000 Euros for EMANICS. The workshop was open to non-EMANICS members and registration was free.

All presentation slides and workshop material has been made freely available to the public on the workshop web site.

3.4 Evaluation

In summary, the workshop was very successful reaching the objectives for which it had been set. For the ACF it was the opportunity to make aware EMANICS and AUTOI about the opportunities of collaborative work that can be undertaken and that finally may lead to de facto standards. For the EMANICS and the AUTOI projects, it was a step towards their liaison and standardisation objectives. In this aspect it is worthy to mention that the ACF and EMANICS agreed to establish a formal collaboration liaison. Also, the model of this workshop, conceived as a meeting between common interest communities, far from the formal organization and structure of most conferences, proved to be effective and invites to repeat this experience in the future.

4 International Summer School on Network and Service Management (ISSNSM)

The 2nd summer school on network and service management² took place June 2-6, 2008 in Zurich, Switzerland. This school combined class room lectures with hands on lab sessions and primarily targeted PhD students working in the area of network and service management. It was organized by Burkhard Stiller and David Hausheer (UniZH).

The EMANICS summer school provided advanced classes on a comprehensive suite of advanced topics in network management. The courses were accompanied with practical hands-on labs in order to combine the theoretical background with some operational experience. The instructors are well known members of the academic and industrial community.

A full report about the summer school which has been submitted for publication to the Journal of Network and Service Management [1] is attached at the end of this deliverable.

4.1 Content

Courses and associated practical labs were be organized by instructors who are well known experts. The courses introduced technologies, which were later further studied by the students in a series of exercises of lab experiments.

- Topic #1: Security
 - Hacking Web2 (Radu State)
- Topic #2: Virtualization and Simulations
 - Simulating Networks with Network Simulator 2 (ns-2) (Frank Eyermann)
 - Using Xen Virtualization in Research Projects (Kyrre Begnum)
 - Distributed Test-Lab: EMANICSLab (Cristian Morariu, David Hausheer)
- Topic #3: Network Monitoring and Management
 - Managing Information from your Network (Bruno Klauser)
 - Do you know SNMP? (Aiko Pras)
 - Nagios (Laurent Andrey, Remi Badonnel)
 - Introduction to NETCONF and YANG (Juergen Schoenwaelder)

²<http://www.csg.uzh.ch/events/issnsm08/>

4.2 Schedule

The overall schedule for the week is show below. The summer school started on Monday morning and closed on Friday afternoon.

Monday:	08:30 - 09:00	Welcome and registration
	09:00 - 17:00	Hacking Web2
Tuesday:	09:00 - 17:00	Simulating Networks with Network Simulator 2 (ns-2)
Wednesday:	09:00 - 15:00	Using Xen Virtualization in Research Projects
	15:30 - 17:00	Distributed Test-lab: EMANICSLab (Exercises)
Thursday:	09:00 - 12:30	Do you know SNMP?
	14:00 - 17:00	Introduction to NETCONF and YANG
Friday:	09:00 - 12:30	An Introduction to Monitoring with Nagios
	14:00 - 17:00	Managing Information from your Network

4.3 Evaluation

The summer school was evaluated by distributing an evaluation form to the participants. A total of 18 evaluation forms were returned. Below is the summary of the numeric data collected. All grades are given on a scale of 1 to 5 (1 being excellent and 5 poor).

Question	Grade
How do you rate the overall organization?	1.2
How do you rate your accommodation on campus?	1.6
How do you rate the rooms and infrastructure provided?	1.1
Did you have enough time to interact with other people?	1.3
How do you rate the selection of the topics?	1.6
How do you rate the selection of presenters?	1.8

Overall, most attendees were very happy. We asked who would attend a third incarnation of the summer school and 16/18 (89%) indicated they would attend ISSNSM in 2009. We also asked free form questions concerning topics participants are specifically interested in, concerning things that can be improved in a future event, and we were asking which aspects of the summer school participants liked very much. This information has been passed on to the organizers of the ISSNSM 2009 event.

4.4 Conclusion

The summer school was attended by 28 persons and turned out again to be a highly interactive and successful event. The evaluation of the summer school was again very positive.

A third incarnation of the summer school following the same principle of combining lectures with practical lab sessions will be hosted by UniBwM in Munich in 2009. More details will soon become available on the ISSNSM 2009 website ³.

³<http://www.aims-conference.org/issnsm-2009/>

5 Autonomous Infrastructure, Management, and Security (AIMS)

This section reports on the 2nd International Conference on Autonomous Infrastructure, Management and Security (AIMS 2008) which was held at Jacobs University Bremen on July 1-3, 2008⁴. A copy of this report has been published in the Journal of Network and Service Management [2].

The three day AIMS 2008 conference has been a single-track event integrating normal conference paper sessions, tutorials, keynotes, posters, and a PhD workshop into a highly interactive event. One of the goals of AIMS is to look beyond borders and to stimulate the exchange of ideas across different communities and among PhD students.

The theme of AIMS 2008 was "Resilient Networks and Services" with a specific focus on novel technologies that can provide resilience in a scalable, economic, secure, and autonomic way. To achieve resilience, new techniques such as autonomic and fully distributed algorithms, virtualization techniques, or self-organizing overlays must be explored. Furthermore, modeling, analysis, and visualization are essential in order to understand the emerging overall system behavior.

AIMS 2008 was organized and supported by the EC IST-EMANICS Network of Excellence (#26854) in cooperation with ACM SIGAPP and ACM SIGMIS and co-sponsored by IFIP WG 6.6 and Jacobs University Bremen.

5.1 Keynote

Simon Leinen, who is working at the Swiss Education and Research Network (SWITCH), delivered the opening keynote talk⁵. He explained the structure of the current SWITCH network and discussed some particular (and sometimes peculiar) network engineering and management practices. Simon Leinen reflected on the change from a pure IP service provider to an organization that also operates the optical links of their core network. He discussed several advantages of operating their own backbone network but he also mentioned the many changes needed to handle the optical infrastructure. Nice examples were link failures caused by little animals or hunters who happen to shoot down links once in a while.

In his talk, Simon Leinen pointed out several cases where the evolution of the Internet was harmed by security best practices. He gave the example of the Domain Name System (DNS), which was designed to run over both UDP and TCP. Since the TCP transport was primarily used for zone transfers in the early days of the Internet, security experts often recommended blocking DNS over TCP as a means to restrict zone transfers. Nowadays, the DNS needs to carry IPv6 addresses and security credentials and suddenly the DNS over UDP limit of 512 bytes becomes a problem but the fallback to TCP does now work anymore.

⁴<http://www.aims2008.org/>

⁵<http://www.eecs.jacobs-university.de/aims2008/keynote.pdf>

At the end of his keynote, Simon Leinen identified several things that would make the life of network operators simpler. The first item on his wish list are better configuration management tools that can "decompile" existing configurations into higher-level descriptions and which can highlight deviations from the higher-level descriptions. The second item on his wish list are mashup-friendly tools. It is very common that operators use several different tools at the same time and it would simplify workflows a lot if tools would integrate more easily. The third item on his wish list are better routing and flow information mining tools, and finally the fourth item are better visualization and data organization tools.

5.2 Technical Paper Sessions

The technical paper sessions covered topics in the areas of "Network Traffic Engineering and Analysis", "Autonomy, Incentives and Trust", "Autonomy, Incentives and Trust", "Load Balancing and Fault Recovery", and "Convergent Behavior". A total number of 13 full papers out of 33 submissions were selected for presentation at the conference. Additionally, a four work-in-progress papers were presented as posters. More details about the paper selection process and the Technical Program Committee (TPC) can be found in the conference proceedings [3]. The technical paper sessions were organized in a way that people were only allowed to ask clarification questions after the talk, while all more general questions had to be kept to a mini-panel at the end of the session. This format enabled a number of interesting discussions after the presentations, sometimes even between the authors.

In order to highlight the most original contribution and to stimulate competition between the authors, an AIMS 2008 best paper award has been established. A best paper award committee was formed consisting of James Hong (POSTECH), Aiko Pras (University of Twente), Ramin Sadre (University of Twente), Jürgen Schönwälder (Jacobs University), and Rolf Stadler (KTH). The award was given to Alva Couch and Marc Chiarini for their paper "Dynamic Consistency Analysis for Convergent Operators". This paper takes a different approach at the policy conflict problem. Instead of trying the traditional approach of analyzing policy rules for logical conflicts, the authors assume that policies can be expressed as convergent operators and they calculate an upper bound when a system applying these convergent operators has to arrive at a stable state that is consistent with the policies. If the system does not converge after the estimated time, the likelihood is high that a conflict exists that prevents the system from converging. For more details, please study the full paper published in the conference proceedings.

5.3 PhD Workshop

The AIMS conference includes a PhD workshop that is targeted at PhD students who have just started their thesis project. Aiko Pras opened the workshop with a tutorial discussing where to publish scientific papers⁶. The tutorial started with a survey of the various journals and conferences that publish network and service management research papers.

⁶<http://www.eecs.jacobs-university.de/aims2008/where-to-publish.pdf>

Aiko Pras then introduced the various metrics being used to assess and compare the quality of the conferences and journals. After discussing acceptance rates and impact factors in quite some detail with many interesting examples, Aiko Pras ended up discussing the h-index (also called the Hirsch index) that is becoming increasingly popular to measure the scientific productivity of researchers or research groups. While this talk was primarily aimed at making PhD students aware of how research is currently evaluated, it was surely interesting for the more senior people in the audience as well.

The second part of the PhD workshop was devoted to short presentations of PhD projects. The eight presentations were selected from twelve short paper submissions that have been received for the PhD workshop. The presenters were asked to present the motivation of their research project and the approach that will be taken to address the research questions. During the discussion, the PhD students had to answer challenging questions such as "Why is research on this topic relevant?" or "Why do you think you can succeed where others have not been successful in the past?". The presentations led to very lively discussions. Some of these discussions continued outside the meeting room where every PhD workshop presenter had a poster.

5.4 Tutorials

One of the differences of AIMS compared to other conferences is that it includes free tutorials which are embedded into the technical program. At AIMS 2008, six short tutorials (90 minutes) were offered covering the topics network virtualization (Omar Cherkaoui), traffic measurement (James Hong), ISO/IEC 20000 and ITIL best practices (Thomas Schaaf), promise theory (Mark Burgess), high-speed passive packet capture and filtering (Luca Deri), and Grid resource management (Jörn Altmann).

The tutorials were generally well attended, although the tutorials at the end of the third day suffered a bit from some people leaving early due to another EMANICS workshop slightly overlapping with the AIMS program. Several tutorials have been very interactive with some in depths discussions of the topics covered.

5.5 Technical Program Chairs

Jürgen Schönwälder is Associate Professor of Computer Science at Jacobs University Bremen, Germany. He received his doctoral degree in 1996 from the Technical University Braunschweig, Germany. His research interests are distributed systems, network management, wireless sensor networks, and network security. He is an active member of the Internet Engineering Task Force (IETF) and chair of the Network Management Research Group (NMRG) of the Internet Research Task Force (IRTF). He is a member of the editorial board of the IEEE Transactions on Network and Service Management and the Springer Journal of Network and Systems Management.

David Hausheer is a senior researcher and lecturer in the Department of Informatics (IFI) at the University of Zurich, focusing on management of Grid and P2P services. He holds a PhD in communication systems and a diploma degree in electrical engineering from

ETH Zurich. He has been involved in the EU projects M3I, MMAPPS, Akogrimo, EMAN-ICS, Cost 290, EC-GIN, and SmoothIT. Moreover, he is a co-applicant of the SNF project DaSAHIT and the Cisco project SCRIPT. Furthermore, he served as PC co-chair for IEEE BoD 2006 and BoD 2008, Tutorial co-chair for ACM AIMS 2007, and TPC co-chair for AIMS 2008. He has co-authored more than 25 peer-reviewed publications and acted as a reviewer for more than 30 journals, conferences, and workshops.

5.6 Conclusions

The AIMS 2008 event, which was attended by roughly 50 people, has been a great success. The goal of offering a highly interactive event has been met and the structure of a very mixed program that includes technical paper sessions, a PhD workshop, a keynote talk, poster presentations and several tutorials has worked very well. The fact that many people stayed on the campus further stimulated fruitful exchanges outside the technical program. Some people left the campus with a remark that they did not realize how fast three days can pass by.

Given the positive feedback about AIMS 2008, the AIMS steering committee has already decided that AIMS 2009 is going to take place at University of Twente, from Juni 30 - July 2, 2009. People who are interested in participating at AIMS 2009 can subscribe to the AIMS mailing list ⁷. More details are available on the AIMS 2009 website ⁸.

⁷aims-announce@ifi.uzh.ch

⁸<http://www.aims-conference.org/2009/>

6 Workshop on Vision and Management of the Future Internet

This section reports on the EMANICS Workshop Vision and Management of the Future Internet⁹ organized by the EMANICS members, that took place at Jacobs University Bremen, Germany on July 3 and 4, 2008. The chairs of the workshop were Gabi Dreo Rodosek and Iris Hochstatter from Universitaet der Bundeswehr Muenchen and Juergen Schoenwaelder from Jacobs University Bremen.

6.1 Workshop Scope

The objective of the workshop on "Vision and Management of the Future Internet" that was co-located with the 2nd International Conference on Autonomous Infrastructure Management and Security (AIMS) was to present and discuss possible approaches towards the Future Internet.

In that context, one position is to replace the Internet as it stands today with a 'clean slate' design. Another possible approach would be to have many parallel / federated Internets instead of a single one. Finally, a third proposal is that evolution happens on the content layer and that the core stays almost untouched as it is. Based on these three positions, an integral part of the workshop was a panel discussion among experts in that field of research in which the different points of view are emphasized and discussed. Another fundamental part of the workshop was the assignment of different working groups that discussed the alternatives, and especially the implications on management. The outline and relevant action items for joint publications were discussed as well.

6.2 Programme

The workshop was held over two days and had the following programme:

Thursday, July 3, 2008:

- 14:00 Welcome and Opening (Gabi Dreo Rodosek)
- 14:15 Keynote: The Future Internet - Is it time to look for a new one? (Juergen Quittek)
- 15:30 Coffee Break
- 16:00 Panel "Future Internet visions and their impact on Network Management" (Chair: Gabi Dreo Rodosek)
 - a) replacement of the current Internet with a 'clean slate' design (Aiko Pras)
 - b) many federated networks (Spiros Spirou)
 - c) evolution happens around IP, while IP stays almost as it is (Georg Carle)

⁹<http://emanics.org/content/view/131/135/>

17:30 Group Assignment

18:30 Social Event

Friday, July 4, 2008:

09:00 Working in groups

12:00 Lunch

13:00 Presentation of group results:

- Group "Clean slate" (Aiko Pras, Burkhard Stiller, David Hausheer, James Hong, Juergen Quittek)
- Group "Evolution" (Georg Carle, Javier Rubio-Loyola, Marinos Charalambides, Spiros Spirou)
- Group "Content" (Jürgen Schönwälder, Gabi Dreo, Iris Hochstatter, Marc Fouquet)

16:00 End

6.3 Local Arrangements and Costs

The organizational and hosting costs of the workshop were of 3000 Euros for EMANICS. The workshop was upon invitation only, but registration was free.

All presentation slides and workshop material is freely available to the public on the workshop web site.

6.4 Evaluation

The workshop on Vision and Management of the Future Internet was a success. With 17 attendees it did lead to many fruitful discussions and scientific exchange. The result of the workshop was presented at the 8th Wuerzburg Workshop on IP: Joint EuroNF, ITC, and ITG Workshop on "Visions of Future Generation Networks" (EuroView 2008) and at the Future Internet Symposium (FIS 2008).

A follow-up workshop on the Management of the Future Internet (ManFI), organized by Gabi Dreo Rodosek and James Hong, is going to take place in New York in June 2009, in conjunction with IM 2009. More information is available on the workshop website ¹⁰.

¹⁰<http://www.manfi.org/>

7 Workshop on Economic Traffic Management (ETM)

The Economic Traffic Management Workshop¹¹ took place at University of Zurich, Switzerland on August 4-5, 2008. It was organized jointly by EC-GIN, SmoothIT, and EMANICS. The chair of the workshop was Burkhard Stiller from the University of Zurich.

A full report about the ETM workshop which has been published as IFI Technical Report [4] and is attached at the end of this deliverable.

7.1 Programme

The workshop was held over two days and had the following programme:

Monday, August 4, 2008

12.00 Lunch (optional)

13.15 Welcome

13.30 Session 1: "Incentives and P2P"

- T. Bocek: Private Shared History
- P. Racz: SmoothIT Overlay Management Architecture
- T. Hossfeld: Modeling of P2P-based Video Streaming

15.00 Coffee Break

15.30 Session 2: "Congestion Control and Traffic Management"

- M. Welzl: Current IRTF/IETF Congestion Control Work and How it Relates to P2P Systems
- J. Fdez-Palacios: Operators Vision about Overlay Traffic Management
- S. Soursos: Insertion of ISP-owned peers and Locality Awareness in BitTorrent

17.00 Discussion: Will Economic Traffic Management Mechanisms be successful?

18.00 Social Event

Tuesday, August 5, 2008

09.00 Session 3: "Bottleneck Detection and Distributed Capturing"

- M. M. Yousaf: Shared Network Bottleneck Detection with SVD
- C. Morariu: DiCAP - An Architecture for Distributed Packet Capturing

10.30 Coffee Break

¹¹<http://emanics.org/content/view/138/36/>

11.00 Session 4: "Locality Mechanisms"

- M. Waldburger: Locality and Contracts
- N. Liebau, A. Kovacevic: Globase.KOM - A P2P Overlay for Fully Retrievable Location-based Search
- A. Juturu Kumar: Locality Information Using BGP

12.30 Lunch

14.00 Session 5: "QoS Management and Traffic Optimization"

- J. Rubio-Loyola: Issues Confronting Business-driven QoS DiffServ Management
- M. Kantor: Inter-domain Traffic Optimization in an Inter-carrier Environment

15.00 Closing

- B. Stiller: Wrap-up Discussion

15.30 End

7.2 Local Arrangements and Costs

The organizational and hosting costs of the workshop were of 3000 Euros for EMANICS. The workshop was open to non-EMANICS members and registration was free.

All presentation slides and workshop material has been made freely available to the public on the workshop web site.

7.3 Evaluation

The workshop on Economic Traffic Management was a success. With 16 attendees it did lead to many fruitful discussions and scientific exchange. A second ETM workshop is planned to take place again in Zurich in fall 2009.

8 Workshop on Netflow/IPFIX Usage in Network Management

This section reports on the *Joint EMANICS/IRTF-NMRG Workshop on Netflow/IPFIX Usage in Network Management*¹² organized by the EMANICS members, that took place at LRZ Munich, Germany on October 30, 2008. The chairs of the workshop were Aiko Pras and Ramin Sadre from the University of Twente. The local organizer was Helmut Reiser from the LRZ Munich.

8.1 Workshop Scope

The goal of the workshop was to exchange and discuss experiences and ideas in the usage of Netflow/IPFIX in network management.

Flow-based approaches are used in various areas of network management today, such as accounting, dependency discovery, and intrusion detection. The workshop addressed these and other areas, as well as related activities such as flow collection and storage, querying, etc.

8.2 Programme

The workshop was an opportunity for people to exchange and discuss their experiences and ideas. To structure the discussions the workshop was organized into several discussion topics. For each discussion topic, there were short presentations (10-15 minutes) highlighting different aspects of the topic, followed by a discussion round.

The workshop was held over one day and had the following programme:

09:00 Registration

09:30 Keynote: Benoit Claise, Cisco

10:15 Coffee break

10:30 Topic: What technologies are available to analyze flow data?

- Presentation: Flow record query languages (Vladislav Marinov, JUB)
- Presentation: Using SQL databases for flow processing (Anna Sperotto, UT)
- Presentation: A distributed architecture for IP flow analysis (Cristian Morariu, UZH)
- Presentation: 10G netflow monitoring (Luca Deri, ntop.org)
- Presentation: Hardware acceleration of NetFlow monitoring (Jiri Novotny, Masaryk University)

¹²<http://www.simpleweb.org/netflow/>

- Discussions

12:35 Lunch break

13:30 Topic: How do sampling and aggregation affect the volume and accuracy of data collection and analysis?

- Presentation: Open issues of hierarchical flow aggregation (Christoph Sommer, UniErlangen)
- Presentation: Flow-based TCP Connection State Detection (Tobias Limmer, UniErlangen)
- Presentation: Self-management of optical networks - can we trust NetFlow data? (Tiago Fioreze, UT)
- Discussions

15:00 Coffee break

15:15 Topic: For what kind of applications can Netflow/IPFIX be used?

- Presentation (canceled): Using IPFIX/PSAMP for anomaly detection (Tanja Zseby, FOKUS)
- Presentation: Application level dependency discovery with flows (Olivier Festor, INRIA)
- Presentation: IPFIX for VoIP monitoring (Sven Anderson, NECLAB)
- Discussions

16:45 Topic: Should we have a standard format for the annotation of Netflow/IPFIX traces?

- Discussions

17:30 Workshop close

8.3 Local Arrangements and Costs

The organizational and hosting costs of the workshop were of 3000 Euros for EMANICS. The workshop was open to non-EMANICS members and registration was free.

8.4 Documents

All presentation slides and the minutes of the discussion rounds have been made freely available to the public on the workshop web site. It is planned to publish a workshop report and/or to organize a special issue in a journal.

8.5 Evaluation

The Netflow workshop was a success. With 38 attendees from industry and academia, including leading personalities in the field as well as PhD students, it did lead to many fruitful discussions and scientific exchange. Given the great success of the workshop, discussions have already started about a second Netflow workshop in 2009, which is likely going to take place in Prague.

9 Dissemination Management

EMANICS did support a number of 83 attendances to major conferences worldwide through travel grants of 700 Euros each since April 2008.

In addition, EMANICS did support IFIP/IEEE Manweek 2008, the 4th International Week on Management of Networks and Services which took place on Samos Island, Greece from September 22 - 26, through the sponsorship of 3 travel grants for EMANICS members:

Author	Affiliation	Title
Anna Sperotto	UT	Anomaly characterization in flow-based traffic time series
Ha Manh Tran	JUB	Crawling Bug Tracker for Semantic Bug Search
Ramin Sadre	UT	Changes in the Web from 2000 to 2007

Moreover, EMANICS did financially support the building of the following tutorials:

Author	Affiliation	Title
Frank Eyermann	UniBwM	Simulating networks with Network Simulator 2 (ns-2)
Jürgen Schönwälder	JUB	Introduction to NETCONF and YANG
Radu State	INRIA	Web 2.0 Hacking
Aiko Pras	UT	Do you know SNMP?
Rémi Badonnel and Laurent Andrey	INRIA	Monitoring networked services with Nagios

Finally, as outlined in the following tables, EMANICS did support with an amount of 4900 Euros the involvement of EMANICS members in leading activities in the area of network and service management.

Emanics member	Role	Journal / Event / Organization	Date
Jürgen Schönwälder	Editorial Board	IEEE TNSM	2008
Jürgen Schönwälder	Editorial Board	Springer JNSM	2008
Jürgen Schönwälder	Chair	IRTF NMRG	2008
Jürgen Schönwälder	Chair	IETF ISMS	2008
Jürgen Schönwälder	Member	IETF Security Directorate	2008
Jürgen Schönwälder	WG Editor	IETF OPSAWG	2008
Jürgen Schönwälder	WG Editor	IETF NETMOD	2008
Jürgen Schönwälder	General Chair	AIMS 2008	July 2008
Jürgen Schönwälder	PC Member	DSOM 2008	July 2008
Jürgen Schönwälder	PC Member	SASO 2008	July 2008
George Pavlou	Program Co-chair	MMNS 2008	September 2008
George Pavlou	PC Member	IEEE/IFIP NOMS 2008	April 2008
George Pavlou	PC Member	IEEE ICC 2008	May 2008
George Pavlou	PC Member	IEEE SASO 2008	October 2008
George Pavlou	PC Member	IEEE GIIS 2008	July 2008
George Pavlou	PC Member	WWIC 2008	May 2008
George Pavlou	Co-editor	IEEE Communications Magazine, NSM series	April/October 2008
George Pavlou	Editorial Board	IEEE Communication Surveys and Tutorials	2008
George Pavlou	Editorial Board	IEEE Transactions on Network and Service Management	2008
George Pavlou	Editorial Board	Springer Journal of Network and Systems Management	2008
George Pavlou	Issue Co-editor	IEEE Journal of Selected Areas in Communications	December 2008
George Pavlou	PC Member	AIMS 2008	July 2008
Thomas Schaaf	PC Member	BDIM 2008	April 2008
Helmut Reiser	PC Member	ICNS 2008	March 2008
Helmut Reiser	PC Member	DFN 2008	May 2008
Helmut Reiser	PC Member	STPG 2008	May 2008
Helmut Reiser	PC Member	HP-SUA Workshop 2008	June 2008
Helmut Reiser	PC Member	AIMS 2008	July 2008
Helmut Reiser	PC Member	SGS 2008	August 2008
Michael Brenner	PC Member	HP-SUA Workshop 2008	June 2008
Michael Brenner	PC Member	BDIM Workshop 2008	April 2008
Heinz-Gerd Hegering	PC Member	NOMS 2008	April 2008
Heinz-Gerd Hegering	Editor	IEEE Transactions on NSM	various
Heinz-Gerd Hegering	Editorial Board Member	JNSM	various
Vitalian Danciu	PC Member	DTMF - SVM08	October 2008

Emanics member	Role	Journal / Event / Organization	Date
Burkhard Stiller	General Co-chair	BoD 2008	April 2008
Burkhard Stiller	Program Co-chair	P2P Management Workshop	March 2008
Burkhard Stiller	Program Chair	ETM Workshop	August 2008
Burkhard Stiller	PC Member	NOMS 2008	April 2008
Burkhard Stiller	PC Member	CMS 2008	March 2008
Burkhard Stiller	PC Member	ANM'08	April 2008
Burkhard Stiller	PC Member	IFIP Networking 2008	May 2008
Burkhard Stiller	PC Member	ICT'08	June 2008
Burkhard Stiller	PC Member	IWQoS 2008	June 2008
Burkhard Stiller	PC Member	AIMS 2008	July 2008
Burkhard Stiller	PC Member	ICCE 2008	June 2008
Burkhard Stiller	PC Member	WWIC 2008	May 2008
Burkhard Stiller	PC Member	IW-NTNAS 2008	April 2008
Burkhard Stiller	PC Member	FG KuVS	June 2008
Burkhard Stiller	PC Member	LANMAN 2008	September 2008
Burkhard Stiller	PC Member	GridNets 2008	October 2008
Burkhard Stiller	PC Member	SASO 2008	October 2008
Burkhard Stiller	PC Member	GC'08 NGNPS	December 2008
Burkhard Stiller	PC Member	HP-SUA 2008	June 2008
Burkhard Stiller	PC Member	Eunice Summer School	September 2008
Burkhard Stiller	PC Member	LCN 2008	October 2008
Burkhard Stiller	PC Member	Gecon2008	August 2008
Burkhard Stiller	PC Member	PDCCS 2008	September 2008
Burkhard Stiller	PC Member	DSOM 2008	September 2008
Burkhard Stiller	PC Member	MMNS 2008	September 2008
Burkhard Stiller	PC Member	IWSOS 2008	December 2008
David Hausheer	PC Member	P2P'08	September 2008
David Hausheer	Program Co-chair	BoD'08	April 2008
David Hausheer	Program Co-chair	AIMS 2008	July 2008
David Hausheer	PC Member	GridNets 2008	October 2008
David Hausheer	Local Co-organizer	ISSNSM 2008	June 2008
David Hausheer	Program Co-chair	P2P Management Workshop	March 2008
David Hausheer	Session Co-chair	Future Internet Conference Bled	March 2008
David Hausheer	Session Co-chair	Future Internet Assembly (FIA) Madrid	December 2008
David Hausheer	PC Member	COMNETS 2008	August 2008

Emanics member	Role	Journal / Event / Organization	Date
Arosha Bandara	PC Member	POLICY 2008	June 2008
Arosha Bandara	PC Member	NOMS 2008	April 2008
Arosha Bandara	PC Member	DANMS 2008	November 2008
Arosha Bandara	Tutorial and Keynote Chair	AIMS 2008	July 2008
Arosha Bandara	PC Member	AIMS 2008	July 2008
Emil Lupu	PC Member	POLICY 2008	June 2008
Emil Lupu	PC Member	NOMS 2008	April 2008
Emil Lupu	PC Member	AIMS 2008	July 2008
Emil Lupu	PC Member	ANM 2008	April 2008
Emil Lupu	PC Member	FTDCS 2008	October 2008
Emil Lupu	PC Member	APWeb 2008	April 2008
Emil Lupu	PC Member	Social Networks and Web 2.0 Track at WWW2008	April 2008
Mark Burgess	Editor	International Journal of Network Management	2008
Mark Burgess	Editor	Science of Computer Programming (Elsevier)	2008
Mark Burgess	PC Member	BDIM 2008	April 2008
Mark Burgess	PC Member	NOMS 2008	April 2008
Mark Burgess	Program co-chair	MACE 2008	September 2008
Mark Burgess	PC Member	DSOM 2008	September 2008
Mark Burgess	PC Member	ICAC 2008	June 2008
Mark Burgess	PC Member	AAMAS 2008	May 2008
Mark Burgess	Steering committee	AIMS	2008
Mark Burgess	Steering committee	USENIX LISA	2008
Mark Burgess	Local Organizer	Promise Theory Workshop	October 2008
Mark Burgess	PC Chair	USENIX/LISA BDIM Workshop	November 2008
Joan Serrat	BoD	Autonomic Communication Forum	
Joan Serrat	PC Member	NOMS'08	April 2008
Joan Serrat	Local Organizer	Autonomic Management workshop	May 2008
Joan Serrat	PC Member	Policy'08	June 2008
Joan Serrat	PC Member	AIMS'08	July 2008
Joan Serrat	PC Member	DSOM'08	September 2008
Joan Serrat	PC Member	EVGM'08	September 2008
Joan Serrat	Local Organizer	Autonomic Communications Forum	May 2008
Joan Serrat	Tutorial Co-chair	CCGRID'08	May 2008

Emanics member	Role	Journal / Event / Organization	Date
Aiko Pras	WG Chair	IFIP Working Group 6.6	2008
Aiko Pras	Series Editor	IEEE Communications Magazine on NSM	2008
Aiko Pras	Associate Editor	International Journal of Network Management (Wiley)	2008
Aiko Pras	Editorial Board	International Journal of Network Management (Wiley)	2008
Aiko Pras	Editorial Board	IEEE Communications Surveys and Tutorials	2008
Aiko Pras	Steering Committee	IFIP/IEEE NOMS and IM Symposia (NISC)	2008
Aiko Pras	Steering Committee	AIMS	2008
Aiko Pras	Steering Committee	E2EMon Workshop	2008
Aiko Pras	Steering Committee	EUNICE Consortium	2008
Aiko Pras	PC Chair	EMANICS/IRTF-NMRG Net-flow Workshop	October 2008
Aiko Pras	PC Chair	AIMS PhD Workshop 2008	July 2008
Aiko Pras	Session Co-chair	NOMS Dissertation Digest Sessions	April 2008
Aiko Pras	OC member	IEEE/IFIP NOMS 2008	April 2008
Aiko Pras	PC Member	GC'08 NGNPS	December 2008
Aiko Pras	PC Member	DANMS'08	November 2008
Aiko Pras	PC Member	APNOMS 2008	October 2008
Aiko Pras	PC Member	DSOM 2008	September 2008
Aiko Pras	PC Member	MMNS 2008	September 2008
Aiko Pras	PC Member	MWS 2008	September 2008
Aiko Pras	PC Member	ICIMP 2008	July 2008
Aiko Pras	PC Member	AIMS 2008	July 2008
Aiko Pras	PC Member	ICIW 2008	June 2008
Aiko Pras	PC Member	IWQoS 2008	June 2008
Aiko Pras	PC Member	ANM 2008	April 2008
Aiko Pras	PC Member	NOMS 2008	April 2008
Aiko Pras	PC Member	BoD 2008	April 2008
Aiko Pras	PC Member	E2EMON	April 2008
Ramin Sadre	PC Chair	EMANICS/IRTF-NMRG Net-flow Workshop	October 2008
Gabi Dreo Rodosek	PC Member	NOMS 2008	April 2008
Gabi Dreo Rodosek	PC Member	AIMS 2008	July 2008
Gabi Dreo Rodosek	PC Member	DSOM 2008	September 2008
Gabi Dreo Rodosek	PC Member	APNOMS 2008	October 2008
Gabi Dreo Rodosek	PC Member	SIMA 2008	November 2008
Gabi Dreo Rodosek	Session Chair	ICT 2008	November 2008
Gabi Dreo Rodosek	Program Co-chair	Vision and Management of the Future Internet Workshop	July 2008

10 Conclusions and Future Events

In this report we have presented the conference, summer school, and workshop organizations and scientific dissemination activities performed in the network since April 2008. All organized events so far have been very successful.

During the reporting period the network was also very active in scientific dissemination management through the support of major events and activities worldwide and the support of 5 new tutorials.

In 2009, EMANICS will again organize the following two major events:

- 3rd International Summer School on Network and Service Management (ISSNSM 2009)

This summer school will be held from July 13 - 17, 2009. It will be organized and hosted by University of Federal Armed Forces Munich.

- 3rd International Conference on Autonomous Infrastructure, Management, and Security (AIMS 2009)

This conference will take place from June 30 - July 2, 2009. It will be organized and hosted by the University of Twente. Aiko Pras will serve as the general chair of the conference.

Moreover, several workshops are planned for 2009, among them are second issues of the Netflow workshop, the ETM workshop, and the P2P management workshop. In addition, EMANICS is going to support the workshop on Management of the Future Internet (ManFI), which will be organized in conjunction with IM 2009.

Finally, JUB has received 500 Euros for setting up a new domain, aims-conference.org, which shall be used from now on to host the websites of future AIMS conferences and summer schools under a common umbrella. JUB plans to run this service beyond the lifetime of the EMANICS project.

11 Acknowledgement

This deliverable was made possible due to the large and open help of the WP3 Partners of the EMANICS NoE. Many thanks to all of them.

References

- [1] Burkhard Stiller and David Hausheer. Report on the 2nd International Summer School on Network and Service Management (ISSNSM'08). *Journal of Network and Systems Management*, 16(4), December 2008.
- [2] Jürgen Schönwälder and David Hausheer. Resilient Networks and Services: A Report on AIMS 2008. *Journal of Network and Systems Management*, 16(4), December 2008.
- [3] David Hausheer and Jürgen Schönwälder, editors. *Resilient Networks and Services, Second International Conference on Autonomous Infrastructure, Management and Security, AIMS 2008, Bremen, Germany, July 1-3, 2008, Proceedings*, volume 5127 of *Lecture Notes in Computer Science*. Springer, July 2008.
- [4] Burkhard Stiller (Edt.). Joint EC-GIN, EMANICS, and SmoothIT Workshop on "Economic Traffic Management" (Proceedings). Technical Report ifi-2008.10, University of Zurich, Switzerland, August 2008.

A Appendices

Attached to this deliverable are the full reports about the following two events:

- Report on the 2nd International Summer School on Network and Service Management (ISSNSM'08)
- Economic Traffic Management – Summary of the Joint EC-GIN, EMANICS, and SmoothIT Workshop

Report on the 2nd International Summer School on Network and Service Management (ISSNSM'08)

Burkhard Stiller, David Hausheer

University of Zürich, CSG@IFI, Binzmühlestrasse 14, CH-8050 Zürich, Switzerland

[stiller|hausheer]@ifi.uzh.ch

I. INTRODUCTION

The 2nd International Summer School on Network and Service Management (ISSNSM'08) was held at the University of Zurich, Switzerland, on June 2—6, 2008 [1]. The full technical and local organization had been performed by the Communication Systems Group (CSG) of the Department of Informatics (IFI) at the University of Zurich, which was supported technically and financially by the European FP6 Network of Excellence for the Management of Internet Technologies and Complex Services (EMANICS) [2]. This short report summarizes the concepts and ideas, which have been applied and refined to organize a summer school, which shows the most suitable benefit for students and interested researchers in a field of highly interrelated theoretical *and* practical aspects. Additionally, this report summarizes the technical program and it draws conclusions, while addressing feedbacks received from participants and experiences made from an organizer's point of view. The 3rd ISSNSM is already planned for 2009 and potentially interested people will be welcome to check for details, following the new links to be established originating from [2].

II. CONCEPT AND APPROACH

While summer schools have found a quite significant position in teaching and education, especially addressed to students and researchers, who are interested to get attached to a new field of expertise in a short period of time, their content and organizational approach varies highly. Therefore, EMANICS determined that the need to educate Ph.D. students in the area of network and service management across affiliation and country borders. The 1st ISSNSM had been hosted by the Jacobs University Bremen, Germany and it enabled students to interact closely on a certain topic during presentations and discussions. To continue in that direction, the 2nd ISSNSM extended the practical parts of the summer school in that respect that about one third of the time, typical classroom teaching took place and in the other two thirds of the time practical lab courses had been organized and run, which addressed the respective topic's key aspects.

The understanding of theoretical concepts *and* practical approaches, tools, and systems has proven to be a highly successful summer school concept, since those prepared lab courses and experiments deepened the knowledge of the topic extremely well. The work in practice — fully supervised by the respective instructor(s) — included the application of knowledge, which typically a pure one-way lecture or a book reading will not provide. Therefore, the group of 8 topics,

presented by academic and industrial instructors, followed this scheme.

III. PROGRAM AND TOPICS

The 5-day summer school had selected 8 topics out of a number of proposals collected from within the EMANICS community and beyond. Those 8 topics covered the areas of (1) security, (2) virtualization and simulations, and (3) network monitoring and management. While instructors have been active in the development of tools themselves, all of them prepared the practical lab course components and made them applicable to a full or half day course. While general questions of the audience have been posed and answered during the respective presentations, many discussions between the exercise groups of two people and the instructor took place in the lab sessions and continued during the breaks and early evenings. All teaching material is available at [1].

A. Security

The objective of the course “Hacking Web2” given by Radu State was to give a hands-on experience to web server security assessment. It provided the necessary background material to learn how web servers are exploited by blackhats. The course covered web server reconnaissance, application level vulnerabilities, web client level abuse, and phishing methods. Since web traffic is typically allowed by most firewalls, more than 80% of the current intrusions are caused by mis-configured or vulnerable web applications. Therefore, providing adequate security solutions for web applications and servers determines an essential building block for an overall enterprise level security architecture.

B. Virtualization and Simulations

The Network Simulator 2 (ns-2) is an open source simulator for different kinds of networks [3]. Because of its open and extendable nature a number of devices, protocols, and applications are already implemented. This course on “Simulating Networks with Network Simulator 2” by Frank Eyermann gives a basic insight into working with ns-2. Based on the structure of ns-2 shown, the lab courses runs less complex examples, which are performed and analyzed. A special focus is put on monitoring of queues and queuing disciplines, routing protocols, and stochastic elements.

The course on “Using Xen Virtualization in Research Projects” by Kyrre Begnum was targeted at researchers who want to utilize virtualization for their experiments and test labs. Xen is a popular open source virtualization technology used widely in the industry today [4]. It provides good performance

even with many virtual machines running on the same hardware. Its ease of specialization makes Xen suitable for repeatable scenarios, where virtual machines are set up in specialized configurations and network topologies. Getting practical experience and to learn how to design and set up virtual machines was extended by virtual machine management, which was covered as well as performance tuning and troubleshooting issues.

The work on “Distributed Test-Lab: EMANICSLab” presented by Cristian Morariu and David Hausheer introduced the basic concepts of virtual distributed test-labs like PlanetLab or EMANICSLab and gave a hands-on training about how to use them for research activities. Based on the underlying idea and principles of PlanetLab an overview of its services and tools was given. At a detailed level the EMANICSLab [5], a smaller-scale test-lab was explained and tested. In particular, the monitoring and management capabilities of EMANICSLab have been experienced, which has been carried out based on a simple service deployed on EMANICSLab.

C. Network Monitoring and Management

The goal of the course termed “Do you know SNMP?” by Aiko Pras was to make attendees aware of common mistakes made in SNMP (Simple Network Management Protocol) related papers. Driven by a short introductory exam to identify what attendees already know/learned from other courses, 4 lab sessions did refine the knowledge in the definition of a new MIB (Management Information Base) module, in finding right MIB data, on using SNMP, and on ASN.1 (Abstract Syntax Notation) decoding. These lab sessions applied MIB validating tools, real MIB data, and an SNMP agent simulator.

The course on “Nagios” by Laurent Andrey and Remi Badonnel outlined the open source software product for monitoring hosts, networks, and services [6]. Widely deployed by network administrators in companies and organizations, this tool provides an easy and extensible way of checking the operational status of network elements, and detecting a large variety of failures in real time, such as host resource overload and network service breakdown. Practical aspects showed how Nagios determines status information about hosts and services using periodic checks, information exchanges by advanced notification schemes, and the implementation and execution of checks.

The “Introduction to NETCONF and YANG” by Jürgen Schönwälder discussed the NETCONF protocol (RFC 4741, RFC 4742) [7] and the YANG data modeling language [8]. The NETCONF protocol provides mechanisms to install, manipulate, and delete the configuration of network devices. The protocol uses a Remote Procedure Call (RPC) paradigm and allows new protocol operations to be added. YANG is a proposed data modeling language for NETCONF, which has recently been selected as the basis of an IETF standardization effort. Based on fundamental concepts of NETCONF and YANG attendees gained practical experience by interacting with NETCONF implementations, while using YANG tools to validate self-written data models.

Finally, the course “Managing Information from your Network” by Bruno Klauser addressed a number of important

network management questions: On what network and traffic data does your planning and engineering rely? Can you validate your design assumptions? Does your network meet the expectations and requirements implied by business critical services? If so: can you prove it? Due to today’s network elements plethora of device manageability instrumentation capabilities suitable answers have been given by the discussion of technology fundamentals as well as the use of appropriate practices through a combination of presentation and hands-on exercises.

IV. EXPERIENCES AND NEXT STEPS

This summer school was attended by 31 persons from 11 different countries, which originated from 16 different affiliations. Furthermore, 7 persons attending did not belong to the EMANICS consortium, thus, showing that the interest in network and service management runs well beyond the NoE’s limits. Attendees also came from industry and senior researchers completed the group of Ph.D. students.

The evaluation form handed out to all participants covered questions on the local organization, infrastructure, and interaction times with instructors as well as on the technical program, the instructors in general and detail, and on the lab sessions as such. On a five digit scale (1 being the best and 5 being the worst) and based on 18 feedback forms received, on average the local organization was rated at 1.2, the infrastructure at 1.1, and the interaction possibilities at 1.3. The selection of topics for the overall program was rated at 1.6, the overall instructor’s quality at 1.8, and the quality and usefulness of lab sessions at 1.9. All participants had a very good and successful time, in which new topics have been learned, practical experiences have been gained, and last but not least new friendships have been formed!

Due to this great success and motivating comments received, the summer school for 2009 is in planning and will continue as the 3rd event the concept of ISSNSM.

REFERENCES

- [1] ISSNSM 2008 Web Site, <http://www.csg.uzh.ch/events/issnsm08/>
- [2] EMANICS Project Web Site, <http://www.emanics.org/>
- [3] The Network Simulator - ns-2 Project Web Site, http://nnsam.isi.edu/nnsam/index.php/User_Information
- [4] Xen Project Web Site, <http://www.xen.org/>
- [5] EMANICSLab Project Web Site, <http://www.csg.uzh.ch/services/emanicslab/>
- [6] Nagios Project Web Site, <http://www.nagios.org/>
- [7] Network Configuration Charter, <http://www.ietf.org/html.charters/netconf-charter.html>
- [8] NETCONF Data Modeling Language Charter, <http://www.ietf.org/html.charters/netmod-charter.html>

A. Author Biographies

Prof. Dr. Burkhard Stiller chairs the Communication Systems Group CSG, Department of Informatics IFI at the University of Zürich UZH since 2004. He holds a Computer Science Diplom and a Ph.D. degree of the University of Karlsruhe, Germany. During his research locations of the Computer Laboratory, University of Cambridge, U.K., the Computer Engineering and Networks Laboratory, ETH Zürich,

Switzerland, and the University of Federal Armed Forces, Munich, Germany his main research interests cover, including current CSG topics, charging and accounting of Internet services, economic management, systems with a fully decentralized control (P2P), telecommunication economics, and biometric management systems.

Dr. David Hausheer is a senior researcher and lecturer in the Department of Informatics IFI at the University of Zürich UZH, focusing on economic management of Grid and P2P networks and services. He holds a diploma in Electrical Engineering and Ph.D. in Communication Systems from ETH Zürich, Switzerland.

Economic Traffic Management —

Summary of the Joint EC-GIN, EMANICS, and SmoothIT Workshop

*Burkhard Stiller (Ed.)*¹

¹ University of Zürich, CSG@IFI and ETH Zürich, TIK, Switzerland, E-Mail: stiller@ifi.uzh.ch

Contributions by: *Thomas Bocek, Peter Racz, Tobias Hofffeld, Michael Welzl, Juan Fernandez-Palacios, Sergios Soursos, Murtaza Yousaf, Cristian Morariu, Martin Waldburger, Nicolas Liebau, Amruth J. Kumar, Javier Rubio-Loyola, Mirosław Kantor, Burkhard Stiller*

1 Overview and Objectives

The Workshop on “Economic Traffic Management (ETM)” had been jointly organized by the European research projects EC-GIN, EMANICS, and SmoothIT. The common denominator of these three projects can be found in the topic of economic management, which includes the question, whether economics and economic theory is applicable in network management in general, in which way this will be beneficial compared to traditional network management approaches, and which players will benefit from such an approach.

Therefore, the main objectives of the workshop are:

- Exchange research ideas in the area of ETM;
- Exploration of economic management questions across project limits; and
- Discuss aspects of ETM, which are essential for their successful application in the Internet today/tomorrow.

To allow for a nicely structured set of presentations, 5 sessions have been organized on “Incentives and P2P”, “Congestion Control and Traffic Management”, “Bottleneck Detection and Distributed Capturing”, “Locality Mechanisms”, and “QoS Management and Traffic Optimization” as well as a single discussion on “Will Economic Traffic Management mechanisms be successful?”. Abstracts of all 13 presentations below show that the special problem addressed or the more general architecture problem tackled have a common basis in terms of considering decentralized and economically-driven characteristics. Therefore, ETM provides for the right incentives to ensure that all players are better off compared to traditional network and traffic management approaches.

Thus, in a nutshell, the ETM Workshop helped researchers to guide their respective area of work, mainly being influenced by practical application constraints as well as by seeing external effects and requirements, which could be considered useful to be integrated.

2 Incentives and P2P

The key concern in Peer-to-peer (P2P) networks and systems is driven by the fact that peers may consume more resources than offered by the same peer. Thus, the so-called free-riding problem had to be tackled by the right incentives, which ensure that upload and download

of resources will get balanced. But furthermore, the role of an Internet Service Provider (ISP) is relevant for the transport of overlay traffic as well, since it may affect the planned traffic to be transported. Therefore, the ISP has to become a member of a collaborative game, which is driven by the overlay network provider

2.1 Private Shared History (Thomas Bocek, UZH)

This talk proposed a scheme termed Private Shared History (PSH), which is about combining a shared history, which is used to find transitive paths, and a private history to verify the correctness of this path. Finding such a path is important, if peers in the network have an asymmetry of interest. In such cases, a private history alone cannot be used as a basis for an incentive scheme and a shared history has to be used instead. However, both approaches have advantages and disadvantages. PSH exploits these advantages and minimizes disadvantages by combining both approaches in an efficient manner. The current implementation and its evaluation was presented. Finally, PSH extensions and its use in EMANICS, EC-GIN, and SmoothIT have been outlined.

2.2 SmoothIT Overlay Management Architecture (Peter Racz, UZH)

This talk provided a brief overview of the SmoothIT project and the architecture currently being developed. It presented the objectives of SmoothIT and discussed various incentives for all players to participate in ETM. Three main solution concepts (namely agreements, locality promotion, and QoS (Quality-of-Service)/QoE (Quality-of-Experience) differentiation) have been outlined and key requirements have been summarized. The TripleWin principle of an optimization of the cooperating roles of users, overlay provider, and underlay provider has been stated.

Finally, the SmoothIT Information Service (SIS) architecture and protocol have been presented, which serves in a client/server-based approach between Internet Service Providers (ISP) to optimize the peer/resource selection process of the overlay with a collaborative underlay.

2.3 Modeling of P2P-based Video Streaming (Tobias Hofffeld, UniWue)

This talk showed how to model P2P-based video streaming and in particular to address the performance evaluation of Economic Traffic Management in the context of the SmoothIt project. As input for the video streaming model, some popular P2P-based video streaming have been characterized exemplarily. These measurements help to understand the system behavior and how to influence it, which in turn helps to derive further mechanisms for ETM. These measurements include a characterization of the formed overlay topology, the observed traffic characteristics, the applied edge-based intelligence (like bandwidth adaptation or re-routing on application layer), as well as a quantification of QoE depending on network disturbances.

In the second part of this presentation, it was shown how to model such a P2P-based video streaming system based on these measurements obtained. A crucial point was to determine the appropriate degree of abstraction, which is a trade-off between computational time, i.e. simulation efficiency, and accuracy of the model applied. This abstraction needs to allow for answering the desired performance questions. In the context of ETM and especially the SmoothIT project, it is necessary (a) to study the TripleWin situation when using ETM, *i.e.* to quantify the traffic optimization from different players' perspectives, and (b) to demonstrate the incentive to use the SmoothIT approach, *e.g.*, by showing the performance gain/loss when using/not using ETM.

3 Congestion Control and Traffic Management

Congestion control determines an important mechanism for managing traffic within a given network. Thus, standardization of respective mechanisms and metrics is essential for inter- and intra-domain scenarios. At the same time, the special case of overlay traffic appearing with a high percentage of the overall traffic in ISPs does need a careful handling to prevent unintended congestion as well as to maximize revenue for all types of traffic being carried. Interconnection issues on the physical and the business level have to be aligned. Finally, the effects of peer and locality awareness on traffic are investigated, while addressing the BitTorrent overlay system.

3.1 Current IRTF/IETF Congestion Control Work and How it Relates to P2P Systems (Michael Welzl, UIBK)

This talk gave an overview of current work related to congestion control in the IRTF (Internet Research Task Force) and IETF (Internet Engineering Task Force). This included an introduction to the scope of the Internet Con-

gestion Control Research Group (CCRG) and a brief overview of recent discussions related to peer-to-peer traffic management. These discussions happened under the heading of TANA (Techniques for Advanced Network Applications), with a BoF (Birds-of-Feathers) session at a recent IETF-72 meeting in Dublin which might lead to the formation of a new working group.

3.2 Operator's Vision about Overlay Traffic Management (Juan Fernandez-Palacios, TID)

This presentation described the rationale behind the need of new traffic management mechanisms being able to promote the overlay traffic locality and provide required QoS for each application. Furthermore, a potential solution for traffic locality promotion and QoS differentiation was introduced. Such solution would be based on the combination of technical incentives and ETMs for ISPs and an overlay collaboration.

3.3 Insertion of ISP-owned peers and Locality Awareness in BitTorrent (Sergios Soursos, AUEB)

File-sharing overlay applications generate a large portion of the total traffic in the Internet. In this work, two approaches were investigated: How to modify the original BitTorrent protocol in order to achieve a more efficient use of the underlying network, and an evaluation run experimentally to study their impact both on the inter-domain traffic for the ISP and on the file download completion times for the end-users. In particular, a locality-aware mechanism was considered and applied to the tracker, based on which Autonomous System (AS) each peer of the swarm belongs to.

It was proposed to insert ISP-owned peers (IoPs) in the network as an alternative means to improve the download completion times. Experiments have been conducted of the aforementioned approaches using the ns-2 simulator and main results have been presented. The locality awareness achieves a reduction of inter-domain traffic, while the insertion of ISP-owned peers reduces further the amount of ingress traffic for the ISP that introduces the IoP. Furthermore, the introduction of an IoP improves the file download completion times. The combination of the two approaches is very effective also.

4 Will Economic Traffic Management mechanisms be successful? (Discussion Moderator: Burkhard Stiller, UZH)

To make the discussion short, the answer to this question was agreed upon to be: Yes. However, the constraints in which this "yes" will be true, have to be added as well. Thus, the following point of views have been expressed.

The decentralization of traffic and network management is a must to ensure scalability concerns of operators in an ever increasing world of new services, applications, and consequently traffic profiles. Thus, the traffic management as such needs to be efficient, but, at the same time, it has to reduce costs of the management tasks undertaken.

Since a direct inter-connection to billing systems may be way too costly, economic incentives should be integrated into the data signaling and data exchange process. This integration may happen at the edge of the network, however, it may not change existing charging schemes, such as the flat fee scheme for residential customers and the 95%-percentile scheme for interconnected ISPs.

Furthermore, the role of congestion control in that respect does play an important role, where traffic shaping as well as the support of fairness issues will be important. If such schemes can be integrated into today's Internet without the need to change protocols, the potential for reliable, secure, resilient, and efficient mechanisms is large.

However, it has to be taken into account that time scales of round-trip times are way shorter compared to overlay-to-underlay mapping feedback loops. Thus, the need to optimize these mapping loops becomes obvious, since a beyond packet-level approach may diminish the complexity, while at the same time, ease the traffic management.

Finally, the need to various traffic classes has been expressed — if it were 3, 4, or 16 or even more, has not been concluded unanimously. The problem of assigning an application or its traffic flow onto the respective class gives raise to further problems, but this cannot be neglected at all, since today overlay applications do — at least in principle — neglect the underlay as well. And this situation is characterized as being non efficient at all.

But the need for service differentiation as well as accompanying measures on the technical side as well the incentive aspect, thus, the economic relevance of the problem, has been stated clearly.

Therefore, the potential of economics being applied to traffic and network management is clearly seen and has to be supported in a variety of aspects, such as mapping functions, incentives for peer selection, pricing schemes for end-user traffic and ISP-to-ISP traffic, or service differentiation.

In which way the benefits of ETM can be quantified and proven is under heavy investigation in different projects and work packages. The success of ETM as such can be stated to be measurable, since revenues, cost reductions, and the minimization of maintenance efforts will form key dimensions and parameters to be used to show that ETM mechanisms are beneficial. This benefit will be visible for all players involved, including the customer, the overlay provider, and the underlay provider.

5 Bottleneck Detection and Distributed Capturing

The problem of shared bottlenecks in a given network shows that many flows may suffer a reduction of quality of this communication. Thus, a detection algorithm will benefit applications in a way, which will allow them to achieve their intended QoS metrics. Furthermore, the problem of network monitoring in a traditional manner sees a single mirroring device and a single or multiple analysis box in place. This approach fails to scale with respect to the data rates of the link, thus, a scalable and robust approach is essential for an efficient monitoring of traffic.

5.1 Shared Network Bottleneck Detection with SVD (Murtaza M. Yousaf, UIBK)

This talk presented a new mechanism for detecting shared bottlenecks between end-to-end paths in a network. This mechanism, which only needs one-way delays from endpoints as an input, is based on the well known linear algebraic approach SVD (Singular Value Decomposition). Clusters of flows, which share a bottleneck are extracted from SVD results by applying an outlier detection method. Simulations with varying topologies and different network conditions show the high accuracy of our technique.

5.2 DiCAP — An Architecture for Distributed Packet Capturing (Cristian Morariu, UZH)

IP (Internet Protocol) traffic measurements form the basis of several network management tasks, such as accounting, planning, intrusion detection, and charging. High-speed network links challenge traditional IP traffic analysis tools with their high amount of carried data that needs to be processed within a small amount of time. Centralized traffic measurements for high-speed links typically require high-performance capturing hardware that usually comes with a high cost. Software-based capturing solutions, such as libpcap or PFRING, cannot cope with those high data rates and experience high packet losses.

Thus, this presentation proposed a scalable architecture and its implementation for Distributed Packet Capturing (DiCAP) based on inexpensive off-the-shelf hardware running the Linux operating system. The prototype designed had been tested as an implementation and was evaluated against other Linux capturing tools. The evaluation showed that DiCAP can perform loss-less IP packet header capture at high-speed packet rates, when used alone, and that it can highly improve the performance of libpcap or PFRING when used in combination with those.

6 Locality Mechanisms

Locality determines typically the information within a given context, where a user, client, or provider is located geographically. This type of information may be of high importance depending on the application and service in use. Thus, the automated detection of jurisdiction forms a key part of an automated contract conclusion or a later claim handling procedure, for which location information in contracts is required. Furthermore, in overlay networks, the search for a resource can be driven by location information in a more efficient manner, especially overcoming the problems of server-based, central solutions. Finally, the Border Gateway Protocol (BGP) can be utilized to extract locality information, which can be applied in turn to rank peers in terms of their locality of their IP addresses.

6.1 Locality and Contracts (Martin Waldburger, UZH)

Location-related parameters such as a service provider's domicile, habitual residence, and establishment constitute key input parameters for private international law. Private international law procedures, also known as conflicts of laws, are relevant to international contracting, thus, to situations where a service provider and service user reside in different legal domains.

Driven by the motivation to automate contract formation in an international context, an attempt to formalize the Swiss federal private international law (IPRG) has been undertaken. The focus was set on determining jurisdiction in an international contract automatically. To that aim, IPRG-specific decision rules and needed input parameters — so-called connecting factors — have been presented in excerpts. This led to visualizing those challenges faced when aiming at a direct law formalization. Consequently, a hypothesis-based approach to address these challenges was introduced.

6.2 Globase.KOM - A P2P Overlay for Fully Retrievable Location-based Search (Nicolas Liebau, Aleksandra Kovacevic, TUD)

Location-based services are becoming increasingly popular as devices that maintain a geographical position become more available to end users. The main problem of existing solutions to location-based search is keeping information updated, which typically requires the centralized maintenance at specific times. Therefore, retrieved results do not include all objects that exist in reality.

A P2P approach can overcome this issue, since peers are responsible for those information users are searching for. Unfortunately, current state-of-the-art overlays cannot fulfill these requirements for an efficient and fully retrievable location-based search. In this talk Globase.KOM was

presented, a hierarchical tree-based P2P overlay that enables fully retrievable location-based overlay operations, which proved to be highly efficient and logarithmically scalable.

6.3 Peer Locality Information Using BGP (Amruth Juturu Kumar, UZH)

A P2P application constructs an overlay network for the purpose of efficient and scalable resource searching or sharing. The underlying network offers interconnected ISPs, either via peering or costly transit links. One key problem in this case is the high traffic load on transit links caused by a non-optimal selection of peers within the overlay network. A new approach to solve this problem is by applying ETM mechanisms based on incentives, where overlay nodes can query information from ISP-provided services in the underlay, to allow for an optimal selection of peers in the overlay. In this respect, information on whether a packet will be routed to a transit link, a peering link, or within the ISP, is highly beneficial to determine whether a remote peer is preferred or not by that ISP. Other useful metrics in these cases include locality and performance.

The current work did design and implement an infrastructure within a test-ISP that provides for respective information on locality of a peer relative to the querying peer. The locality information is based on the BGP routing table and also on the information from ISP-maintained databases.

7 QoS Management and Traffic Optimization

The QoS management driven by business indicators does show an approach, which can automate the policy-based management of commercial services. Thus, an integration of policy-based management approaches in a multi-domain case with business value becomes promising. Furthermore, for the optimal interconnection of ISPs the respective routes become crucial, if not selected carefully. The new routing algorithm proposed shows a concept, which may require a more difficult coordination between ISPs compared to ISPs at the benefit of a more detailed knowledge of QoS connectivity, resilience, and cost.

7.1 Issues Confronting Business-driven QoS DiffServ Management (Javier Rubio-Loyola, UPC)

Network and services policies have been proven to be an efficient vehicle to assess QoS DiffServ (Differentiated Services) management in intra-domain and inter-domain environments. Moreover, current frameworks that address this issue have been decoupled traditionally from the

business value, even when the research community recognizes business profit as one of the main motivations for any management solution.

This talk gave an outline of the key aspects confronting business-driven QoS DiffServ management. It presented initially principles of the application domain of this research topic and provided an introduction to the technical approach that has been chosen to address it. Finally, it provides a scenario outlining the scope of this research and summarized the issues that are currently being addressed in this work.

7.2 Inter-domain Traffic Optimization in an Inter-carrier Environment (Miroslaw Kantor, AGH)

Due to the development of Next Generation Networks, which leads to a multiservice transport layer within a multi-domain environment, the importance of inter-domain traffic engineering issues keeps growing. As the telecommunications market is still increasing and the number of ISPs is growing, operators face different routing options with regard to service quality and cost. Also changes in pricing models and the explosive growth of traffic force carriers to deploy new routing models, since the business environment becomes very dynamic and routing changes are required in shorter time frames. Connections have to be routed according to the lowest cost paths to maximize operator's income. Inefficiencies in implementing interconnection strategies can decrease carriers' outcome and make them spending more time on network management.

Therefore, the need to develop algorithms supporting the choice of optimal interconnection routes becomes crucial. Least Cost Routing (LCR) algorithms to optimize the utilization of resources are proposed. By using the methodology proposed the best upstream/transit ISPs are selected. The chosen ISPs will assure low cost, good performance, and sufficient path diversity to protect against the network failures. By using the LCR algorithms proposed, the routing strategy can be more efficiently executed by incorporating the knowledge of cost with network conditions. The LCR algorithm can also decrease the time interval needed to analyze a huge number of alternatives and helps a carrier make decisions considering new agreements with other carriers within a dynamic framework.

8 Conclusions

The workshop has shown that Economic Traffic Management (ETM) mechanisms show a high potential, which has to be investigated and exploited in research and prototypes. While the advantages of a highly decentralized traffic management approach in the world of today's interconnected networks of the Internet is obvious — due

to many providers and far more customers being interconnected — the need for a scalable management functionality in this world is emerging — mainly due to too many flows and applications to be supported. Thus, the application of incentives — either monetary ones or non-monetary ones — enables a high decentralization degree, which typically leads to economics, since fully decentralized markets show a significant number of commonalities, which a decentralized network and traffic management can exploit. Therefore, the economics are an important aspect of tomorrow's management approaches, since they combine the incentive metric with the traffic to be transported, monitored, and signalled. In conclusion, the ETM mechanisms addressed so far will play an important role in application areas and networks, where the benefits in terms of gains achieved, *e.g.*, in terms of revenue, cost savings, or smaller investments for providers, will be quantified and underlay providers, overlay providers, and customers will cooperate under determined strategies. This approach will lead to a TripleWin situation, where all cooperating parties will be better off, compared to traditional traffic management approaches.

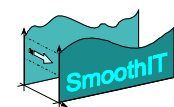
A number of those areas tackled in the Workshop on "Economic Traffic Management" are being worked on in much more detail in a variety of national and European projects. The group of people at the workshop reflected, besides other project work, important views and goals, which are addressed in the Framework 6 Specific Targeted Research Project "Europe-China Grid InterNetworking" (FP6-2006-IST-045256-STREP), the Framework 6 Network-of-Excellence "EMANICS: European Network of Excellence for the Management of Internet Technologies and Complex Services" (FP6-2004-IST-026854-NoE), and the Framework 7 Specific Targeted Research Project "SmoothIT: Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies" (FP7-2008-ICT-216259-STREP).



6th Framework Project FP6-2006-IST-045256-STREP
Europe-China Grid InterNetworking



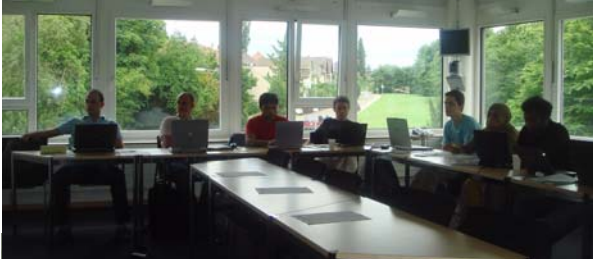
6th Framework Project FP6-2004-IST-026854-NoE
Management of the Internet and Complex Services



7th Framework Project FP7-2008-ICT-216259-STREP
Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies

9 Key Words

Incentives, SmoothIT Information Service, Modeling P2P Streaming Services, Congestion Control, Overlay Traffic Management, Locality Awareness, Shared Bottleneck Detection, Distributed Packet Capturing, Locality, Contracts, Business-driven Management, and Least Cost Routing.



The ETM Workshop Team during Presentations Given

10 People Involved

The team of highly motivated researchers and workshop participants are shown in the environment of the local host, the Communication Systems group CSG of the Department of Informatics IFI, at the University of Zürich UZH in the picture above and below.



The ETM Workshop Team during Presentations Given

Attendees: Thomas Bocek (UZH), Peter Racz (UZH), Tobias Hoßfeld (UniWue), Michael Welzl (UIBK), Juan Fdez-Palacios (TID), Sergios Soursos (AUEB), Murtaza Yousaf (UIBK), Cristian Morariu (UZH), Martin Waldburger (UZH), Nicolas Liebau (TUD), Amruth J. Kumar (UZH), Javier Rubio-Loyola (UPC), Mirosław Kantor (AGH), Philipp Gschwandtner (UIBK), Humaira Ijaz (UIBK), and Burkhard Stiller (UZH).