Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies

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Final Report on Liaisons, Standardizations, and Dissemination

The SmoothIT Consortium

University of Zürich, UZH, Switzerland
DoCoMo Communications Laboratories Europe Gmbh, DoCoMo, Germany
Technische Universität Darmstadt, TUD, Germany
Athens University of Economics and Business - Research Center, AUEB-RC, Greece
PrimeTel Limited, PrimeTel, Cyprus
Akademia Gorniczo-Hutnicza im. Stanislawa Staszica W Krakowie, AGH, Poland
Intracom S.A. Telecom Solutions, ICOM, Greece
Julius-Maximilians Universität Würzburg, UniWue, Germany
Telefónica Investigación y Desarollo, TID, Spain

For more information on this document or the SmoothIT project, please contact:

Prof. Dr. Burkhard Stiller
Universität Zürich, CSG@IFI
Binzmühlestrasse 14
CH—8050 Zürich
Switzerland

Phone: +41 44 635 4355
Fax: +41 44 635 6809
E-mail: info-smoothit@smoothit.org

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Editor(s):   Sergios Soursos

E-mail: souse@intracom.com

Author(s):   Sergios Soursos, Ioanna Papafili, Simon Oechsner, Marian Callejo, Juan Fernández-Palacios, Konstantin Pussep, Eleni Agiatzidou, Fabio Hecht, Burkhard Stiller, Krzysztof Wajda, Spiros Spirou, Sergey Kuleshov

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V0.8	19 January 2011	Sergey Kuleshov, Sergios Soursos	Update on external Liaisons.
V0.9	11 February 2011	Ioanna Papafili, George D. Stamoulis, Rafal Stankiewicz, Frank Lehrieder, Sergios Soursos	Update on new publications and talks

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1 Introduction

The SmoothIT consortium was very active with respect to dissemination and standardization activities and established a number of external liaisons, both to promote the work done within the project and also to get in contact with other companies, projects and stakeholders related with the field of research conducted by the SmoothIT partners.

In this deliverable, the summary of all such activities is presented, highlighting the impact and the recognition of the SmoothIT project and its outcomes to the research and industrial community. The research work conducted within all work packages was sufficiently documented and several articles have been published to various workshops and conferences, as well as in recognized journals. Members of the SmoothIT consortium were also invited to several panels in order to share the knowledge gained within and the concepts introduced by the project. At the same time, SmoothIT members have approached other projects and companies whose work is (directly or indirectly) related to or affected by the solutions proposed. Finally, the SmoothIT consortium made sure that a wider audience would become aware of the project by issuing press releases and web announcements to institutions' web sites and other technological sites and magazines.

The remainder of this deliverable is structured as follows:

- Section 2 focuses on the external liaisons that the consortium made with other companies, projects and initiatives. The major achievement of SmoothIT was the active participation, organization and steering of the Future Internet Socio-Economic (FISE) work group, within the Future Internet Assembly (FIA). Other contacts include similar projects, content providers, etc.

- In Section 3, the complete list of published material is provided. This includes all the book chapters written and all the papers accepted in conferences, journals and workshops. Additionally, all the talks given by members of the SmoothIT consortium are included, as well as the press releases and borchures prepared.

- Section 4 provides a brief overview of the project's web site, which has been updated to serve better its purpose.

- In Section 5, the three workshops that we (co-)organized by SmoothIT are presented, with a small summary of the activites and discussions taking place there.

- Finally, Section 6 includes a summary of all the standardization efforts of the consortium.

This deliverable is the final outcome of tasks T5.2, T5.3 and T5.4 and relates to all the research, implementation and evaluation work conducted in workpackages WP1, WP2, WP3 and WP4. Moreover, this deliverable serves as a summary of achieved goals, as those were identified in Deliverable 5.1 "Dissemination and External Liaisons Plan" [2].

2 External Liaisons

In this section, a report of all the project's external liaisons is provided. This includes the participation in external to the project bodies and at EU events, any contacts with companies and other professionals, as well as any collaboration with other projects. The section is divided in two sub-sections: section 2.1 provides a summary of all the FIA-related activities, which have been in the focus of the consortium for several years, while section 2.2 presents the rest of contacts achieved throughout the duration of the project.

2.1 Future Internet Assembly

The Future Internet Assembly (FIA) *"[…] is a collaboration between projects that have recognized the need to strengthen European activities on Future Internet to maintain European competitiveness in the global marketplace. […], FIA brings together around 150 research projects that are part of Challenge 1 of the ICT programme of FP7"* [12].

The SmoothIT consortium was, from the very beginning, very active in the FIA events. Since the SmoothIT project was recognized as one of the driving forces of research on network socio-economics, it had partly undertaken the (co-)organization of the Future Internet Socio-Economics (FISE) work group [13]. Two out of the three caretakers of FISE are from institutions that belong to the SmoothIT consortium (University of Zurich and Intracom Telecom). Currently, the FISE group involves over 20 projects and approximately 80 people are registered to its mailing list.

In the following table, an overview of the attendees from SmoothIT to the various FIA meetings is presented. Note also that, though not included, the FISE caretakers also attended a number of preparatory meetings in Brussels, prior to a FIA meeting, as well as several concertation meetings.

Table 1: The SmoothIT participation in FIA events

Event	Location	Date	SmoothIT Attendees
1st FIA meeting	Bled, Slovenia	March 2008	D. Hausheer (UZH) S. Spirou (ICOM) M.A. Callejo (TID)
2nd FIA meeting	Madrid, Spain	December 2008	D. Hausheer (UZH) C. Courcoubetis (AUEB) M.A. Callejo (TID)
3rd FIA meeting	Prague, Czech Republic	May 2009	D. Hausheer (UZH) S. Spirou (ICOM) G.D. Stamoulis (AUEB)
2nd EU-Japan Symposium	Tokyo, Japan	October 2009	G.D. Stamoulis (AUEB) T. Hossfeld (UniWue)
4th FIA meeting	Stockholm, Sweden	November 2009	B. Stiller (UZH) G.D. Stamoulis (AUEB) S. Soursos (ICOM)
5th FIA meeting	Valencia, Spain	April 2010	B. Stiller (UZH) S. Soursos (ICOM)
6th FIA meeting	Ghent, Belgium	December 2010	S. Soursos (ICOM) G.D. Stamoulis (AUEB) M. Waldburger (UZH)

In the subsections to follow, a summary of the SmoothIT activities in each FIA event is provided.

2.1.1 FIA Bled

The first FIA meeting was held on 31 March – 2 April 2008 in Bled, Slovenia [15]. The EC had classified SmoothIT as a FI project, so a SmoothIT delegation (D. Hausheer, M. A. Callejo Rodriguez and S. Spirou) was invited to attend and contribute to the event. Particular SmoothIT activities during the 1st FIA were:

- Contribution to *Bled Declaration* [16] and signing. (D. Hausheer, S. Spirou).

- Presentation of *SmoothIT poster*. (D. Hausheer, M. A. Callejo Rodriguez and S. Spirou).

- Co-organization of *panel on FI Socio-Economics*. (D. Hausheer).

- Presentation on *Expected Evolution of User Behavior*. (M. A. Callejo Rodriguez).

- Presentation on *Future Internet Wars*. (S. Spirou).

The Bled Declaration was the call-to-action from the European Commission to the academic and industrial community for involvement in designing the next generation of the Internet with a strong European focus. Both D. Hausheer and S. Spirou had been participating for the months leading up to FIA Bled in formulating the text for the declaration. The document was given away, in the form of a poster, during the closing plenary session to all participants, thereby signifying their support.

The consortium, and especially UZH, had created a poster about SmoothIT, which explained the problem that the project is aiming at and the basic concept in solving it. The poster was visible on the poster hall to all participants for the duration of the event. D. Hausheer, M. A. Callejo Rodriguez and S. Spirou supported the poster with discussions during a dedicated poster session (Figure 1).

Figure 1: SmoothIT representatives at FIA Bled in front of the SmoothIT poster.

D. Hausheer, on invitation from the SmoothIT Project Officer, had organized, together with P. Nikander from Ericsson, a 1.5 hours panel discussion on FI Socio-Economics (Figure 2). The panel aimed at bringing light around how the socio-economic macro-level reality

of the Internet emerges from the micro-level decisions made during the design of the network architecture and implementation, and build from that towards sustainable ways of providing inter-networking services. Invited panelists were:

- K. Wuenstel, *General Aspects of Socio-Economics of Networking*. (4WARD, Alcatel Lucent).

- M. A. Callejo Rodriguez, *Expected Evolution of User Behavior*. (SmoothIT, Telefonica R&D).

- S. Ristol, *The role of trust in building services*. (Atos Origin).

- S. Spirou, *Future Internet Wars*. (SmoothIT, Intracom Telecom).

- L. Ladid, *IPv6: The Two-Way Internet*. (EFIPSANS, IPv6 Forum).

- W Kleinwaechter, *Internet Governance*. (EURO-NF, University of Aarhus).

The session was attended by about 50 people. A rather stimulating discussion took place after the position statements, mostly emphasizing that network socio-economics is an important, but neglected area. The session was the starting point for a whitepaper on FI Socio-Economics [17] and the formation of the FI Socio-Economics (FISE) group [13].

Figure 2: The FI Socio-Economics panel at FIA Bled.

2.1.2 FIA Madrid

During the Future Internet Assembly in Madrid, the SmoothIT representative, Costas Courcoubetis, participated in the FISE session, discussing and presenting socio-economic issues of the Future Internet. In particular, Costas Courcoubetis as a representative of SmoothIT was a one of the panelists in the FISE session. Furthermore, as the keynote speaker of the FISE session, he gave a talk titled "Socioeconomic issues of the Internet of the Future.

2.1.3 FIA Prague

One year after the first FIA meeting in Bled, Slovenia, the third FIA meeting was held on 11-13 in Prague, Czech Republic [18]. D. Hausheer, S. Spirou and G. Stamoulis attended the event on behalf of SmoothIT. Specifically, this delegation to the 3rd FIA was involved in:

- Facilitation and contribution to *FISE Scenarios* [19]. (S. Spirou).

- Organization of *session on FI Socio-Economics*. (D. Hausheer, S.Spirou).

- Presentation on *SmoothIT*. (D. Stamoulis).

A few months before the event, the European Commission had asked the caretakers to produce a document on Future Internet scenarios for each group. S. Spirou, as a FISE group caretaker, edited such a document with contributions from several group members. The EC collected all scenarios and adapted them to create a newspaper about the Internet. The newspaper was called *Internet Express* and it was dated for the year 2025 to present the scenarios as realities for that date. The Internet Express was shown during the FIA meeting plenary (Figure 3) and was given to all participants as a hard copy.

Figure 3: The Internet Express newspaper presented during the opening plenary.

D. Hausheer and S. Spirou had organized, together with M. Boniface from IT Innovation, a 2.5 hours session on FI Socio-Economics (Figure 4). The target of the session was to discuss the vision, roadmap, and trends with regard to the socio-economic impacts of the Future Internet. The agenda of the session was formed around a keynote presentation by Eric Meyer (Oxford Internet Institute) on *Freeing Science*, a panel discussion and an invited talk by Susanna Avessta (Dimes Association) on *Experimental Facilities for Socio-Economic Research* . Panelists were:

- G. Stamoulis, *Brief SmoothIT Statement*. (SmoothIT, Athens University of Economics and Business).

- F. Forest, *Real World Internet: Socio-Economic Scenarios and Design Recommendations*. (SENSEI, Pierre-Mendes-France University).

- G. G. Aguirrebeitia, *MUGGES & m:Ciudad Position*. (m:Ciudad, ROBOTIKER-Tecnalia).

- P. Eardley, *Architecting the Future Internet*. (Trilogy, British Telecom).

Figure 4: S. Spirou introducing the Socio-Economics session.

Besides the panelists, specific project representatives had been invited to make brief statements:

- A. Karila. (PSIRP, Athens University of Economics and Business).

- F. Sivrikaya. (PERIMETER, TU Berlin).

- K. Wuenstel. (4WARD, Alcatel Lucent).

- G. Stamoulis. (EuroNF, Athens University of Economics and Business).

Figure 5: The attendees just before the beginning of the session.

About 50 people were present at the session (Figure 5). The discussion began with the panelists in the form of Q&A, but quickly spread to most session participants, under the moderation of D. Hausheer. Topics discussed were the involvement of end-users in research, the extension of FI scenarios, the socio-economic impact of ICT research, and

the socio-economic challenges for the Future Internet. Results of the session were summarized by S. Spirou during the closing plenary of the 3rd FIA.

2.1.4 2nd EU-Japan Symposium

The objective of the 2nd EU-Japan Symposium was to explore prospects for deeper exchange and collaboration between the Japanese and European research communities in the area of what is referred to as "New-Generation Network (NWGN)" in Japan and "Future Internet (FI)" in Europe.

George D. Stamoulis and Tobias Hossfeld participated in this event representing SmoothIT. They attended the Socio-Economic session of the symposium and they were active in discussing socioeconomic issues of the Future Internet. In this session, George D. Stamoulis gave a talk titled "Achieving Win-Win by means of Economic Management of Traffic" and Tobias Hossfeld a talk titled "Improving User's Quality of Experience for Overlay Applications".

2.1.5 FIA Stockholm

During the Future Internet Assembly in Stockholm [10], the SmoothIT representatives (S. Soursos, B. Stiller and G.D. Stamoulis) were active in organizing, moderating, presenting and discussing socio-economic issues of the Future Internet, as part of the activities undertaken by the FISE group. The activities of SmoothIT are summarized in the following:

- *Socio-economic views on the Future Internet* (plenary session, chaired by B. Stiller)
  - *Serving the Incentives of Users and Providers* (presentation by G.D. Stamoulis)
- *Enterprises* (break-out session, attendance and presentation by S. Soursos)
- *Trust* (break-out session, attendance by B. Stiller)
- *FISE session* (chaired by B. Stiller, S. Soursos and M. Boniface, presentations by all FISE representatives from break-out sessions)
- *ETMS: A System for Economic Management of Overlay Traffic* (poster session, presented by S. Soursos)

It is worth noticing that FISE was the only group that managed to obtain a small slot in the plenary session to present the socio-economic impact of the Future Internet technologies. In this sense, the SmoothIT objectives and concepts (TripleWin, ETM, etc), as presented by G.D. Stamoulis, were presented at a wide audience and were well-received by many participants. This was made evident by positive comments (made by certain participants with technological background and by economists too) about the concept of ETM and the necessity of achieving TripleWin when managing traffic in practical cases, both in the discussion at the end of the session and in informal discussions thereafter.

SmoothIT had also a poster in the exhibition area, entitled "*ETMS: A System for Economic Management of Overlay Traffic*", describing the main objectives of the project and the basic solutions identified. The poster was the initial contribution of SmoothIT to the FIA's process of selecting material for the upcoming FIA Book.

For the break-out sessions, FISE has identified four sessions as more closely related to its scope: the *Enterprises* session, the *Trust* session, the *Architecture and Business Models* sessions and the *Smart City* session. A representative from FISE attended each of the

selected sessions either as a presenter or an observer in order to provide socio-economic viewpoints during discussions. Each representative summarized the outcome of topic sessions during the FISE working group meeting.

In the *Enterprises* session, S. Soursos gave a short presentation on *what Future Internet means for Enterprises* from the socio-economic perspective. Then, S. Soursos along with P. Moore chaired one of the three knowledge cafes where the socio-economic aspects of the emergence of Future Internet technologies in Enterprises were discussed. Finally, a summary of those discussions was presented in the closing part of the *Enterprises* session.

On the second day of the FIA meeting, the FISE group session was held. The session was chaired by B. Stiller. After a small introduction, the four representatives (S. Soursos, B. Stiller, M. Boniface and S. Delaere) reported back a summary of the discussions that took place at the break-out session each of them has attended. Afterwards, a brainstorming and discussion session followed, trying to identify and explore the socio-economic topics. Three such topics received the most attention: "Incentives for the digital Economy", "Europe's response to globalization" and "User modeling and technical design".

The complete report of the FISE activities during the FIA Stockholm meeting can be found in [11]. Note that not all activities are directly related to SmoothIT, but most of them were organized by SmoothIT members, as stated earlier.

Finally, all three FISE caretakers attended the caretakers meeting right after the end of the FIA meeting where some decisions on the structure and topics of the next FIA meeting were taken.

2.1.6 FIA Valencia

At the Future Internet Assembly in Valencia [14], SmoothIT was represented by B. Stiller and S. Soursos. In the plenary session, S. Soursos briefly presented the already accepted FIA Book paper entitled "ETMS: A System for Economic Management of Overlay Traffic". The SmoothIT paper was one of the four papers selected to be presented in the plenary session of the FIA Valencia meeting, achieving high visibility. In the break-out sessions that followed, SmoothIT representatives attended various sessions, including the "Architectures: FI Reference model", "The economics of information for citizens, communities and commerce" and "Deploying on Future Internet Research & Experimentation (FIRE)". Regarding "The economics of information for citizens, communities and commerce", SmoothIT was involved, since the new Coordination Action "SESERV: Socio-Economics Service for European Research Projects" that supported this session, includes two SmoothIT partners, UZH and AUEB, transferring the knowledge and organization from the FISE group.

2.1.7 FIA Ghent

At the Future Internet Assembly in Ghent [20], SmoothIT was represented by S. Soursos, G.D. Stamoulis and M. Waldburger. They participated in the plenary and some break-out sessions, with more focus on the "Information as an economics good" session, organized by the SESERV Coordination Action.

2.2 Other Contacts

Apart from the participation of SmoothIT in the Future Internet Assembly meetings, the project additionally contacted several other European projects, P2P developers, experimentation facilities and telecommunication companies, in order to fulfill its objectives as well as to promote the work done within. In the following subsections, the summary of all those contacts is provided.

2.2.1 FP7 P2P-Next IP

In the very early stages of the SmoothIT project, the consortium realized the need to use and extend an existing P2P file sharing and video streaming client to achieve the project's objectives. In this context, SmoothIT partners (ICOM and TUD) have approached the P2P-Next project and discussed the possibility of using their P2P client, initially named "Tribler" and then "NextShare". Both projects achieved an agreement resulting in the extensions for the Tribler/NextShare client, developed within the SmoothIT consortium throughout the duration of the project. The events where P2P-Next and SmoothIT have met and collaborated can be summarized in the following:

- IEEE P2P 2008: participation in the Streaming tutorial organized by P2P-Next members, and the following meeting of SmoothIT and P2P-Next members

- Loose exchange of e-mails regarding the client software with NextShare/Tribler chief developer Arno Bakker (mostly in 2009)

- IEEE P2P 2010: informal discussions during conference breaks

2.2.2 German startup P2P streaming company

TUD has also contact to a German startup company developing their own P2P streaming client. The cooperation takes place as part of the national project Premium Services (http://premiumservices.research-events.com/joomla/) that focuses on pricing of services for e-Commerce. Here TUD is involved into the development and assessment of a pricing model for a Video-on-Demand service (from the content provider's perspective). Therefore, TUD was able to share the knowledge related to economic management of delivery overlays.

2.2.3 FP7 NAPA-WINE STREP

After meeting a participant from NAPA-WINE at the 3rd ETM workshop, a meeting between UniWue and NEC (participating in NAPA-WINE) was organized on November 24th, 2010. Here, the aim was to exchange experiences and background information from the SmoothIT and NAPA-WINE projects, since both are working in the context of Application Layer Traffic Optimization.

UniWue presented selected SmoothIT work on BitTorrent measurements and the performance evaluation of locality awareness, while NEC provided information about their P2P live-streaming simulations, trial setup and status quo.

Since the two projects work on different applications (SmoothIT: VoD and file-sharing, NAPA-WINE: live streaming), the work was found to be complementary. Both projects follow a number of similar approaches for the mechanism evaluation, while the SmoothIT assessment methodology based on BitTorrent measurements was considered interesting by the NAPA-WINE partners. One possible additional outcome is the combination of an

Internet AS-relationship and cost model developed in NAPA-WINE with the swarm topology models developed in SmoothIT. However, results of this approach might not surface before the end of the SmoothIT project.

2.2.4 German Lab Experimentation Facility

TUD, DOCOMO, and UniWue are partners in the GLAB project, as well. Via this connection, the usage of the GLAB experimental facility for the purposes of the external trial was made possible and organized. This provides support for the trial phase of the project, while SmoothIT is considered a valuable use-case in the context of GLAB.

2.2.5 FP7 Euro-NF NoE

AUEB, AGH, and UniWue participated in the Euro-NF project ISPeer, which focused on topics complementary to SmoothIT. In particular, it evaluated situations where a cooperation between providers and users is taken for granted, in contrast to the SmoothIT assumptions. Early results concerning the IoP ETM as well as possibilities identified for traffic management served as an input for ISPeer, while the evaluations from that project in turn were taken into consideration for the assessment of the IoP.

2.2.6 CISCO/Juniper

TID participated in one meeting with Cisco, where Cisco presented their work on the IETF ALTO group. In the same sense, TID had a brief talk to Juniper people to exchange the ideas about the work related to the IETF ALTO group.

In both brief meetings (held at the beginning of the projects), the participants mainly discussed about the scenarios to be considered for the evaluation of the different options and about the incentives for the different stakeholders to adopt solutions similar to those ones proposed in ALTO or being discussed in the early stages of the SmoothIT project.

2.2.7 Kendra Initiative

PTL has good relations with Kendra initiative based on the common work undertaken in other FP7 projects (Saracen). Kendra initiative brings together major content owners in attempt to define common marketplace for digital content. PTL was negotiating possibilities of getting content and necessary permissions for running external trials. Unfortunately this attempt gave to results.

2.2.8 OnDemand UK

PrimeTel has strong business relations with OnDemand which provides large amount of content available on PrimeTel's IPTV platform. OnDemand decided to honor the request to provide full length titles under category "Destinations" for use in external trials of SmoothIT project.

2.2.9 Polish Network Operators Group

AGH has started cooperation with PLNOG (Polish Network Operators Group, which forms the largest business telecommunication conference in Poland) aiming at promotion of SIS-like solutions in the operators' environment. The recent opportunity to present the ETM

mechanisms and inter-SIS solutions was the 5th PLNOG Meeting, taking place on the 21-22 October, 2010 in Kraków. During this meeting it was agreed to implement and test the SIS-like solution in a volunteered ISP network. AGH has found as most promising the offer of GHnet operator (http://www.ghnet.com.pl/), which is a small size ISP operating in Kraków closely cooperating with AGH. The sequence of possible tests is forecasted for next few months.

3 Dissemination

In this section, the complete list of all dissemination activities carried out by the SmoothIT consortium is provided. This includes all the book chapters and papers published in conferences, journals and workshops, as well as all the talks, press releases, leaflets and interviews that the members of the SmoothIT consortium gave so as to promote the work done within the project.

The following picture provides an overview of the dissemination activity of the SmoothIT consortium. More details about the different publications are provided in the next subsections.
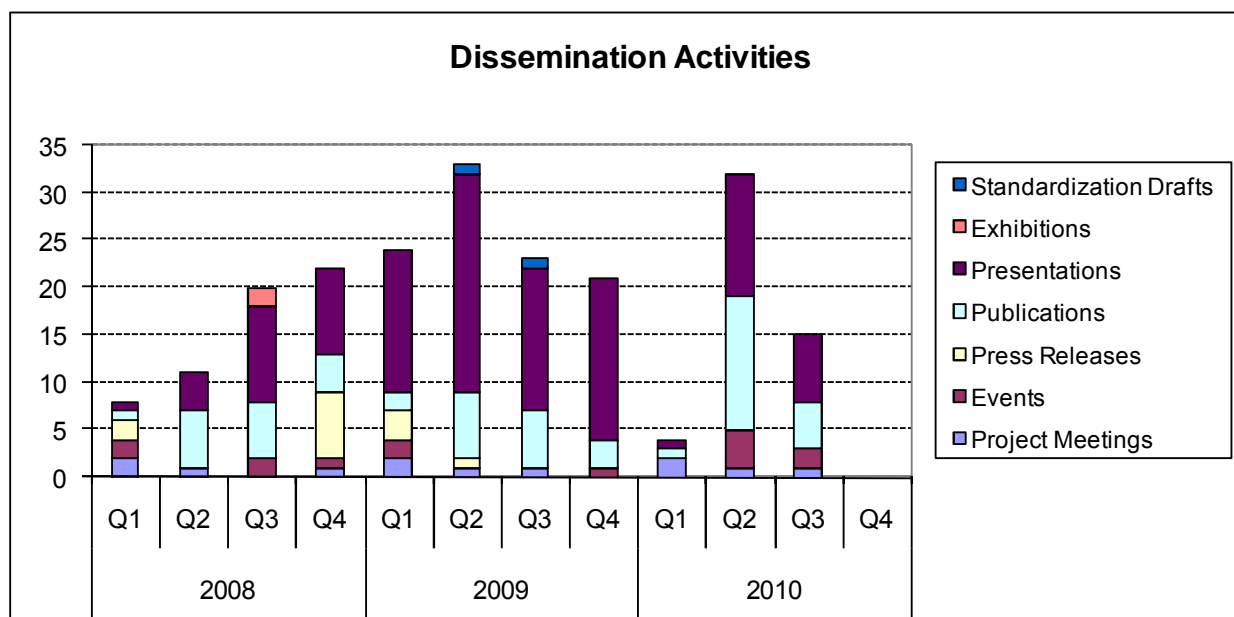

Figure 6: Overview of SmoothIT dissemination activities

As shown in Figure 6, where the data until Q3 of 2010 is shown, during 2010, SmoothIT partners have mainly focused on publication activities to present near final SmoothIT results.

3.1 Book Chapters

Title:	Future Internet Socio-Economics: Challenges and Perspectives	
Author(s):	D, Hausheer, P. Nikander, V. Fogliati, Klaus Wunstel, M.A. Callejo, S. Ristol Jorba, S. Spirou, L. Ladid, W. Kleinwachter, B. Stiller, M. Behrmann, M. Boniface, C. Courcoubetis, M.-S. Li	
Book Title:	Towards the Future Internet - A European Research Perspective	
Editors:	G. Tselentis, J. Domingue, A. Galis, A. Gavras, D. Hausheer, S. Krco, V. Lotz, T. Zahariadis	
Date:	May 2009	**Pages:** 1 – 11
Abstract:	Socio-economics aims to understand the interplay between the society, economy, markets, institutions, self-interest, and moral commitments. It is a multi-disciplinary field using methods from economics, sociology, history, and even anthropology. Socio-economics of networks have been studied for over 30 years, but mostly in the context of social networks instead of the	

	underlying communication networks. The aim of this paper is to present and discuss challenges and perspectives related to "socio-economic" issues in the Future Internet. It is hoped that this will lead to new insights on how to structure the architecture and services in the Internet of the future.
Comments:	The work for this position paper rose out of the discussions during the 1st FIA meeting at Bled, Slovenia. Specifically, D. Hausheer, had co-moderated a panel on Future Internet Socio-Economics where M.A. Callejo and S. Spirou were invited panelists. That panel discussion continued through the FISE mailing list after the FIA meeting and eventually led to the establishment of the FISE work group.

Title:	An Economic Traffic Management Approach to Enable the TripleWin for Users, ISPs, and Overlay Providers
Author(s):	T. Hoßfeld, D. Hausheer, F. Hecht, F. Lehrieder, S. Oechsner, I. Papafili, P. Racz, S. Soursos, D. Staehle, G.D. Stamoulis, P. Tran-Gia, B. Stiller
Book Title:	Towards the Future Internet - A European Research Perspective
Editors:	G. Tselentis, J. Domingue, A. Galis, A. Gavras, D. Hausheer, S. Krco, V. Lotz, T. Zahariadis
Date:	May 2009	**Pages:** 24 – 34
Abstract:	Socio-economic aspects play an increasingly important role in the Future Internet. To enable a TripleWin situation for the involved players, i.e. the end users, the ISPs and telecommunication operators, and the service providers, a new, incentive-based concept is proposed referred to as Economic Traffic Management (ETM). It aims at reducing costs within the network while improving the Quality-of-Experience (QoE) for end users. In particular, peer-to-peer (P2P) overlay applications generate a large amount of costs due to inter-domain traffic. ETM solution approaches have to take into account (a) the traffic patterns stemming from the overlay application, (b) the charging models for transit traffic, and (c) the applicability and efficiency of the proposed solution. The complex interaction between these three components and its consequences is demonstrated on selected examples. As a result it is shown that different ETM approaches have to be combined for an overall solution. To this end, the paper derives functional and non-functional requirements for designing ETM and provides a suitable architecture enabling the implementation of a TripleWin solution.
Comments:	The chapter was the outcome of all WPs, and especially WP1.

Title:	ETMS: A System for Economic Management of Overlay Traffic
Author(s):	S. Soursos, M.A. Callejo Rodriguez, K. Pussep, P. Racz, S. Spirou, G.D. Stamoulis, B. Stiller
Book Title:	Towards the Future Internet – Emerging Trends from European Research
Editors:	G. Tselentis, A. Galis, A. Gavras, S. Krco, V. Lotz, E. Simperl, B. Stiller, T. Zahariadis
Date:	April 2010	**Pages:** 1 – 10
Abstract:	The concept of Economic Traffic Management (ETM) encompasses various techniques for optimizing overlay networks considering both, underlay and overlay networks' performance requirements as well as the

	resulting economic implications for ISPs. This work presents several mechanisms through an overall ETM System (ETMS), identifying the possibility for synergies between mechanisms, both in the sense of complementarity of decision grounds and in the sense of functionality and components employed thereby. The paper describes the core ETMS architecture and how various mechanisms are instantiated. It continues with the discussion of the flexibility and modularity of this architecture, allowing for the accommodation of synergies. Finally, it presents selected results from the test-bed trials of the ETMS and a dedicated discussion on incentives behind these ETM mechanisms.
Comments:	The paper was presented during the plenary session of the FIA Valencia meeting and involved the work conducted in Work Packages 3 and 4, with respect to the architectural design and the first trial results of the SmoothIT solution. It was one of the four papers selected (among the 25 papers included in the FIA Book 2010) for presentation. Since the paper presented the SmoothIT architecture, the project accomplished high visibility during that plenary. After the plenary session, there were some discussions with a couple of participants, so as to provide a better understanding of the project's objectives, since the 10-minute presentation was not enough to cover all aspects.

Title:	Assessment of Economic Traffic Management of Overlay Traffic - Methodology and Results	
Author(s):	I. Papafili, G. D. Stamoulis, R. Stankiewicz, S. Oechsner, K. Pussep, B. Stiller, R. Wojcik, J. Domzal, D. Staehle	
Book Title:	Towards the Future Internet	
Editors:	G. Tselentis et al.	
Date:	2011	**Pages:** -
Abstract:	The optimization of traffic in the Internet is a crucial problem for Internet Service Providers (ISPs). Thus, decentralized and efficient mechanisms are required. Economic Traffic Management (ETM) defines the incentive-based concept that employs socio-economic aspects and mechanisms in order to deal with overlay traffic in a way that is mutually beneficial for all stakeholders of the Future Internet, which include end users, service providers, and ISPs, thus enabling "TripleWin". A wide variety of techniques are employed by ETM for optimizing especially overlay traffic management considering performance requirements of overlay and underlay networks together with cost implications for ISPs. This work employs an innovative assessment methodology to evaluate different ETM techniques, as well as major results are presented here.	
Comments:	The paper presents the methodology followed in WP4 to assess the results obtained from the simulations (WP2) and the field trials (WP4). To be published as a chapter in FIA book 2011.	

3.2 Conferences/Journals

Title:	Impact of Self-Organization in Peer-to-Peer Overlays on

	Underlay Utilization
Author(s):	K. Pussep, S. Oechsner, O. Abboud, M. Kantor, B. Stiller
Conference/Journal:	The Fourth International Conference on Internet and Web Applications and Services (ICIW 2009)
Place:	Venice, Italy **Date:** 24-28.05.2009 **Pages:** 84-89
Abstract:	Peer-to-Peer (P2P) systems gained popularity and are responsible for a large share of today's Internet traffic. Nevertheless, their dynamic nature and the intended lack of control through central instances make their behavior unpredictable and, therefore, it is difficult to achieve a high level of Quality-of-Service for P2P traffic. Thus, peers are themselves responsible for dealing with these issues by applying so-called self-organization mechanisms to deal with their heterogeneity, unpredictable behavior, and asymmetric resources. This paper discusses and classifies relevant self-organizing aspects of P2P systems, including metrics and mechanisms. Hereby, the key focus is in better understanding on how such self-organizing mechanisms - originally designed to improve the performance of P2P overlays - affect the underlying Internet infrastructure.
Comments:	Analysis of mechanisms relevant for locality-aware behavior in p2p overlays. This publication was an outcome from WP1.

Title:	Underlay Awareness in P2P Systems: Techniques and Challenges
Author(s):	O. Abboud, A. Kovacevic, K. Graffi, K. Pussep, R. Steinmetz
Conference/Journal:	Proceedings of the 23rd IEEE International Symposium on Parallel and Distributed Processing IPDPS 2009 (HotP2P'2009)
Place:	Rome, Italy **Date:** 25-28.05.2009 **Pages:** 1-8
Abstract:	Peer-to-peer (P2P) applications have recently attracted a large number of Internet users. Traditional P2P systems however, suffer from inefficiency due to lack of information from the underlay, i.e. the physical network. Although there is a plethora of research on underlay awareness, this aspect of P2P systems is still not clearly structured. In this paper, we provide a taxonomical survey that outlines the different steps for achieving underlay awareness. The main contribution of this paper is presenting a clear picture of what underlay awareness is and how it can be used to build next generation P2P systems. Impacts of underlay awareness and open research issues are also discussed.
Comments:	Survey of underlay-awareness techniques for content distribution.

Title:	A New Approach for Managing Traffic of Overlay Applications of the SmoothIT Project
Author(s):	J.P. Fernandez-Palacios Gimenez, M.A. Callejo Rodriguez, H. Hasan, T. Hoßfeld, D. Staehle, Z. Despotovic, W. Kellerer, K. Pussep, I. Papafili, G.D. Stamoulis, B. Stiller
Conference/Journal:	2nd International Conference on Autonomous Infrastructure, Management and Security
Place:	Bremen, Germany **Date:** July 2008 **Pages:** -

Abstract:	In this paper, the authors present a new technical approach for controlling and managing network traffic of overlay applications based on incentives that lead users to configure their traffic (for their own good) in such a way that the overall situation in the network is improved. Firstly we analyze both technical and economic characteristics of some of the more popular overlay applications. Afterwards, we describe how these applications are currently impacting on operator's network planning and, in consequence, what are the key issues on overlay traffic management under an operators' perspective. Finally, we present a new solution for managing traffic of overlay applications which is aiming to minimize the impact of overlay applications on network costs, while improving the service quality perceived by end users and enabling the implementation of new overlay services with different Quality-of-Service (QoS) requirements.
Comments:	This paper was one of the first papers jointly published by SmoothIT partners. It provided a statement of the activities to be done and was elaborated during the identification of requirements done in WP1. The paper was finally presented as a poster where SmoothIT partners were able to collect the feedback from the different participants in the conference.

Title:	Economic Traffic Management for Overlay Networks		
Author(s):	P. Racz, S. Soursos, M.A. Callejo Rodriguez, S. Spirou, F. Hecht, I. Papafili, G.D. Stamoulis, H. Hasan, B. Stiller		
Conference/Journal:	ICT-Mobile Summit 2009		
Place:	Santander, Spain	Date: June 2009	Pages: -
Abstract:	Economic Traffic Management (ETM) determines an innovative approach to manage application traffic flows in overlay networks. ETM inter-relates traditional mechanisms of network management with economic incentives. To enable a suitable theoretical understanding of this approach, relevant ETM approaches are studied and classified. The key outcome of these investigations shows that a large potential exists for ETM's applicability in Internet Service Provider (ISP) networks. Therefore, a dedicated architecture for integrating ETM into ISP networks is developed by the EU FP7 SmoothIT project (Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies). This architecture enables the integration of all identified ETM approaches due to its flexible and modular nature.		
Comments:	This paper was mainly outcome of WP3, and material for it was used from D3.3. During the presentation of the paper, the main questions were related to the win-win scenarios and how we keep the reliability of the overlay network.		
Title:	Embracing the Peer Next Door: Proximity in Kademlia		
Author(s):	S. Kaune, T. Lauinger, A. Kovacevic, K. Pussep		
Conference/Journal:	8th International Conference on Peer-to-Peer Computing 2008		

	(P2P '08)
Place:	Hannover, Germany **Date:** 8-11.09.2008 **Pages:** 343-350
Abstract:	At present, the probability of selecting ``the peer next door'' as an overlay neighbour in Kademlia is fairly small. Prior research has been concerned with reducing the lookup latency by means of proximity neighbour and route selection, but focused on recursive routing algorithms. We find that evaluation with real-world measurement data gives evidence that locality of traffic also tends to reduce lookup latencies; therefore our work leverages location data about peers and extends Kademlia's iterative routing algorithm to reduce cross-network traffic at the level of the distributed hash table. In turn, mechanisms that aim at reducing lookup latencies do not necessarily reduce cross-network traffic to the same extent.
Comments:	Evaluation of a locality-awareness mechanism for Kademlia DHT. One of the issues raised by the audience was the impact of search overlays on the inter-domain costs.

Title:	Pushing the Performance of Biased Neighbor Selection through Biased Unchoking
Author(s):	S. Oechsner, F. Lehrieder, T. Hoßfeld, F/ Metzger, K. Pussep, D. Staehle
Conference/Journal:	9th International Conference on Peer-to-Peer Computing
Place:	Seattle, USA **Date:** September 2009 **Pages:** 301-310
Abstract:	Locality promotion in P2P content distribution networks is currently a major research topic. One of the goals of all discussed approaches is to reduce the interdomain traffic that causes high costs for ISPs. However, the focus of the work in this field is generally on the type of locality information that is provided to the overlay and on the entities that exchange this information. An aspect that is generally neglected is how this information is used by the peers. In this paper, we consider the predominant approach of Biased Neighbor Selection and compare it with Biased Unchoking, an alternative locality aware peer selection strategy we propose in this paper. We show that both mechanisms complement each other for the BitTorrent file sharing application and achieve the best performance when combined.
Comments:	Results from WP2 (BGPLoc), noticed on the ALTO mailing list.

Title:	Modelling the Internet Delay Space Based on Geographical Locations
Author(s):	S. Kaune, K. Pussep, C. Leng, A. Kovacevic, G. Tyson, R. Steinmetz
Conference/Journal:	17th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing (PDP 2009)
Place:	Weimar, Germany **Date:** 18-20.09.2009 **Pages:** 301-310
Abstract:	Existing approaches for modelling the Internet delay space predict end-to-end delays between two arbitrary hosts as static

	values. Further, they do not capture the characteristics caused by geographical constraints.
	Peer-to-peer (P2P) systems are, however, often very sensitive to the underlying delay characteristics of the Internet, since these characteristics directly influence system performance.
	This work proposes a model to predict lifelike delays between a given pair of end hosts. In addition to its low delay computation time, it has only linear memory costs which allows large scale P2P simulations to be
	performed. The model includes realistic delay jitter, subject to the geographical position of the sender and the receiver. Our analysis, using existing Internet measurement studies reveals that our approach seems to be an optimal tradeoff between a number of conflicting properties of existing approaches.
Comments:	Realistic underlay models for simulations of P2P overlays.

Title:	Security architecture in manageable overlay networks based on SmoothIT Information Service (SIS) solution		
Author(s):	M. Niemiec, Z. Dulinski		
Conference/Journal:	Krajowe Sympozjum Telekomunikacji i Teleinformatyki (KSTiT) 2009		
Place:	Warsaw, Poland	**Date:** 16–18 Sept. 2009	**Pages:** -
Abstract:	The paper presents a concept of security architecture in overlay networks proposed within SmoothIT project. The motivation for the work has been given. The architecture of the developed system has been presented as well as threats for interfaces have been defined. The methods assuring the security of the system have been proposed and described. Proposed security techniques have been based on ITU-T recommendations. The functionality of the future system has been also specified.		
Comments:	Text in Polish.		

Title:	Contribution of the Department of Telecommunications AGH University of Science and Technology in SmoothIT project		
Author(s):	P. Cholda, J. Derkacz, J. Domzal, M. Kantor, M. Niemiec, R. Stankiewicz, K. Wajda, R. Wojcik, Z. Dulinski, A. Jajszczyk		
Conference/Journal:	Krajowe Sympozjum Telekomunikacji i Teleinformatyki (KSTiT) 2009		
Place:	Warsaw, Poland	**Date:** 16–18 Sept. 2009	**Pages:** -
Abstract:	The paper presents the SmoothIT project. In the first part of the paper the goals of the project have been listed as well as motivation for the work has been given. The second part consists of the contribution of the Department of Telecommunications AGH University of Science and Technology in SmoothIT project.		
Comments:	Text in Polish.		

Title:	How to efficiently decrease P2P traffic?
Author(s):	B. Polaczyk, P. Cholda, M. Kantor
Conference/Journal:	Krajowe Sympozjum Telekomunikacji i Teleinformatyki (KSTiT) 2009
Place: Warsaw, Poland	**Date:** 16–18 Sept. 2009 **Pages:** -
Abstract:	The paper presents the methods for decreasing the p2p inter-domain traffic. The traffic generated by p2p networks represents a vast majority of the whole Internet traffic. This huge traffic creates many problems for operators especially in inter-domain relations. In the paper the methods helping to deal with this huge traffic have been overview. Some new proposals have been also proposed and described.
Comments:	Text in Polish.

Title:	Mechanisms for optimal choice of P2P partners
Author(s):	Z. Duliński, M. Kantor, P. Cholda
Conference/Journal:	Krajowe Sympozjum Telekomunikacji i Teleinformatyki (KSTiT) 2009
Place: Warsaw, Poland	**Date:** 16–18 Sept. 2009 **Pages:** -
Abstract:	P2P applications generate most of the traffic in the present Internet. This kind of traffic significantly increases the costs of operators as the traffic goes out of the domain. In the paper a mechanism for decreasing the cost of operators have been presented. The mechanism is based on the information from BGP protocol related to location of the potential peers. The proposed mechanism optimizes the cost by promoting the partners within domain.
Comments:	Text in Polish.

Title:	Adaptive Server Allocation for Peer-assisted Video-on-Demand
Author(s):	K. Pussep, O. Abboud, F. Gerlach, R. Steinmetz, T. Strufe
Conference/Journal:	Proceedings of the 24th IEEE International Symposium on Parallel and Distributed Processing IPDPS 2010 (HotP2P'2010)
Place: Atlanta, USA	**Date:** 19-23.04.2010 **Pages:** 1-8
Abstract:	Dedicated servers are an undesirable but inevitable resource in peer-assisted streaming systems. Their provision is necessary to guarantee a satisfying quality of experience to consumers, yet they cause significant and largely avoidable cost for the provider, which can be minimized. We propose two adaptive server allocation schemes that estimate the capacity situation and service demand of the system to adaptively optimize allocated resources. Extensive simulations support the efficiency of our approach, which, without considering any prior knowledge, allows achieving a competitive performance compared to systems that are well dimensioned using global knowledge.
Comments:	This work was done during the preparations of WP4 (external trial). The propose mechanism allows to fix the quality of service

at the overlay level while varying the server load, thus, providing the trade-off between the "win" situations for overlay providers and users.

Title:	Optimal Choice of Peers based on BGP Information		
Author(s):	Z. Duliński, M. Kantor, W. Krzysztofek, R. Stankiewicz, P. Chołda		
Conference/Journal:	International Communications Conference 2010 (ICC'2010)		
Place:	Cape Town, South Africa	**Date:** 23-27 May 2010	**Pages:** -
Abstract:	The paper presents a concept of the peer-to-peer related traffic optimization. The mechanism is based on the *Oracle* idea, where a peer is informed on closely located P2P nodes suggesting connection to them. The *Oracle* gains the relevant information on the basis of BGP databases, where the important extension is related to using a cooperation mechanism between different operators' domains.		
Comments:	The work was done with support of SmoothIT partners and was oriented to prove that it is possible to explore a BGP-based routing information and get a profit from known route asymmetry.		

Title:	A Markov Model for the Evaluation of Cache Insertion on Peer-to-Peer Performance		
Author(s):	I. Papafili, G.D. Stamoulis		
Conference/Journal:	EuroNF NGI conference (NGI2010)		
Place:	Paris, France	**Date:** June 2010	**Pages:** -
Abstract:	Peer-to-peer file sharing applications generate huge volumes of the Internet traffic, thus leading to increased congestion and costs for the ISPs, particularly due to inter-domain traffic. Thus, analysis of peer-to-peer applications and related optimization approaches (such as locality awareness or caching techniques) has been the subject of extensive recent research. In this paper we introduce and analyze a probabilistic model that employs a Markov chain, aiming to approximate the transient evolution of a swarm with a fixed number of peers. This model estimates the distribution of the number of chunks already downloaded by a certain peer at any time. We also show how this model can serve as a tool to analyze certain properties of peer-to-peer applications, such as monotonicity of performance, and primarily to evaluate the effectiveness of cache insertion in a network serving peer-to-peer. For tractability reasons, the model employs certain simplifications of the original BitTorrent protocol, the impact of which is limited as validated experimentally.		
Comments:	This paper was mainly outcome of WP2 (Task 2.3) and its complete version is included in D2.4.		

Title:	Secure inter-SIS communication in overlay networks	
Author(s):	M. Niemiec, Z. Dulinski	
Conference/Journal:	Krajowa Konferencja Radiokomunikacji, Radiofonii i Telewizji	

	(KKRRiT) 2010
Place:	Krakow, Poland **Date:** 16-18 June 2010 **Pages:** -
Abstract:	The paper presents the results of the work related to system security in manageable overlay networks. The methods for assuring security of communication between servers which control the traffic in p2p network have been proposed and described.
Comments:	Text in Polish.

Title:	Can P2P-Users Benefit from Locality-Awareness?
Author(s):	F. Lehrieder, S. Oechsner, T. Hoßfeld, Z. Despotovic, W. Kellerer, M. Michel
Conference/Journal:	10th IEEE International Conference on Peer-to-Peer Computing 2010 - IEEE P2P 2010
Place:	Delft, The Netherlands **Date:** August 2010 **Pages:** 1-9
Abstract:	Locality-awareness is considered as a promising approach to increase the efficiency of content distribution by peer-to-peer (P2P) networks, e.g., BitTorrent. It is intended to reduce the inter-domain traffic which is costly for Internet service providers (ISPs) and simultaneously increase the performance from the viewpoint of the P2P users, i.e, shorten download times. This win-win situation should be achieved by a preferred exchange of information between peers which are located closely to each other in the underlying network topology. A set of studies shows that these approaches can lead to a win-win situation under certain conditions, and to a win-no lose situation in most cases. However, the scenarios used assume mostly homogeneous peer distributions and that all peers have the same access speed. This is not the case in practice according to several measurement studies. Therefore, we extend previous work in this paper by studying scenarios with real-life, skewed peer distributions and heterogeneous access bandwidths of peers. We show that even a win-no lose situation is difficult to achieve under those conditions and that the actual impact for a specific peer depends heavily on the used locality-aware peer selection and the concrete scenario. Therefore, we conclude that current proposals need to be refined so that users of P2P networks can be sure that they also benefit from their use. Otherwise, a broad acceptance of the concept of locality-awareness in the user community of P2P networks will not take place.
Comments:	Results from WP2 (BGPLoc), extended results from the P2P publication of the previous year and led to the IJNM paper.

Title:	BGP-based Locality Promotion for P2P Applications
Author(s):	P. Racz, S. Oechsner, F. Lehrieder
Conference/Journal:	International Conference on Computer Communication Networks (ICCCN) 2010
Place:	Zurich, Switzerland **Date:** August 2010 **Pages:** 1-8
Abstract:	P2P applications attract a lot of users and generate the dominant

	portion of the overall traffic in the Internet today. On the one hand, this large amount of traffic results in high operational costs for ISPs, mainly because of expensive interdomain connections. On the other hand, the performance of P2P applications is constricted by suboptimal peer selection or by bandwidth limitations of ISPs. To overcome these problems, the collaboration of P2P applications and ISPs is desirable, where locality promotion is one of the possible approaches. In this paper, we propose a locality promotion mechanism based on BGP routing information of an ISP and show by simulations that it can reduce inter-domain traffic, prefers shorter connections and peering links over transit links while P2P applications can achieve a better performance as well.
Comments:	Input from WPs 3 and 2.

Title:	Technical Assessment and Deployment Considerations of Economic Traffic Management Mechanisms
Author(s):	M.A. Callejo, J.A. Sanz, A. Maeso
Conference/Journal:	10th IEEE International Conference on Peer-to-Peer Computing 2010
Place:	Delft, Netherlands **Date:** August 2010 **Pages:** -
Abstract:	This paper presents the technical assessment of the Economic Traffic Management (ETM) mechanisms that have been specified and implemented in the EU FP7 SmoothIT (Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies) project. The proposal inter-relates traditional mechanisms of network management with economic incentives. The most relevant ETM mechanisms are being implemented in an architectural framework for integrating ETM into today's ISP networks. This implementation architecture is outlined and it forms the ground for the technical assessment of the proposed methods whose main goals are to validate the effectiveness of the locality mechanisms as a way to reduce network costs and to improve the quality experienced by overlay users and the scalability validation of the proposed solution.
Comments:	The paper presented the results of the WP4 internal testbed trials in order to show the scenarios and ETM mechanisms that leaded to win-win scenarios. The paper was presented during the industrial session of the P2P'10, where we were invited by the organizers, and the feedback was positive from the research community.

Title:	Performance Evaluation of P2P Caches: Flash-Crowd Case
Author(s):	P.Cholda, J. Domzal, R. Wojcik, R. Stankiewicz, F. Lehrieder, T. Hoßfeld, S. Oechsner, V. Singeorzan
Conference/Journal:	Australasian Telecommunication Networks and Applications Conference (ATNAC) 2010
Place:	Auckland, New Zealand **Date:** 31 Oct-3 Nov 2010 **Pages:** -

Abstract:	Peer-to-peer (P2P) based content distribution networks (CDNs), e.g., BitTorrent, are widely used in the today's Internet. Since all peers interested in a specific content provide storage and upload capacity those CDNs facilitate a cheap and easy distribution of large amounts of data. However, they generate a lot of costs for Internet Service Providers (ISPs) as normal users also act as a source for downloads. One option for ISPs to encounter the problem of the costly inter-domain traffic is to establish P2P caches. In the study the potential of those caches in flash-crowd scenarios, i.e., when a large number of peers tries to download the content at the same time has been investigated. To that end, simulations as well as experiments with real BitTorrent clients have been performed.
Comments:	The work was done with support of SmoothIT partners. The evaluation shows that ISPs as well as P2P users will benefit from the use of caches.

Title:	Characterization of BitTorrent Swarms and their Distribution in the Internet		
Author(s):	Tobias Hoßfeld, Frank Lehrieder, David Hock, Simon Oechsner, Zoran Despotovic, Wolfgang Kellerer, Maximilian Michel		
Conference/Journal:	Elsevier Computer Networks		
Place:	-	Date: 1 Dec 2010	Pages: -
Abstract:	The optimization of overlay traffic resulting from applications such as BitTorrent is a challenge addressed by several recent research initiatives. However, the assessment of such optimization techniques and their performance in the real Internet remains difficult. Despite a considerable set of works measuring real-life BitTorrent swarms, several characteristics of those swarms relevant for the optimization of overlay traffic have not yet been investigated. In this work, we address this lack of realistic swarm statistics by presenting our measurement results. In particular, we provide a statistical characterization of the swarm sizes, the distribution of peers over autonomous systems (ASs), the fraction of peers in the largest AS, and the size of the shared files. To this end, we consider different types of shared content and identify particular characteristics of regional swarms. The selection of the presented data is inspired by ongoing discussions in the IETF working group on application layer traffic optimization (ALTO). Our study is intended to provide input for the design and the assessment of ALTO solutions for BitTorrent, but the applicability of the results is not limited to that purpose.		
Comments:	Available online: http://dx.doi.org/10.1016/j.comnet.2010.11.011		

Title:	Mitigating Unfairness in Locality-Aware Peer-to-Peer Networks
Author(s):	F. Lehrieder, S. Oechsner, T. Hoßfeld, D. Staehle, Z. Despotovic, W. Kellerer, M. Michel
Conference/Journal:	International Journal of Network Management (IJNM), Special

	Issue on Economic Traffic Management		
Place:	-	**Date:** 2011 (to be published)	**Pages:** -
Abstract:	Locality-awareness is considered as a promising approach to increase the efficiency of content distribution by peer-to-peer (P2P) networks, e.g., BitTorrent. It is intended to reduce the inter-domain traffic which is costly for Internet service providers (ISPs) and to simultaneously increase the performance from the viewpoint of the P2P users, i.e., to shorten download times. This win-win situation should be achieved by a preferred exchange of information between peers which are located closely to each other in the underlying network topology. A set of studies shows that these approaches can lead to a win-win situation under certain conditions, and to a win-no lose situation in most cases. However, the scenarios used mostly assume homogeneous peer distributions. This is not the case in practice according to recent measurement studies. Therefore, we extend previous work in this paper by studying scenarios with real-life, skewed peer distributions. We show that even a win-no lose situation is difficult to achieve under those conditions and that the actual impact for a specific peer heavily depends on the used locality-aware peer selection and the specific scenario. This contradicts the principle of economic traffic management (ETM) which aims for a solution where all involved players benefit and consequently have an incentive to adopt locality-awareness. Therefore, we propose and evaluate refinements of current proposals, achieving that all users of P2P networks can be sure that their application performance is not reduced. This mitigates the unfairness introduced by current proposals which is a key requirement for a broad acceptance of the concept of locality-awareness in the user community of P2P networks.		
Comments:	Results from WP2 studies on BGPLoc, uses measurements from WP1 as input.		

Title:	Collaboration between ISPs for Efficient Overlay Traffic Management		
Author(s):	Eleni Agiatzidou, George D. Stamoulis		
Conference/Journal:	Networking 2011		
Place:	Valencia, Spain	**Date:** 9-13 May 2011	**Pages:** -
Abstract:	As peer-to-peer (P2P) applications (e.g. BitTorrent) impose high costs to Internet Service Providers (ISPs) due to the large volumes of inter-domain traffic generated, extensive research work has been done concerning locality-awareness approaches. Although such approaches are based on properties of the physical network topology, they take very little consideration of the real business relationships between ISPs (peering and transit agreements) as well as of the heterogeneous peer distributions among ISPs. In this paper, we propose an innovative way to exploit the business relationships between ISPs of either the		

	same or different Tiers, by introducing new collaborative approaches for overlay traffic management on top of the locality-awareness ones. By means of simulations, we show that win-win situation (reduced transit traffic for ISPs and better performance for users) can mostly be achieved under certain complicated collaborative approaches. Also we show how the collaboration between the upper Tier ISPs can affect favorably both the inter-domain traffic in the transit links, where charging applies, and the performance of their customers ISPs and how the latter can benefit from their collaboration with the transit ISPs.
Comments:	Specification and performance evaluation of collaborative locality-based mechanisms (Collaborative BGPLoc, Layered Collaborative BGPLoc, Splitting Chunks).

Title:	Cost-driven peer rating algorithm.		
Author(s):	Z. Dulinski, R. Stankiewicz, P. Wydrych, M. Kantor P. Cholda		
Conference/Journal:	IEEE ICC'2011 (accepted for publication)		
Place:	Kyoto, Japan	**Date:** 5–9 June 2011	**Pages:** -
Abstract:	The paper presents a concept of a rating algorithm aiming at overall peer-to-peer traffic reduction with locality awareness and decrease of load on costly links, thus diminishing operator's costs. The rating algorithm is not only performed by a sole Oracle, as is typically proposed, but its operation is also supported by a similar entity located in other domains. Due to this concept, a usually omitted fact that the inter-domain routes are asymmetrical is properly dealt with. Simulations performed on a real topology show the usefulness of the presented approach.		
Comments:	The work was done with support of SmoothIT partners. The peer rating algorithm is proposed that allows for optimization of costs of inter-domain traffic. BGP route asymmetry is taken into account. The investigations done justify the need for inter-SIS (inter-ALTO) protocol. The paper is closely related to inter-ALTO IETF draft submitted in 2010 and the further work on it.		

3.3 Workshops

Title:	A framework of economic traffic management employing self-organization overlay mechanisms		
Author(s):	S. Oechsner, S. Soursos, I. Papafili, T. Hoßfeld, G.D. Stamoulis, B. Stiller, M.A. Callejo, D. Staehle		
Workshop:	Third International Workshop on Self-Organizing Systems (*IWSOS'08*)		
Place:	Vienna, Austria	**Date:** 10-12.12.2008	**Pages:** 84-96
Abstract:	Applications based on overlays have become very popular, due to the separation they provide and the improvement of perceived QoS by the end-user. Recent studies show that overlays have a significant impact on the traffic management and the expenditures of the underlying network operators. In this paper, we define a framework for Economic Traffic Management (ETM) mechanisms that optimize the traffic impact of overlay applications on ISP and telecommunication operator networks based on the		

	interaction of network operators, overlay providers and users. We first provide a definition and an overview of Self- Organization Mechanisms (SOMs) and ETM for overlays. We then describe a basic framework for the interaction of components of SOMs and ETM, in terms of information and metrics provided, decisions made etc. Finally, we describe in detail how SOMs can be used to support ETM and we illustrate our approach and its implications by means of a specific example.
Comments:	Contributions from WPs 1, 2, and 3

Title:	Cooperation in P2P Systems through Sociological Incentive Patterns		
Author(s):	S. Kaune, K. Pussep, G. Tyson, A. Mauthe, R. Steinmetz		
Workshop:	3rd International Workshop on Self-Organizing Systems 2008 (IWSOS'08)		
Place:	Vienna, Austria	**Date:** 10-12.12.2008	**Pages:** 10-22
Abstract:	While the performance of peer-to-peer (p2p) systems largely depend on the cooperation of the member nodes, there is an inherent conflict between the individuals' self interest and the communal social welfare. In this regard, many interesting parallels between p2p systems and cooperation in human societies can be drawn. On the one hand, human societies are organized around a certain level of altruistic behavior. Whilst, on the other hand, individuals tend to overuse public goods, if they are free to do so. This paper proposes a new incentive scheme that extracts and modifies sociological incentive patterns, based on the Tragedy of Commons analogy, to work efficiently in a p2p environment. It is shown through simulations that this scheme encourages honest peers whilst successfully blocking non-contributors.		
Comments:	Analysis of cooperation incentives for P2P content distribution.		

Title:	A Peer-to-Peer Recommender System with Privacy Constraints		
Author(s):	K. Pussep, S. Kaune, J. Flick, R. Steinmetz		
Workshop:	Third International Workshop on P2P, Parallel, Grid and Internet Computing (3PGIC-2009)		
Place:	Fukuoka, Japan	**Date:** 16-19.03.2009	**Pages:** 409-414
Abstract:	A recommender system can be used to suggest users potentially interesting content based on their previous consumption behavior. Such services already became common in centralized systems, such as Amazon, and approaches exist for decentralized recommender systems. However, common P2P recommender systems expose the user's preferences in the whole system. This is not desirable if privacy is required. Realization of a recommender system in a private P2P environment is not a trivial task, since we cannot gather the user data at central servers or just spread them in the community. In this work we propose a private file sharing application based on social contacts. Instead of gathering all the information about users at one place the users exchange information only with their social contacts. We show how a personalized recommender system can be built in such an environment.		
Comments:	Recommender system for p2p content distribution, which allows to proactively download content during idle times, thus offloading Internet links during busy times.		

Title:	Improvement of BitTorrent Performance and Inter-Domain Traffic by Inserting ISP-owned Peers
Author(s):	I. Papafili, S. Soursos, G.D. Stamoulis
Workshop:	6th International Workshop on Internet Charging and QoS Technologies (ICQT'09)

Place:	Aachen, Germany	Date: May 2009	Pages: 97-108

Abstract:	Large volumes of Internet traffic are nowadays generated by BitTorrent. In this article, we propose the insertion of high-bandwidth ISP-owned peers as an optimization approach to improve end-users' performance and reduce inter-domain traffic. An ISP-owned peer participates in BitTorrent swarms in order to download chunks and subsequently serve regular peers. We have run simulations on the ns-2 platform showing that our approach results in considerable reduction of both inter-domain traffic and the downloading times of users. We also show that the insertion of an ISP-owned peer can complement effectively the use of locality awareness, and lead to further performance improvements.
Comments:	The paper was outcome of work conducted within WP2. One major remark on the proposed ETM solution was the content rights needed for the content storing in the ISP's premises.

Title:	Economic Traffic Management
Author(s):	S. Spirou, B. Stiller
Workshop:	1st IFIP/IEEE International Workshop on Management of the Future Internet

Place:	New York, USA	Date: June 2009	Pages: -

Abstract:	As network complexity will grow to accommodate new users and applications, traffic management relying on humans will fall short. At the same time, the rise of global services and mobile users will make single-domain, self-interested traffic management adversarial. Autonomous and cooperative traffic management could serve future networks better. We present a method, called Economic Traffic Management, which introduces these traits into traffic management. We also describe an example of the method on peer-to-peer traffic management.
Comments:	The short paper was presented as a poster during the workshop. The main concern of most people that provided comments was that ETM might be complex to integrate into the flow of network operators.

Title:	Collaboration between Peering ISPs for Economic Management of Overlay Traffic
Author(s):	E. Agiatzidou, G.D. Stamoulis
Workshop:	4th GIITG KuVS Workshop on The Future Internet and 2nd Workshop on Economic Traffic Management (ETM)

Place:	Zurich, Switzerland	Date: November 2009	Pages: -

Abstract:	The Splitting Chunks mechanism and the outcomes of the first simulation results have been presented in this extended abstract. The swarm consisted of peers only from Tier 3 and Splitting Chunks achieved 40% reduction in inter-domain traffic without affecting the performance that the users experience.

Comments:	The paper was outcome of the work conducted within WP2. Reviewers suggested further elaboration on incentives of ISPs that belong to different Tiers, in order to implement Splitting Chunks mechanism.

Title:	BGP-based Locality Promotion for Cooperative Management of Overlay Traffic		
Author(s):	S. Soursos, S. Spirou, M. Makidis M.A. Callejo Rodriguez, J.A. Sanz Garcia		
Workshop:	2nd Workshop on Economic Traffic Management		
Place:	Zurich, Switzerland	Date: 9-10 November 2009	Pages: -
Abstract:	Recent studies consider locality promotion as important in achieving collaboration between overlay and underlay networks, with benefits for all stakeholders. The SmoothIT project investigates Economic Traffic Management mechanisms that achieve such a win-win situation. We give an overview of the first such mechanism, BGP-based locality promotion (BGP-Loc), describe the implemented architecture, and present validation results on an emulated environment.		
Comments:	The paper was presented to an audience of about 30 people. Some people commented that the evaluation results presented did not show significant gains with ETM. S. Spirou, who presented the paper on behalf of S. Soursos, noted that the test-bed was quite simplistic, because the goal was to validate the software and not evaluate ETM. Another comment was that while the end-user, the lower-tier ISP and the overlay provider might get benefits, hence the TripleWin, the higher-tier, transit network operator might be in a disadvantage because of ETM. The traffic share of P2P was also a matter of controversy.		

Title:	Impact of BGP Routing Asymmetry on the Optimal Choice of Peers		
Author(s):	M. Kantor, W. Krzysztofek, R. Stankiewicz, P. Cholda, Z. Duliński		
Workshop:	2nd Workshop on Economic Traffic Management		
Place:	Zurich, Switzerland	Date: 9-10 November 2009	Pages: -
Abstract:	The paper presents an approach for P2P traffic optimization where the asymmetry of BGP routes is taken into account. The mechanism is based on the SIS (SmoothIT Information Service) idea, where a peer is informed on closely located P2P nodes suggesting connection to them. The SIS gains the relevant information on the basis of BGP databases using a cooperation mechanism between different operators' domains		
Comments:			

Title:	NGN Usage in Future Internet Scenarios		
Author(s):	M.A. Callejo Rodríguez, J.A. Sanz García, A. Maeso Martín-Carnerero, P. Racz, F. Hecht, S. Spirou, I. Papafili, G. Stamoulis, W. Kellerer, K. Wajda		
Workshop:	Future Network and MobileSummit 2010, IIMC International Information Management Corporation		
Place:	Florence, Italy	Date: June 2010	Pages: -
Abstract:	Overlay applications are generating the most of the traffic in today's Internet. Therefore, the ISP has to consider the optimization of this traffic		

and its associated operational costs. This paper presents the approach of the SmoothIT project to improve the end users' QoE and to reduce the ISPs costs. This approach is based on the specification of Economic Traffic Management mechanisms that are implemented in the "SmoothIT Information Service" architecture. We also present how this architecture can also take advantage of the usage of NGN transport control functionalities, providing improved QoE to the end users of the overlay applications.

| **Comments:** | The paper was outcome of WP2 and mainly WP3. |

Title:	Overlay Connection Usage in BitTorrent Swarms
Author(s):	S. Oechsner, F. Lehrieder, D. Staehle
Workshop:	3rd Workshop on Economic Traffic Management (ETM), Collocated with 22nd International Teletraffic Congress (ITC 22)
Place: Amsterdam, Netherlands	**Date:** September 2010	**Pages:** -
Abstract:	The amount of peer-to-peer (P2P) traffic and its inefficient utilization of network resources make it a high priority for traffic management. Due to the distributed nature of P2P overlays, a promising approach for a management scheme is to change the client behavior and its utilization of overlay connections. However, from the viewpoint of a client, there are different categories of overlay connections. In this paper, we discern between these different types of overlay connections in BitTorrent, the currently most popular P2P file-sharing application. A simulation study of BitTorrent and a video-streaming derivate called Tribler provides insights into the usage of these types of connections for data exchange. Thus, traffic management based on client behavior can be optimized by efficiently targeting connections which carry the most traffic. We also show the implications of these results for locality-awareness mechanisms such as Biased Neighbor Selection and Biased Unchoking.
Comments:	Results from a WP2-related study, feedback received and contact established from/to NAPA-WINE project partners, leading to a joint workshop (see Section 2.2).

Title:	An Incentive-based Approach to Traffic Management for Peer-to-Peer Overlays
Author(s):	K. Pussep, S. Kuleshov, C. Groß, S. Soursos
Workshop:	3rd Workshop on Economic Traffic Management (ETM)), Collocated with 22nd International Teletraffic Congress (ITC 22)
Place: Amsterdam, Netherlands	**Date:** 6.09.2010	**Pages:** 2-13
Abstract:	Peer-to-Peer overlays are responsible for a large amount of consumer traffic, including the costly inter-domain traffic. Managing this traffic requires to consider the interests of the involved parties (users, overlay providers, and network providers), since many traditional approaches benefit only single parties. In this work we propose a mechanism where an Internet provider offers additional free resources to selected users that act in a most network-friendly way and are able to bias the overlay traffic for higher localization. By the means of simulations, we show that a proper cooperation with overlay providers can result in a mutual benefit. For typical interconnection agreements, this also applies if only a single Internet provider adopts the proposed mechanism.

Comments:	Outcome of a HAP ETM study performed within WP2.

Title:	Cache Capacity Allocation to Overlay Swarms		
Author(s):	I. Papafili, G.D. Stamoulis, F. Lehrieder, B. Kleine, S. Oechsner		
Workshop:	5th International Workshop on Self-Organizing Systems (IWSOS'11)		
Place:	Karlsruhe, Germany	Date: February 2011	Pages: 68-80
Abstract:	Peer-to-peer applications generate huge volumes of Internet traffic, thus leading to higher congestion, as well as higher costs for the ISPs particularly due to inter-domain traffic. The traditional traffic management approaches employed by ISPs (e.g. traffic shaping or even throttling) often lead to a deterioration of users' Quality-of-Experience. Previous works have verified that the insertion of ISP-owned Peers (IoPs) can deal effectively with this situation. The mechanism offers caching while exploiting the self-organizing structure of overlays. Thus, it leads to both improved performance for peers and reduced inter-domain traffic costs for ISPs. In this paper, we study how the available IoP bandwidth capacity should be allocated among the various swarms that it can possibly join. In particular, we identify a variety of factors that influence the effectiveness of Swarm Selection and Bandwidth Allocation, and we investigate their impact on the practically relevant example of BitTorrent, primarily by means of simulations.		
Comments:	Outcome of the IoP's modules, i.e. Swarm Selection and Bandwidth Allocation, evaluation performed within WP2.		

3.4 Talks

Only those talks not related to papers are listed here. A connection with the "external liaisons" respective reference is provided where possible.

Title:	Expected Evolution of User Behavior	
Presenter:	M.A. Callejo Rodriguez	
Event:	The Future of the Internet Workshop	
Place:	Bled, Slovenia	Date: March 1-2, 2008
Short Description:	Talk about the expected evolution of users behavior in their Internet usage	
Comments:	During the talk, we exposed how end users are evolving and how the applications are developed in order to talk about the potential collaborations about different stakeholders to efficiently use the network resources.	

Title:	Future Internet Wars	
Presenter:	S. Spirou	
Event:	Future of the Internet Workshop	
Place:	Bled, Slovenia	Date: 1-2 Mar. 2008
Short Description:	Europe, the United States, Japan, and Korea have all launched Future Internet initiatives. Other countries and regions may follow with their own initiatives. This proliferation of separate efforts is good for innovation, as it can produce more ideas. However, if initiatives	

	remain separate throughout the development of the Future Internet, many technologically incompatible Internets could emerge. In contrast to the current global Internet, these separate Internets can cause market fragmentation and even social seclusion. To avoid such adverse possibilities, design and implementation of the global Future Internet should proceed with a growing degree of cooperation between initiatives. However, to boost innovation, healthy competition should be encouraged during the concept generation phase. Europe has considerable experience in alligning separate efforts, so it should swiftly promote the proposed strategy for the development of the Future Internet.
Comments:	The audience reacted to the talk only mildly. It seemed that the topic had not been considered by most people, as the European initiative on the Future Internet was at its first steps.

Title:	Future Internets	
Presenter:	S. Spirou	
Event:	EMANICS Workshop on Vision and Management of the Future Internet	
Place:	Bremen, Germany	**Date:** 3-4 July 2008
Short Description:	Europe, the United States, Japan, and Korea have all launched Future Internet initiatives. Other countries and regions may follow with their own initiatives. This proliferation of separate efforts is good for innovation, as it can produce more ideas. However, if initiatives remain separate throughout the development of the Future Internet, many technologically incompatible Internets could emerge. In contrast to the current global Internet, these separate Internets can cause market fragmentation and even social seclusion. To avoid such adverse possibilities, design and implementation of the global Future Internet should proceed with a growing degree of cooperation between initiatives. However, to boost innovation, healthy competition should be encouraged during the concept generation phase. Europe has considerable experience in alligning separate efforts, so it should swiftly promote the proposed strategy for the development of the Future Internet.	
Comments:	The talk stirred some controversy and discussion between the attendants. A few people supported the suggestion that there is indeed a danger of fragmentation between the separate initiatives. However, most people seemed to believe that this will not be a problem given that the different initiatives are already collaborating.	

Title:	Operator's vision about overlay traffic management	
Presenter:	J.P. Fernández Palacios Giménez	
Event:	SmoothIT and EMANICS workshop on Economic Traffic Management	
Place:	Zurich, Switzerland	**Date:** 4-5 August 2008
Short Description:	Talk about the impact of the traffic in both the operator's network planning and the QoE perceived by the end users	
Comments:	During the talk, WP1 scenarios and requirements were explained.	

Title:	ISP-owned Peer and Locality Awareness in BitTorrent	
Presenter:	S. Soursos	
Event:	Joint Economic Traffic Workshop by SmoothIT, EC-GIN and EMANICS	
Place:	Brussels, Switzerland	Date: 4-5 Aug. 2008
Short Description:	File-sharing overlay applications generate a large portion of the total traffic in the Internet. In this work, we investigate two approaches to modify the original BitTorrent protocol in order to achieve more efficient use of the underlying network, and we evaluate experimentally their impact both on the inter-domain traffic for the ISP and on the file download completion times for the end-users. In particular, we consider a locality-aware mechanism applied on the tracker, based on which Autonomous System each peer of the swarm belongs; and propose the insertion of ISP-owned peers (IoPs) in the network, as an alternative means to improve the download completion times. We conduct experiments of the aforementioned approaches using the ns-2 simulator and present the main results. Locality awareness achieves 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 also is very effective.	
Comments:	The presentation raised some interesting discussions. The first issue with respect to the IoP was about the legality of the content that is cached. As an counter-example to this argument, the case of Linux distributions was mentioned, as well as other possible "commercial" approaches such us software updates, offline video content, Youtube-like services etc. The possibility of having regular peers acting as "IoPs" was also briefly discussed. Finally, the distinction between IoP and SIS was elaborated.	

Title:	Insertion of ISP-owned Peer in BitTorrent Networks	
Presenter:	I. Papafili	
Event:	IA. Workshop on Socio-Economic issues in Euro-NF	
Place:	Athens, Greece	Date: October 2008
Short Description:	Presentation of the insertion of ISP-owned Peer as an Economic Traffic Management mechanism aiming to improve both peers' performance and ISPs inter-connection costs. Presentation and discussion of extensive evaluation results obtained by simulations on the ns-2 simulator.	
Comments:	One major remark on the proposed ETM solution was the content rights needed for the content storing in the ISP's premises. A question asked during the presentation was how the IoP selection which swarms to join; the answer was that it was still work in progress then.	

Title:	Economic Traffic Management (ETM): Scenarios and Architecture Design
Presenter:	P. Cholda

Event:	ICT Event 2008	
Place:	Lyon, France	Date: 27 Nov. 2008
Short Description:	SmoothIT Project was represented by Jan Derkacz and Piotr Cholda. They presented poster "Economic Traffic Management (ETM): Scenarios and Architecture Design" on SmoothIT works performed in the first year of the project. Additionally, Jan Derkacz took part in a panel discussion on new ideas in network management, where he presented the SmoothIT approach.	
Comments:	Presented during poster session.	

Title:	Socio-Economic Issues in the Internet of the Future	
Presenter:	Costas Courcoubetis	
Event:	Future Internet Assembly (FIA)	
Place:	Madrid, Spain	Date: December 2008
Short Description:	Costas Courcoubetis was the keynote speaker in the Future Internet Socio-Economics (FISE) session; he gave a talk titled "Socioeconomic issues in the Internet of the future", in which he motivated the study of socioeconomic issues. In particular, he explained the notion of tussles, introduced by D.Clark, the interaction of technology and stakeholders' objectives and incentives; he then gave examples of important tussles in the Internet, and finally discussed requirements for the how the solution provided by the Internet architecture should accommodate tussles.	
Comments:	Positive feedback was received from the audience; the talk has served as a basis for interesting discussions on many issues of the Future Internet afterwards.	

Title:	Economic Traffic Management	
Presenter:	S. Spirou	
Event:	Dagstuhl Seminar no. 09052 on Management of the Future Internet	
Place:	Dagstuhl, Germany	Date: January 2009
Short Description:	As users, applications, and traffic increase, networks inevitably grow in size and complexity. Such growth under a single authority makes management increasingly expensive and error-prone. Also, as users and service providers try to work around network operator restrictions towards a flat service delivery model, management becomes adversarial and inefficient. Autonomy and cooperation could help in approaching these two challenges. Before any low level management mechanism is designed, the players, their goals, and related incentives should be identified in the network to be managed. Methods from Economics, such as Game Theory and even Mechanism Design, could the be applied to this triad of information to produce a set of rules for the players to follow. Careful economical modeling can produce rules that are mutually beneficial, so that players cooperate willingly. With such a set of compatible incentives, the managed network can achieve sustainable equilibrium autonomically. Only then should technical elements facilitating rule application should be designed and deployed. We call this method	

	Economic Traffic Management. An application to the management of P2P traffic, identifies Overlay Providers, Network Operators, and Users as players, with QoS, profit, and QoE as their respective goals. The exchange of information about traffic flows and network status between Overlay Providers Network Operators creates an incentive for cooperation and autonomically fulfills all goals. In practice, the Network Operator should deploy a device facilitates the information exchange through related interfaces.
Comments:	Prof. Henning Schulzrinne commented that the proposal of ETM seems like a step in the wrong direction, because it is complex and assumes that there's competition between network operators. Several of the European attendees noted that in Europe, at least, ETM makes sense because net operators are indeed in competition, unlike the US. The discussion on the talk continued during the Socio-Economics and Incentives break-away session. That session resulted in a paper at the 2nd IEEE Workshop on the Network of the Future.

Title:	The SmoothIT project	
Presenter:	S. Soursos	
Event:	Future Internet Cluster meeting	
Place:	Brussels, Belgium	**Date:** 19 February 2009
Short Description:	The presentation provided an overview of the SmoothIT project and a summary of the activities of the first year. More specifically, after describing what motivated our studies, the main objectives of the projects were presented, including the stakeholders and the respective incentives required reaching the desired goals. A classification of incentives was then presented and the notions of TripleWin and ETM were introduced. The presentation concluded with the presentation of the ETMs identified during the 1st year of the project along with some initial results from simulations.	
Comments:	This presentation was part of the introduction of all the projects that belong to the Future Internet cluster. No special feedback was obtained since the purpose was just to get familiar with the objectives and research activities of each project of the cluster.	

Title:	FISE Scenarios	
Presenter:	S. Soursos	
Event:	Future Internet Cluster meeting, Scenario Workshop	
Place:	Brussels, Belgium	**Date:** 19 February 2009
Short Description:	The purpose of this presentation was to summarize the different Future Internet scenarios identified by the FISE group. Four (4) scenarios were presented, dealing with the mobility of the devices accessing the Internet, the User Generated Content, the existence of many Internets with different purposes and the variety of devices connected to the Internet.	

Comments:	SmoothIT, as an active member of FISE and part of the caretakers' board, presented the Future Internet scenarios prepared by the FISE group. During the Scenario workshop, the objective was to collect all the proposed scenarios, categorize them and extract the architectural challenges from them.

Title:	Future of the Internet Communication: Issues, Challenges and Opportunities of Peer-to-Peer Mechanisms	
Presenter:	R. Steinmetz	
Event:	PDP 2009: 17th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing	
Place:	Weimar, Germany	**Date:** April 18, 2009
Short Description:	The talk discusses the issues related to (P2P) content distribution overlays. It highlighted the tussle between the network operators and the need for ISP- and overlay-friendly solutions. It presented locality-awareness mechanisms able to achieve a win-win situation for the overlay user and network operators. The talk also introduced the concept of Economic Traffic Management.	
Comments:	The talk was a keynote at the PDP conference and introduced the ETM concept to a broad audience of P2P researchers.	

Title:	Dealing with the Economic Implications of Overlay Traffic: Issues and Ideas	
Presenter:	S. Soursos	
Event:	Euro-NF Plenary meeting	
Place:	Kaiserslautern, Germany	**Date:** 3-5 June 2009
Short Description:	The first part of the talk provided a short presentation of the motivation behind SmoothIT, described the main problems faced by the stakeholders, the modern form of SLA agreements and summarized the topics to be considered when discussing about locality enforcement in overlay networks. The second part focused on some initial results from numerical and simulative experiments on the effects of applying locality enforcement and presented a model for formulating locality games between ISPs.	
Comments:	The talk was given during the JRA 3.x session of the Euro-NF NoE plenary meeting, and provided a small overview of the research activities of the Network Economic Services Group of AUEB. More specifically, the talk was part of the JRA 3.2 "SLAs, Pricing, Quality of Experience", focusing on pricing and its effects. Since SmoothIT is dealing with socio-economic aspects, it is important for AUEB, as partner both of SmoothIT and Euro-NF, with experience in network economics, to promote the work done therein.	

Title:	Economic Traffic Management for BitTorrent-Based P2P Networks	
Presenter:	K. Pussep	
Event:	4th GI/ITG KuVS Workshop on The Future Internet and 2nd Workshop on Economic Traffic Management	
Place:	Zurich, Switzerland	**Date:** June 16, 2009

Short Description:	The talk provided an overview of the initial locality-promotion in BitTorrent developed within SmoothIT. The main focus was the evaluation of the Biased Optimistic Unchoking Mechanism and its comparison to the Biased Neighbor Selection (also their combination was evaluated). The results revealed that a combination of both approaches is especially beneficial for the ISP. The outlook also gave an overview of other ETM mechanisms developed within SmoothIT.
Comments:	The presentation was based on the outcome of the collaboration between WP2 and WP3 regarding the locality mechanisms for BitTorrent-like systems and their implementation within SmoothIt prototype.

Title:	Future Multimedia Communication over the Internet	
Presenter:	R. Steinmetz	
Event:	International Workshop on Future Multimedia Networking FMN 2009	
Place:	Coimbra, Portugal	**Date:** June 22, 2009
Short Description:	Issues of current and future and multimedia communications, including web services, p2p traffic etc.	
Comments:	The talk discusses the issues related to (P2P) content distribution overlays. It highlighted the tussle between the network operators and the need for ISP- and overlay-friendly solutions. The talk also covered the ETM approaches developed within SmoothIT so far.	

Title:	Achieving Win-Win by means of Economic Management of Traffic	
Presenter:	G.D. Stamoulis	
Event:	2nd EU-Japan Symposium on New Generation Networks and Future Internet	
Place:	Tokyo, Japan	**Date:** October 2009
Short Description:	Explained the concepts of Economic Traffic Management (ETM) and TripleWin, and outlined the main SmoothIT ETM mechanisms for overlay traffic, and assessment conclusions up to that point.	
Comments:	The material of the presentation was mostly related to WP2. A question that was posed related to the general applicability of ETM. It was explained that the concept of ETM is broad, and that the mechanisms presented are based on ideas that are more generally applicable than the SmoothIT context.	

Title:	Two Schools of P2P Caching	
Presenter:	S. Spirou	
Event:	2nd Workshop on Economic Traffic Management	
Place:	Zurich, Switzerland	**Date:** 9-10 Nov. 2009
Short Description:	Just like Web caching, peer-to-peer (P2P) caching can decrease transit traffic by moving content closer to the edge. In most cases this lowers operational costs of Internet Service Providers (ISP). P2P caching can also enhance application performance as content	

	proximity usually results in lower delay and higher throughput. There are two architecturally distinct approaches to P2P caching. They differ in whether the cache is part of the P2P application or not. Using established P2P protocols to communicate with the P2P cache is the oldest approach and has even found commercial applications. The alternative approach of using a standard protocol that all P2P applications use to communicate with the P2P cache has recently raised interest within the IETF. We'll describe the two approaches, note their benefits and drawbacks, and make critical comments from the implementation and deployment point of view.
Comments:	This was an invited talk that begun as an investigation of the work carried out within the IETF DECADE BoF. The audience commented that it was a good survey of the P2P caching methods and that the information on the IETF work was quite useful. However, a possible drawback with P2P caching might be the legal issues behind storing copyright-infringing files at ISP-owned elements.

Title:	What does Future Internet means for Enterprises? The FISE perspective.	
Presenter:	S. Soursos	
Event:	FIA Plenary meeting	
Place:	Kista-Stockholm, Sweden	**Date:** 23-24 Nov. 2009
Short Description:	The emergence of Future Internet is expected to affect the Enterprises. More specifically, it is expected that the (organizational and operational) structure of the enterprises will change, as well as the relationships and interaction of the enterprise with the outside world. In this presentation, we outline some aspects of the expected changes and provide an example of how FI could affect the line of business of a Telecommunications Provider/Operator.	
Comments:	The purpose of this presentation was to stimulate the discussion regarding the socio-economic impact of the Future Internet on the Enterprises. It was part of the "Enterprises" session and more specifically FISE's contribution to it. After the presentation a short discussion was held with participants expression their views and opinions.	

Title:	Serving the Incentives of Users and Providers	
Presenter:	G.D. Stamoulis	
Event:	Future Internet Workshop	
Place:	Stockholm, Sweden	**Date:** November 2009
Short Description:	Explained the concept of "mechanism" as a means of attaining a desirable equilibrium, and how this can be ported to Economic Traffic Management (ETM) in order to achieve TripleWin; also briefly outlined the main SmoothIT ETM mechanisms for overlay traffic.	
Comments:	The material of the presentation was mostly related to WP2.	

Title:	Technical Assessment and Deployment Considerations of Economic Traffic Management Mechanisms

Presenter:	M.A. Callejo, J.A. Sanz, A. Maeso
Event:	IEEE P2P 2010
Place:	Delft, Netherlands	**Date:** August 2010
Short Description:	Talk in the industrial session of the 10th IEEE International Conference on Peer-to-Peer Computing 2010
Comments:	Presentation done during the industrial session of the conference based on WP4 internal trial results.

Title:	Performance Challenges and Optimization Potential of Current P2P Overlay Technologies
Presenter:	S. Oechsner and T. Hoßfeld
Event:	14th International Telecommunications Network Strategy and Planning Symposium, NETWORKS 2010 (Tutorial)
Place:	Warsaw, Poland	**Date:** September 2010
Short Description:	Tutorial on Optimization of P2P Overlays, heavily featured mechanisms and results from SmoothIT
Comments:	Positive feedback from audience, both from academia and industry.

Title:	Incentives and QoS
Presenter:	George D. Stamoulis
Event:	Future Internet Cluster Workshop "Socio-Economics of the Network of the Future"
Place:	Brussels, Belgium	**Date:** October 2010
Short Description:	This was a short slide presentation on incentives and QoS. First, motivation for Economic Traffic Management (ETM) and QoS awareness to provide TripleWin for users, ISPs and overlay providers was given. Then, from the set of ETM mechanisms that the SmoothIT project put to trial, the "Promotion of Highly Active Peers" (HAP) mechanism was highlighted as a means to provide TripleWin.
Comments:	Besides the context of SmoothIT, there was agreement that it is necessary that the incentives of all players should be aligned in other cases too e.g. CDNs and Content Centric Networks.

Title:	A game-theoretic framework for ISP interactions in the context of ETM
Presenter:	George D. Stamoulis
Event:	3rd EuroNF Socio-Economics Workshop
Place:	Ghent, Belgium	**Date:** December 2010
Short Description:	This talk included preliminary work on a game-theoretic model for ISPs' interactions when employing or not ETM mechanisms. In particular, basic concepts, definition of a simple two-player game, and payoff metrics have been presented. Additionally, the example of a 2-ISPs game employing the IoP insertion mechanism has been briefly discussed.
Comments:	Positive feedback was received from the audience during the presentation and some interesting questions were posed: Is convergence attained? When win-win is achieved? Are the two metrics symmetric?

Title:	
Presenter:	George D. Stamoulis
Event:	Invited talk given in the Distributed Information Systems Laboratory (LSIR) of Ecole Polytechnique Federale de Lausanne (EPFL)
Place:	Lausanne, Zwitzerland	**Date:** 10 February 2011
Short Description:	Globally optimal network management and control, even when performed centrally by a single Internet Service Provider (ISP) in its own Autonomous System (AS), requires knowledge of users' preferences for quality. Such information is often privately known by the users only (rather than the ISP too), which is a case of Information Asymmetry. Matters become more complicated when multiple ASes are involved, due to the private information on each domain's properties. Moreover, in both cases, the preferences of the stakeholders (ISPs, application providers, users) involved can be conflicting; e.g. users may prefer inserting more traffic to the network, while ISPs prefer lower congestion. Even if all necessary information were available by a central entity, solving the problem in a way that combines the optimization criteria of all stakeholders in a single metric may lead to a solution that is not meaningful. Indeed, such a solution may imply that certain stakeholders adopt choices that are not individually optimal, which cannot be taken for granted. Therefore, distributed and incentive-based approaches are required that employ economic concepts and mechanisms to deal with the problem in a way that is acceptable by all stakeholders involved. In this presentation, we will first motivate in detail the use of such approaches and overview the main underlying concepts. Then, we will consider the case of optimizing the traffic generated by applications based on overlays, such as peer-to-peer (P2P) file-sharing and video-streaming, which at present generate huge volumes of traffic in the Internet due to their high popularity and large size of the files exchanged. We will present the approach of Economic Traffic Management (ETM), developed by EU-funded project SmoothIT, which deals with the overlay traffic in a way that is incentive compatible for all parties involved. Thus, ETM leads the system to a so-called "TripleWin" situation, which is mutually beneficial for users, overlay providers and ISPs. We will also present the main mechanisms employed by ETM, and assess their effectiveness towards achieving "TripleWin".
Comments:	Several questions were posed during and at the end of the talk, thus giving rise to discussion on the following subjects: ▪ The relation of ETM and charging: It was explained that SmoothIT did not try to introduce new charging schemes, but to provide incentives in the context of flat rate access pricing. ▪ The dynamics of ETM adoption, and whether or not it is beneficial for an ISP to adopt a mechanism if another one has done so. ▪ Legal and privacy issues concerning ETM and the fact that the ISP

| | becomes aware of the content downloaded by users. |
| | ■ Economic cost-benefit tradeoff, about which it was explained that it is part of the final evaluation work of the project. |

A set of additional talks have been presented by B. Stiller in various colloquia of European universities (as reported in the SmoothIT QMRs). These talks covered the ETM principles, the new incentive schemes, and respective results achieved at that time of presentation.

4 Web Site

The SmoothIT public web-site is active at the address: http://www.smoothit.org/ (during the project lifetime, the web page container was modified in order to provide more functionality). For a quick overview of the main page, check Figure 7.

Figure 7: The SmoothIT website homepage

In addition, in the figure below you can find the statistics about the visibility of the SmoothIT web-site during the two years the page has been available (from the page was created at the beginning of 2009, until October 2010), in terms of visits received and the total number of page views of this site.
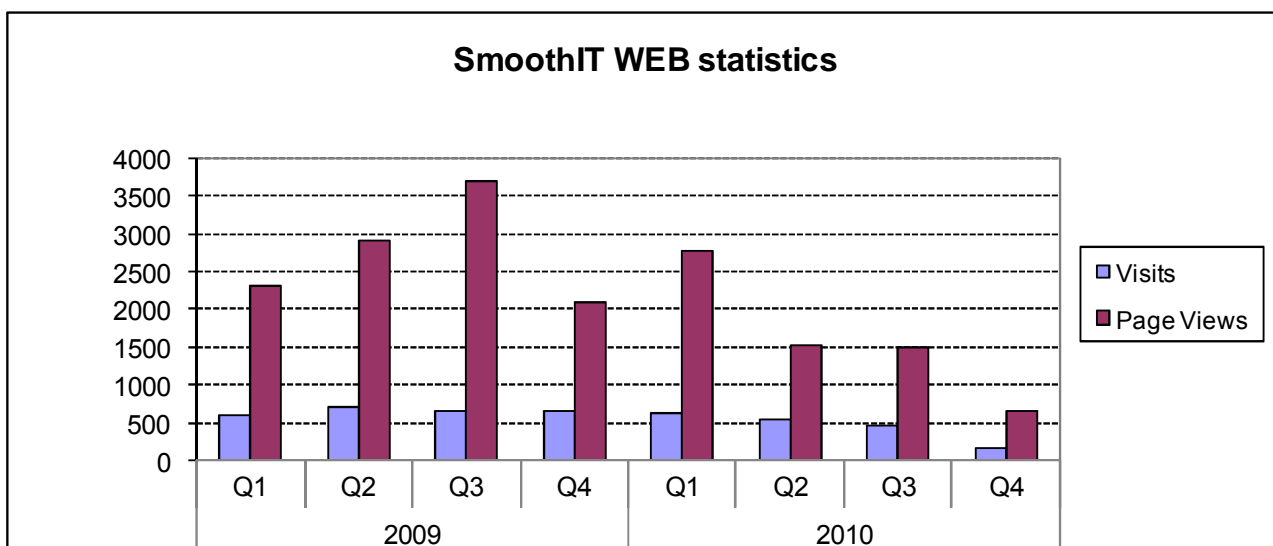
Figure 8: The SmoothIT website popularity

Public deliverables, presentations, news, positioning papers, leaflets and the abstracts of publications developed by the project have been uploaded upon dissemination opportunity in the public pages of this SmoothIT web-site. Although the website was designed at the

beginning of the project by the coordinator UZH (see [2] for a more detailed description of this first version of the SmoothIT website [1]), the procedure of updating links and the content (upon a dissemination opportunity) have been in progress until the end of the project. In particular, TID has been in charge of the periodical website maintenance activities.

As it is shown in Figure 9, from the main page of the SmoothIT webpage it is possible to get access to the Intranet of the webpage in order to read the Description of Work of the SmoothIT project, download the confidential and private deliverables, information and documentation about the Review Meetings, some publications done by some of the SmoothIT partners, and the quarterly management periodic reports. See below the private access of the Intranet.
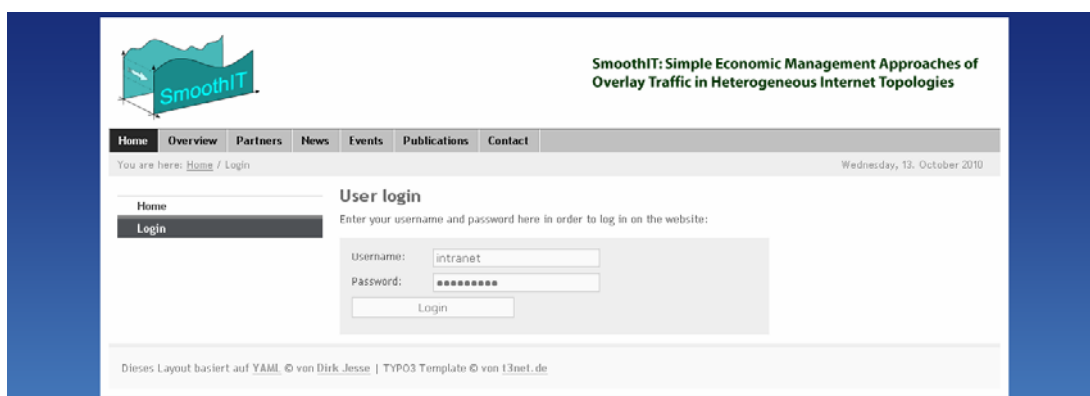
Figure 9: The login screen to the Intranet website

Within the Overview tab available from the main page of the website, you can read a brief description of the motivation that favored the beginning of this project, and also in this page it has been described the main objectives that have been treated by the SmoothIT consortium.
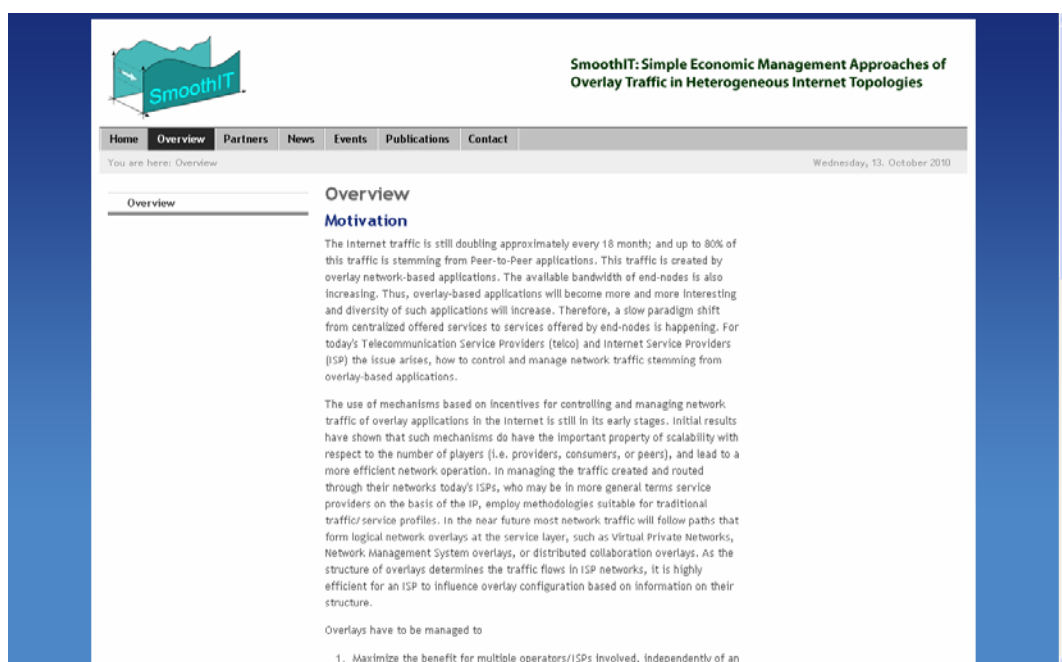
Figure 10: An overview description of the project

Below in Figure 11 it is shown an image capture of the page related to the information of each of the partners of the SmoothIT consortium. From this page it is also possible to see a brief description of the profile of all the people involved in the project in order to facilitate the contact information to the web page visitors, as you can see in Figure 12.
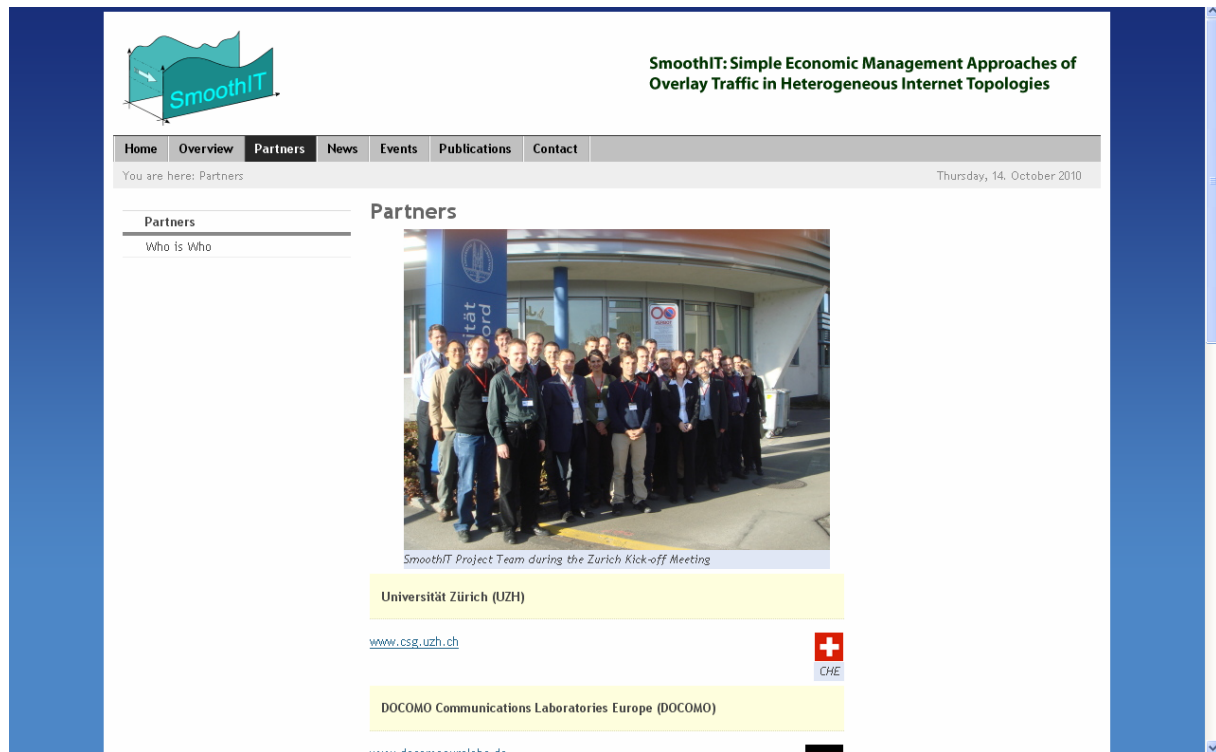
Figure 11: The SmoothIT partners
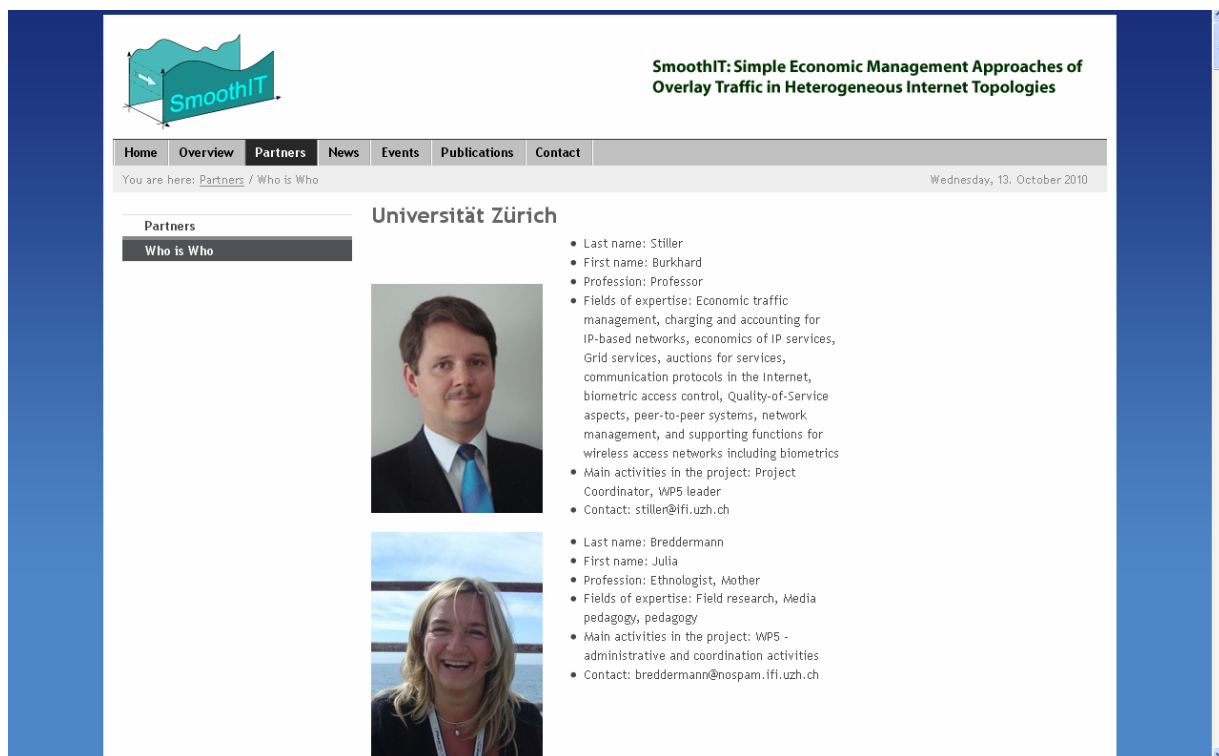
Figure 12: People's profile description involved in the SmoothIT project

In order to provide the latest information about the SmoothIT project, through this webpage it could be consulted the news where the SmoothIT project has been appear. See below a screen capture of this page.
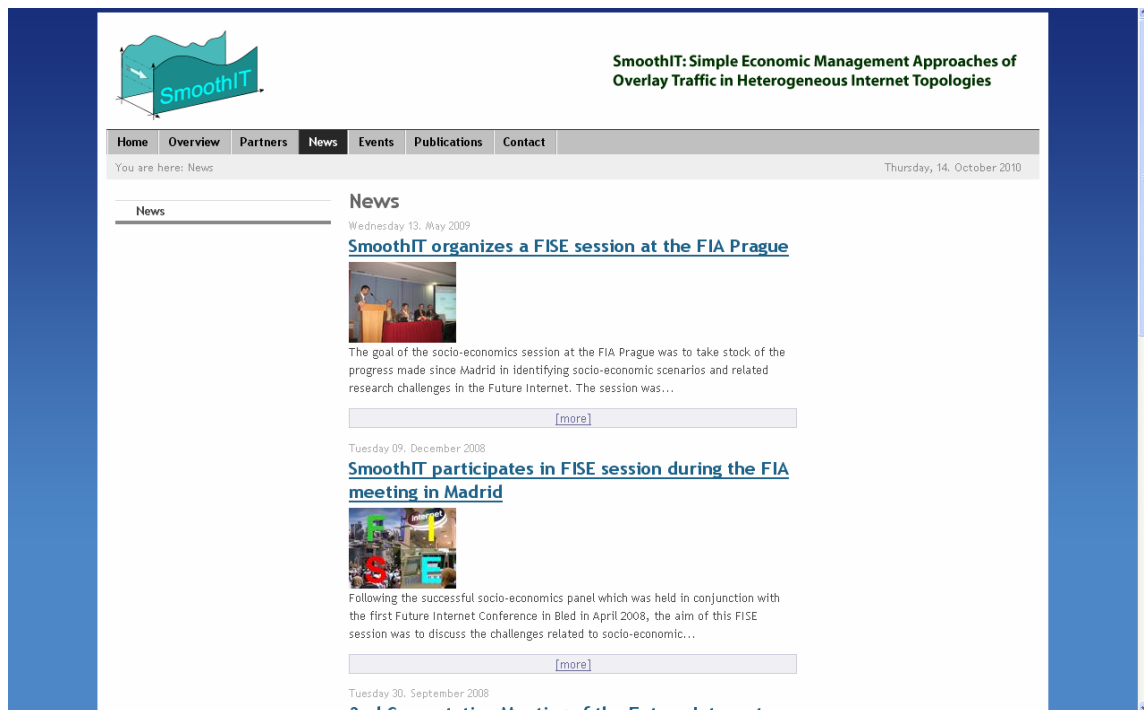
Figure 13: News where the SmoothIT project appears

Going on with the commented latest of the project, the SmoothIT webpage provides another flap where all the events in which this consortium has been involved are described.
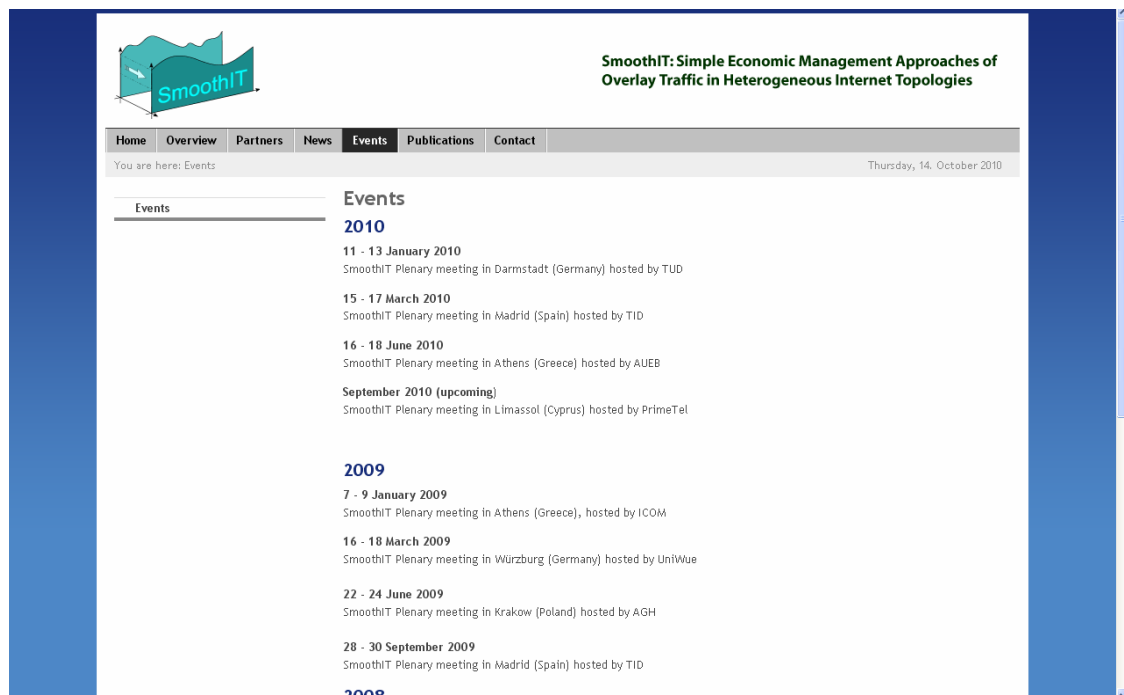
Figure 14: Events the SmoothIT project has been involved

In Figure 15 it is shown one of the more important places where the dissemination of the SmoothIT project is performed. As you can see in this picture, this page provides several subsections, where all the talks, conferences, workshops, book chapters, press releases and journals where the SmoothIT consortium has participated or has published some of the work that has been done during the project. Moreover, within this page the public deliverables are able for anyone interested in the topics that the SmoothIT has dealt with, and it is also provided the name the private ones out of curiosity. See below some pictures with captures of all of these subsections of the Publication page.
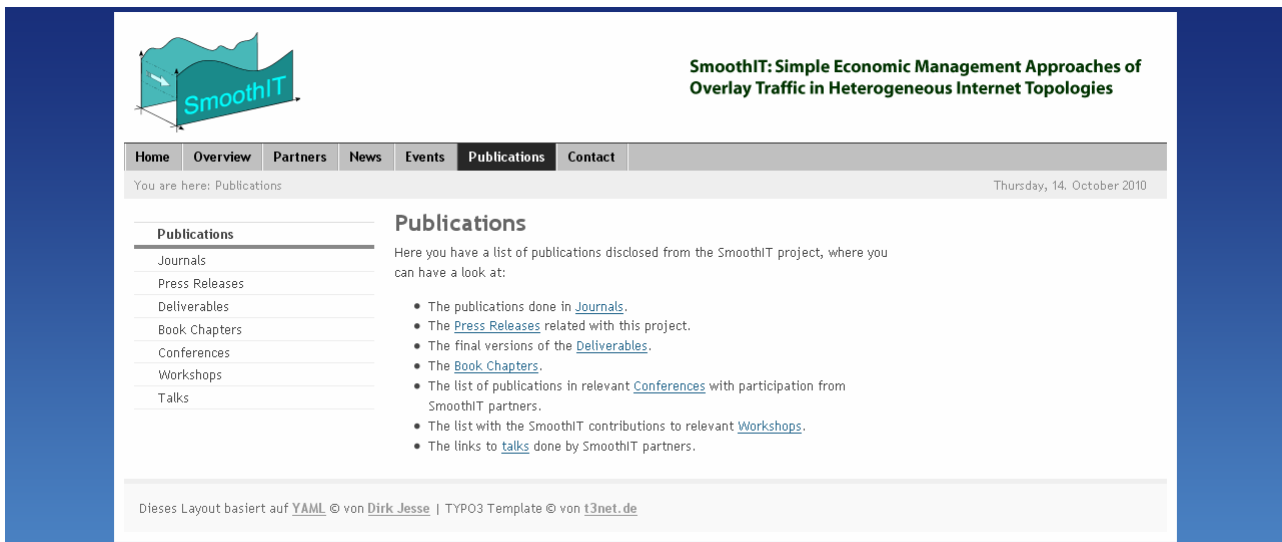
Figure 15: The SmoothIT publications page
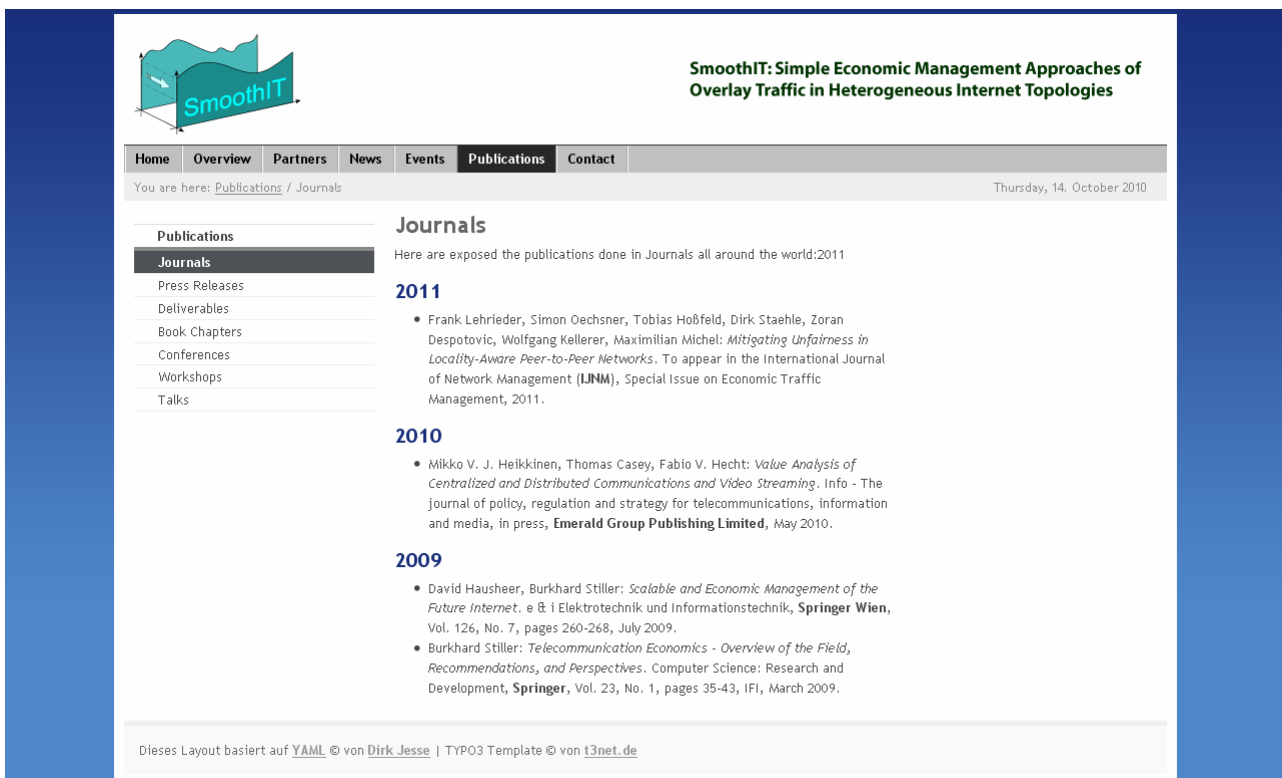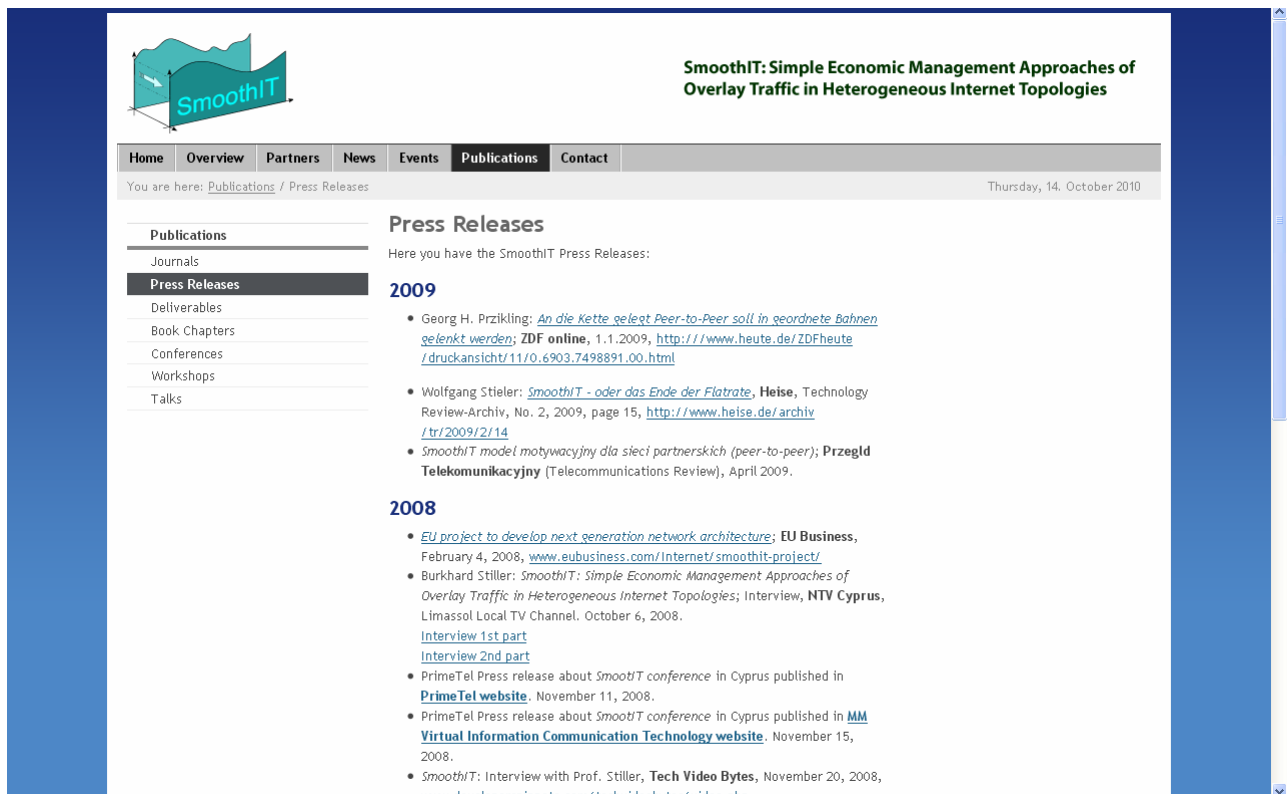
Figure 16: Journals where the SmoothIT consortium is mentioned

Figure 17: Press releases which the project has been mentioned

Figure 18: The deliverables done by this consortium

Figure 19: Book chapters done by part of the SmoothIT partners

Figure 20: Public conferences from SmoothIT people

Figure 21: Workshops where papers about the SmoothIT have been present
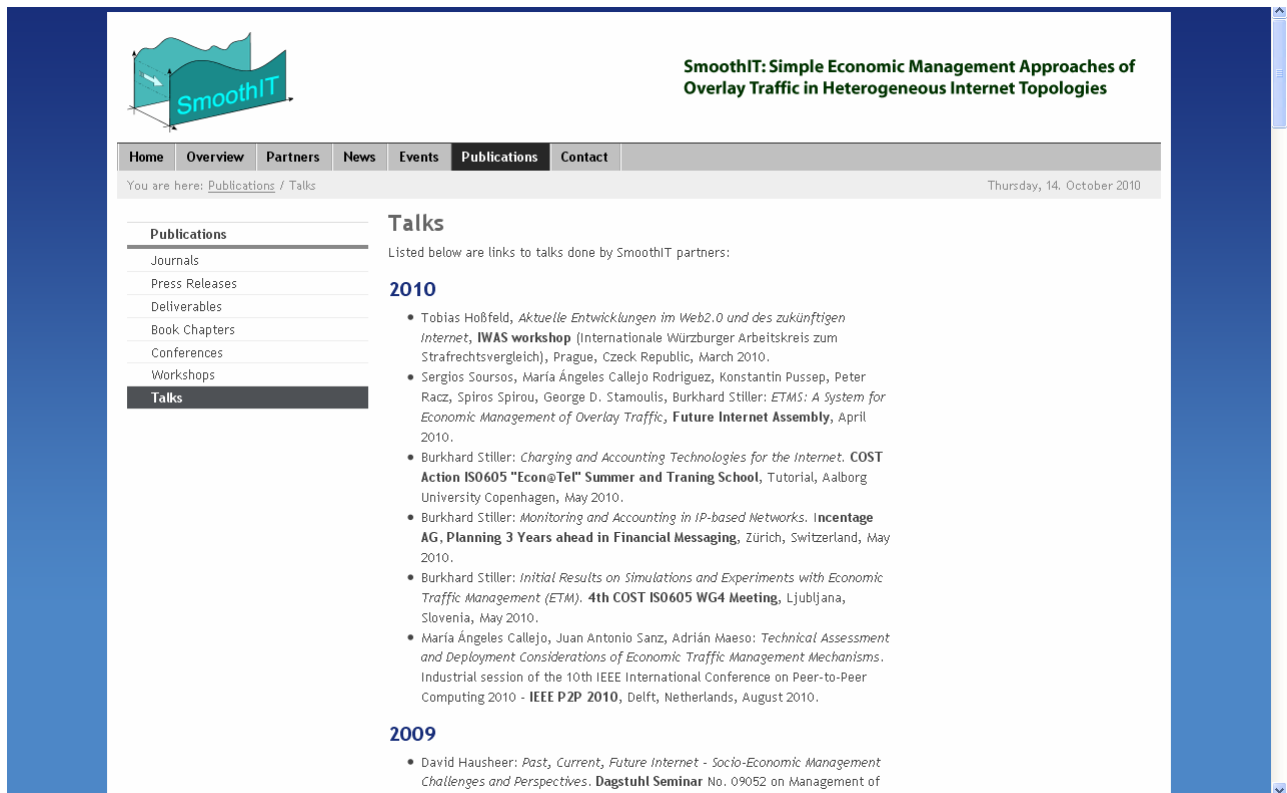
Figure 22: Talks provided by SmoothIT partners

Finally, this SmoothIT webpage provides the contact of the Project Coordinator of the consortium if needed.

Figure 23: The SmoothIT website's Coordinator information

5 ETM Workshops

SmoothIT organized a series of workshops, which have been jointly run in its first twi instances, and where the 3rd one was collocated with the renowned International Teletraffic Congress (ITC).

5.1 1st ETM Workshop

The 1st ETM 2008 workshop has been run as a joint EC-GIN, EMANICS, and SmoothIT workshop, since those three FP6 and FP7 projects have had common grounds on Economic Management aspects. While the STREP EC-GIN addressed particularly economics in grids, the NoE EMANICS observed economic management aspects and its advantages in networks. Finally, the STREP SmoothIT explicitly applies economic principles onto overlay traffic, which resulted in the newly defined terminology of ETM (Economic Traffic Management). At the time of this 1st ETM workshop the number of attendance had reached 16, which originated from one industry partner and seven academic partners of those projects. All over those participants are based in 7 European countries. The program had been organized in five sessions, which was complemented by a panel discussion on "Will Economic Traffic Management Mechanisms be successful?" As of today, more than two years later at the time of writing this deliverable, this question can be answered with a clear yes, since SmoothIT results show that many cases can benefit from the application of ETM mechanisms in the Internet of today.

5.1.1 Overview and Objectives

The Workshop on "Economic Traffic Management (ETM)" had been jointly organized by the European research projects EC-GIN, EMANICS, and SmoohtIT. 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.

5.1.2 Program

	Monday August 4, 2008
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: Operator's 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	End

	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
10.00	Discussion: Will Economic Traffic Management Mechanisms be successful?
10.30	Coffee Break
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-drivenQoS DiffServ Management M. Kantor: Inter-domain Traffic Optimization in an Inter-carrier Environment
15.00	Closing: B. Stiller: Wrap-up Discussion
15.30	End

5.1.3 Technical Program

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.

The first session, entitled "**Incentives and P2P**", began with the talk "*Private Shared History*" by Thomas Bocek, UZH 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.

The talk "*SmoothIT Overlay Management Architecture*" by Peter Racz, UZH, 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.

The talk "*Modeling of P2P-based Video Streaming*" by Tobias Hoßfeld, UniWue, 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. These measurements help to understand the system behavior and how to influence it, which in turn helps to derive further mechanisms for ETM. 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. 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.

Session 2 was entitled "**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.

The talk "*Current IRTF/IETF Congestion Control Work and How it Relates to P2P Systems*", by Michael Welzl, UIBK, 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 Congestion 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.

The presentation "Operator's *Vision about Overlay Traffic Management*" by Juan Fernandez-Palacios, TID, 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.

The last talk of the session, entitled "*Insertion of ISP-owned peers and Locality Awareness in BitTorrent*", was done by Sergios Soursos, AUEB, and had as motivation the fact that 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. It was proposed to insert ISP-owned peers (IoPs) in the network as an alternative means to improve the download completion times. 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.

After the technical session, there was a discussion panel "*Will Economic Traffic Management mechanisms be successful?*". The discussion moderator was 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. 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. 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.

On the next day of the workshop, Session 3 was entitled "**Bottleneck Detection and Distributed Capturing**". The problem of shared bottlenecks in a given network shows that a detection algorithm will allow applications 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.

In the talk "*Shared Network Bottleneck Detection with SVD*", Murtaza M. Yousaf, UIBK, 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.

Cristian Morariu, UZH, then presented "*DiCAP — An Architecture for Distributed Packet Capturing*". 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 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 of PFRING when used in combination with those.

Session 4 was entitled "**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.

Martin Waldburger, UZH, opened the session with the talk "*Locality and Contracts*". 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 lead to visualizing those challenges faced when aiming at a direct law formalization. Consequently, a hypothesis-based approach to address these challenges was introduced.

Nicolas Liebau, and Aleksandra Kovacevic, TUD, then presented "*Globase.KOM - A P2P Overlay for Fully Retrievable Location-based Search*". 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. 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.

Amruth Juturu Kumar, UZH continued with the talk entitled "*Peer Locality Information Using BGP*". 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.

The last session of the workshop targeted "**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.

Javier Rubio-Loyola, UPC, started with the presentation "*Issues Confronting Business-driven QoS DiffServ Management*". 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. 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.

Miroslaw Kantor, AGH continued with the talk "*Inter-domain Traffic Optimization in an Inter-carrier Environment*". 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. Operators face different routing options with regard to service quality and cost. 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.

5.1.4   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)

Figure 24: Pictures Taken During 1st ETM Workshop

5.2   2nd ETM Workshop

The 2nd ETM 2009 workshop was fully integrated with the 4th Future Internet Workshop in Zürich. It has attracted 28 participants, from which 5 originated from industry, 1 from the European Commission, and 22 from academia. All over those participants are based in 17 European and one Asian country. As the program below outlines, the sessions consisted out of two invited paper sessions, one on each workshop day, four full paper sessions, and 1 short paper session.

5.2.1   Program

	Monday	November 9, 2009	Affiliation		Presentation
10.30	Welcome	B. Stiller	UZH	CH	-
11.00	Session 1	*Invited Presentations: Hyperspace and Interconnection*			
IP1	P. de Sousa		European Commission	BE	From the Internet to the Hyperspace: A Network Story
IP2	M. Meulle		Orange France Telecom Group	FR	Business Issues and the Connectivity of the Inter-domain IPv6 Internet
12.00	Lunch				
13.30	Session 2	*Virtualization and P2P*			
P1	C. Werle, L. Völker, R. Bless		Univ. of Karlsruhe	DE	Attachment of End Users to Virtual Networks
P2	Z. Bozakov, A. Galatis		Univ. of Hannover	DE	Performance and Migration Evaluation of Virtual Software Routers
P3	S. Oechsner, F. Lehrieder, T. Hoßfeld, D. Staehle, F. Metzger, K. Pussep		Univ. of Würzburg, Univ. Darmstadt	DE	Economic Traffic Management for BitTorrent-Based P2P Networks
15.00	Coffee Break				
15.30	Session 3	*Peer Selection Schemes*			

P4	S. Soursos, S. Spirou, M. Makidis, M. A. Callejo Rodriguez, J. A. Sanz Garcia	INTRACOM TELECOM, TID	GR	BGP-based Locality Promotion for Cooperative Management of Overlay Traffic
P5	M. Kantor, W. Krzysztofek, R. Stankiewicz, P. Chołda, Z. Dulinski	AGH	PL	Impact of BGP Routing Asymmetry on the Optimal Choice of Peers
P6	E. Agiatzidou, G. D. Stamoulis	AUEB	GR	Collaboration between Peering ISPs for Economic Management of Overlay Traffic
17.00 End of Day 1				
17.50 Take off to Social Event				
18.30 Social Event				
21.30 Return				
	Tuesday	**November 10, 2009**	**Affiliation**		**Presentation**

9.00 *Session 4*		*Invited Presentations: Broadband and P2P*		
IP3	S. Burschka	Swisscom	CH	Traffic Mining, Feel the Packets, be the Packets
IP4	G. Haßlinger	Deutsche Telekom	DE	Traffic Management on Network Provider Platforms for Broadband Internet Access
IP5	S. Spirou	INTRACOM TELECOM	GR	Two Schools of P2P Caching
10.30 Coffee Break				
11.00 *Session 5*		*Short Presentations (Statements)*		
SP1	M. Charalambides, J. Rubio-Loyola, G. Pavlou, J. Serrat	UCL	UK	Business-driven DiffServ QoS Management
SP2	S. Mies, O. P. Waldhorst	Univ. of Karlsruhe	DE	Next Steps in Overlay Construction on Dynamic Heterogeneous Networks
SP3	M. Waldburger, T. Schaaf, B. Stiller	Univ. of Zürich, LMU	CH	An Approach to an Automated Determination of Legal Parameters in SLAs
SP4	R. Strijker, M. Cristea, C. de Laat, R. Meijer	Univ. of Amsterdam	NL	Framework for Programmable Network Control
SP5	J. An, S. Pack	Korea Univ.	KOR	Catching Three Rabbits: Hybrid Channel Access with Network Coding in Wireless Networks
12.30 Lunch				
13.30 *Session 6*		*Intrusion and Spam Detection*		
P7	S. Schmerl, M. Vogel, H. König	Brandenburg Univ. of Tech.	DE	Cooperating Intrusion Detection Overlay Structures
P8	W. van Wanrooij, A. Pras	Univ. of Twente	NL	Detecting Spam using Blacklists

14.30 Coffee Break				
15.00 *Session 7*		**Monitoring and Provisioning**		
P9	D. Haage, R. Holz	University of Tübingen	DE	CLIO/UNISONO: Practical Distributed and Overlay-Wide Network Measurement
P10	C. Morariu, P. Racz, B.Stiller	Univ. of Zürich	CH	Experimental Results of Distributed Traffic Monitoring
P11	M. Chamania, A. Jukan	Univ. of Braunschweig	DE	The Role of Transport Service Provisioning for Future Networks: Pressing Issues
16.30 Wrap-up	B. Stiller			
17.00 End of Day 2				

5.3   3rd *ETM Workshop*

The 3rd Workshop on Economic Traffic Management (ETM) was collocated with the 22nd International Teletraffic Congress (ITC 22) and took place on September 6, 2010, in Amsterdam, The Netherlands.

5.3.1 Program

08.30 - 09.00 **Registration**

09.00 - 09.15 **Opening Remarks**

09.15 - 10.30 **Invited Speaker:**
Costas Courcoubetis, Athens University of Economics and Business, Greece

Socio-economic Challenges for the Internet of the Future: The Case of Congestion Control

10.30 - 11.00 **Coffee Break**

11.00 - 12.30 **Session 1: P2P and Overlay Management**
Konstantin Pussep, Sergey Kuleshov, Christian Groß, Sergios Soursos: An Incentive-based Approach to Traffic Management for Peer-to-Peer Overlays
Jan Seedorf, Saverio Niccolini, Martin Stiemerling, Ettore Ferranti, Rolf Winter: Quantifying Operational Cost-Savings through ALTO-Guidance for P2P Live Streaming
*Simon Oechsner, Frank Lehrieder, Dirk Staehl*e: Overlay Connection Usage in BitTorrent Swarms

12.30 - 14.00 **Lunch**

14.00 - 15.30 **Session 2: Evaluations and Estimations**
Mirja Kühlewind, Michael Scharf: Implementation and Performance Evaluation of the re-ECN Protocol
Hirochika Asai, Hiroshi Esaki: Estimating AS Relationships for Application-Layer Traffic Optimization
Henna Warma, Tapio Levä, Lars Eggert, Heikki Hämmäinen, Jukka Manner: Mobile Internet in Stereo: An End-to-End Scenario

15.30 - 16.00 **Coffee Break**

16.00 - 17.30 **Session 3: Short Papers**
Eitan Altman, Pierre Bernhard, Stephane Caron, George Kesidis, Julio Rojas-Mora, Sulan Wong: A Study of Non-neutral Networks with Usage-based Prices
Hélène Le Cadre: Stability of Alliances between Service Providers
Grażyna Suchacka, Leszek Borzemski: Business-Driven QoS Management of B2C Web Servers

Thomas Wozniak, Katarina Stanoevska-Slabeva, Diogo Gomes, Hans D. Schotten: The Applicability of Context-based Multicast - A Shopping Centre Scenario

17.30 - 18.00 **Closing Remarks**

5.3.2 Welcome

After the general welcome and opening remarks from the ETM **General Chair**, Burkhard Stiller, on the overall organization and program of the 3rd ETM workshop, he thanked the ETM TPC for its review work. The **TPC Co-chair** George D. Stamoulis outlined afterwards the details of the paper submission, the acceptance ratio (6 full papers out of 21 papers submitted, plus 4 additional short papers). He motivated the tussle in the Internet as seen today by conflicting interests of participating partners.

5.3.3 Keynote

In that context, the invited speaker Costas Courcoubetis started his **keynote** on "Socio-economic Challenges for the Internet of the Future: The Case of Congestion Control". After motivating the tussle historically, the focus was driven on bandwidth. The problem of the control of bandwidth during run-time, and not at design time, shows that TCP (Transmission Control Protocol) friendliness only works successfully in case of well-behaving end-points. ISPs (Internet Service Provider) face the dilemma of how to maintain good services for Web browsing, while providing acceptable services to P2P (Peer-to-peer) applications. Adding capacity to the network does not solve this issue, and Deep Packet Inspection (DPI) does not deliver a solution either. Nevertheless, TCP friendliness is the path to follow, which serves besides the technical correctness to be kept and the easier engineering to be maintained, and it stands as the basis for incentives.

The specific congestion tussle has been tackled by a charge according to the congestion volume (Kelly, 1998). Driven by the "pollution" of a user (the volume inserted into the network), users choose a weighted TCP version. Packet flows are accounted for the amount of congestion they collect (congestion marks). This approach provides the right incentives for users: latency-sensitive users act more aggressively and volume users act less aggressively. The re-ECN (Explicit Congestion Notification) approach solves the accounting problem in a combination of layer 3 and 4 feedback notifications.

A summary of TCP, WFQ (weighted Fair Queuing), volume cap, and DPI was presented in terms of bit rate over time. However note that weighted sharing does not imply differentiated network services, but only weighted aggressiveness of an end-system's rate response to congestion (cf. the LEDBAD working group in IETF).

While seeing that such approaches reach an acceptable solution to some applications, is charging by congestion marks still optimal? Shall volume charges still remain? What is the impact of different ISP tariff structures to user-perceived performance and ISP profits? How do users choose congestion control protocol parameters as a result of ISP tariffs? And which tariffs are more competitive to ISPs?

The goal by now is, how does a model of the Internet look like, which captures an end-systems response to pricing. This involves (from fast to slow time scales) congestion control mechanisms, flow initiations and terminations, the user demand for downloads, and the tariff choice by ISPs. Costas outlines the details of this model as it stands by now, where different aggressiveness levels are modeled as weights – determining the users' strategy chosen. The various time scales show that the equilibrium in p is affected in fast times scales (Round Trip Time, RTT) the state of the number of flows matter. In medium

time scales many files arrive and completions are done. In slower time scales the ISPs choose tariffs, which make users switch to different ISPs. Users measure the average net value per bit and decide uncooperatively. But which congestion control weight w to be chosen? Users act non-cooperatively, they learn from experience, and maximize the net benefit per bit! The Wardrop equilibrium and a relevant definition was shown, which is based on a congestion control vector and a demand vector. In case the maximum social welfare (sum of all benefits over all flows) is attained, the equilibrium defined is efficient. Results: (A) If users (singly type) pick their weights in TCP and the frequency of their usage, the equilibrium is inefficient. In case of linear congestion controllers (same as having priorities) there exists a unique efficient equilibrium. (B) Two user types with a linear congestion control (such as for Web browsing) and a weight-proportional fair congestion control (off-line) are assumed. In an efficient allocation Web users will have full priority over off-line users in the limit. But, off-line delays become very soon too large. An additional volume bit charge makes the system efficient!

Concluding, economic analysis is necessary for new technical solutions. New engineering must be redefined to take incentive-compatibility into account and a interest neutrality. The examined cased in a generalization of Kelly's model and offers a tussle-neutral technology. The time-scale separation for non-cooperative behavior leads to the model discussed above.

Major questions asked to Costas Courcoubetis included:

- Phuoc Tran-Gia: Why shall a user pay more, if the network is badly dimensioned?

- Phuoc Tran-Gia: The tussle happens on higher levels, above TCP?

- Leszek: Service provider and users are two sides: but the TCP does not have to be used!

- Jan: Is the linear controller proposal the right one to go for?

- Jan: Competition between two streams, are they protected all over the life time?

- Jan Seedorf: P2P applications need the traffic now, not so simple to be with the model proposed.

- Sergey Kuleshov: Extensions based on content of users possible? Is in the DPI a hard cap of the bit rate really in place?

- Gerhard Haßlinger: Three classes of traffic may reflect most likely the real world today, can those be integrated into your model?

5.3.4 Technical Program

After a coffee break the **Session 1 on "P2P and Overlay Management"** was chaired by Tobias Hoßfeld and started with the talk by Konstantin Pussep on *"An Incentive-based Approach to Traffic Management for Peer-to-Peer Overlays"*. Due to the growing amount of Internet traffic ISPs will see Internet videos in a large amount, impacting ISPs. Based on a real-life scenario with interacting ISPs and a comparison to existing approaches the SmoothIT approach presented incentivizes ISPs to be network citizens: Selected peers will receive an increase of their upload bandwidth and reward ISP-friendly behavior additionally. The Highly Active Peer (HAP) approach is outlined and detailed in the talk, which sees a content-unaware, protocol-independent and monitored system design and operation. Konstantin summarized the results of all 4 experiments and explained the gains achieved. The evaluation has been performed in a peer-assisted VoD (Video-on-Demand)

set-up by simulations and is proposed to run in a real trial. Next steps will include different incentive schemes (such as rewards for the locality-aware peer selection), heterogeneous ISP sizes, and game theory.

Jan Seedorf presented the paper on "Quantifying Operational Cost-Savings through ALTO-Guidance for P2P Live Streaming". Driven by P2P video live streaming applications (PPlive, SOPCast, Tvants, or TVUPlayer) with more than 10.000 users per swarm as well as 1-10 Mbit/s High Definition (HD) TV and the ALTO (Application Layer Traffic Optimization) working group results, the study on costs savings with the ALTO service have been studied. The quantification was done by the costs measured as the number of traversed AS (Autonomous System) links, which are costly, while each chunk exchanged was logged, cost-wise. This has to be achieved, while the delay has to be kept low and overall application requirements shall be fulfilled. The Internet routing topology with 32.000 ASes, showing business relationships in terms of Customer-to-Provider, Provider-to-Customer, and cost-neutral peering. ALTO was simulated as a ranking service with r*d candidate neighbors from the tracker. The disjoint bucket (AS hops and upload bandwidth) and the weighted sum (compromising between distance and upload bandwidth) have been applied to the peer selection algorithm. The Napa-Wine project's P2PTV-sim simulator has been used to determine results. Concluding, ALTO can reduce costs significantly, but there is a risk of over-localization. Using AS hop distance for ALTO results in 3 to 4 hops in a non-uniformly distributed case. The peers selection based on inter-AS business relationships seems to fail a cost reduction.

Simon Oechsner outlined the work on "Overlay Connection Usage in BitTorrent Swarms" as undertaken in SmoothIT. Driven by BitTorrent's neighbor selection and choke algorithms overlay connections (initiated connections are triggered by the local peer and accepted connections are triggered by other peers) are distinguished. The locality awareness in P2P-based CDN (Content Distribution Networks), the biased neighbor selection, and the biased unchoking approaches are outlined. Those connections and CDNs are investigated simulation-wise within the extended ProtoPeer simulator. Concluding, more downloads happen on initiated connections, which grows even stronger for longer seeding times. For inter-arrival times of peers distinct conclusions can be drawn. Finally, the impact of locality awareness studied with respect to the ASes shows that all different choking strategies behave as assumed. ETMs affect the connection establishment influence the download significantly.

The lunch break was followed by **Session 2 on "Evaluations and Estimations"**. Chaired by George Stamoulis, the first presentation by Mirja Kühlewind on "Implementation and Performance Evaluation of the re-ECN Protocol" gave an insight into the re-ECN protocol and the simulation set-up. Motivated by the principle of capacity sharing in the Internet, following the TCP congestion control and its decision to share the resource of bandwidth, over-provisioning for workload peaks can be operated as well. In any case, these situations are exposed to congestion and related accounting. The TCP/IP signaling mechanism for congestion and protocol operation, called re-ECN, is explained. The dropper and policer element extend the components within an implementation, avoiding the cheating on such ECN marks being sent or not re-sent as specified by the protocol. Performance results in the simulation show that a dropper mechanism has to take into account the type of exposure signal. The re-ECN accuracy with inelastic cross traffic varies with the TCP implementation utilized. Concluding, re-ECN signals congestions, but depends on factors, such as flow size or RTT. For accounting, the absolute number of markings is relevant, which varies according to the investigations undertaken.

Hirochika Asai presented the work on "Estimating AS Relationships for Application-Layer Traffic Optimization", which determines a method of application-layer traffic optimization. The proposed method runs in two phases, which (1) quantifies the AS size/magnitude and (2) estimates the AS relationship. Results show that the differences in the degree do not characterize the peering relation well. The related model outlines the quantification equations and determines the differences in the AS magnitude. The evaluations ran a ROC (Receiver Operating Characteristics) analysis on top of the CAIDA AS relationship dataset from October 8, 2009. Possibly inaccurate annotations have been found. The difficulty of AS path is based on a minimum number of AS required within a certain path.

Henna Warma talked about "Mobile Internet in Stereo: An End-to-End Scenario", which outlines a business cased for multi-path TCP, including the techno-economic modeling. The study case sees a mobile end-user, the ISP, and the content provider's network, which looks very much alike Google, Nokia, or Apple. The techno-economic modeling applies investment costs of a technology against the revenue it generates. It exploits future forecasting, technology decision, and investment theory (Net Present Value analysis). Traffic volume assumptions based on Nokia views, which sees a 25% annual growth for downloads. Costs include CAPEX (implementation and purchase of multi-path TCP proxy) and OPEX (maintenance costs and energy costs for proxy). Revenue estimations are less straight-forward. Results conclude that approximately a 3.5% rate of chargeable downloads would make the business case profitable – under those numerical assumptions made and argued for. Limitations are discussed and the value of the model is explained, serving as a basis for future studies.

Finally, following the afternoon Coffee Break the **Session 3 with Short Papers** was chaired by Burkhard Stiller and started off with the presentation of Eitan Altman, who presents "A Study of Non-neutral Networks with Usage-based Prices". Although the Internet serves as a tool for exercising the freedom of speech, France passed a law in 2009, which may disconnect that person from the Internet upon the non-authorized downloading of copyrighted material. The universal right to access the Internet is described in Directive 2002/22/EC within the European Union. Broadband access was placed as a universal right in 2009 in Finland. Network Neutrality is an approach to provide network access without unfair discrimination neither among applications, content, nor the specific source of the traffic. A fair discrimination is reached, once it is left to the user. Eitan models the competition between ISPs and Content Providers (CP) with respect to the impact of charging the CP. The basic model contains three collective actors and usage-based pricing. A linear demand function is assumed. In turn, the model shows that there is a network neutrality paradox: At the equilibrium, the demand equals zero, all actors loose! The extension of revenue generation by advertizing does not help. The Stackelberg game sees an equilibrium, which corresponds to an asymmetric competition, where one player is a leader and other players follow the leader's steps.

Hélène Le Cadre's talk on "Stability of Alliances between Service Providers" had to be skipped due to the absence of the speaker.

Grażyna Suchacka presents work on "Business-Driven QoS Management of B2C Web Servers". The key motivation is a Web server overload, due to FIFO (First in, first out) scheduling and a lack of service differentiation. The business-to-consumer Web server specificity is determined by the session and its related attributes. The KARO method (Key Customers and Revenue-oriented Admission and Scheduling) is applied. Thus, the Web server is modeled as a multi-stage process, which sees the Web server as a control plant. The sequence of control decisions enables a maximization of the revenue throughput in

the observation window. The efficiency of KARO was run in the C++/CSIM19 simulation tool. Results show amongst others successfully completed key customer sessions.

Katarina Stanoevska-Slabeva motivated the work on "The Applicability of Context-based Multicast - A Shopping Center Scenario" due to the increase of traffic and the decoupling of respective mobile traffic revenues. The assessment of technical and financial applicability of context-based multicast content distribution was researched in two steps: (1) simulation of a use case (a St. Gallen-based shopping center) and (2) the calculation of potential financial benefits. The simulation considered network properties and the duration of advertizing events. Based on a list of service characteristics and the set-up explained far less – than expected – multicast streams have been required. The financial result shows that advertizing means payments of such video streams by the shops. Concluding, the approach reduces the network load, which means that technical gains are translated into financial benefits. Such a realistic, but specific scenario limits the generalization, such as the lack of investment cost considerations.

5.3.5 Closing and Statistics

The workshop was closed after a successful and fruitful set of discussions by the General Chair Burkhard Stiller.

As the entire event was taking place at the CWI building in Amsterdam, The Netherlands, the Workshop room was comfortably suited for the 24 attendees. From industrial participants the 3rd ETM workshop had welcomed 4, namely NEC Laboratories Europe, PrimeTel Ltd., Deutsche Telekom, and ITU, out of which one participant originated from SmoothIT project members. Academic participation included 14 different ones, namely, INRIA, Athens University of Economics and Business, Universität Zürich, Université de Versailles, Wroclaw University of Technology, University St. Gallen, The University of Tokyo, University of Tsukuba, Universität Würzburg, Technische Universität Darmstadt, Aalto University, University of Stuttgart, Opole University of Technology, TU Chemnitz, and CWI, out of which 4 affiliations originated from the SmoothIT project.

Thus, in total 9 different countries (CH, CY, DE, FI, FR, GR, NL, PL, and JP) and 1 international organization (ITU) have been represented in ETM 2010, which reflects a nice result in the dissemination of results in the technical and scientific context of ETM mechanisms. Note as well that out of 6 full and 4 short papers of the 3rd ETM workshop, 2 full papers originated from the SmoothIT project. And since the overall process of peer reviewing was following a strict and quality-driven approach with 3 reviews per paper these 6 full papers have been selected out of 21 papers submitted – resulting in a 26.8% full paper acceptance rate.

Finally, the entire set of proceedings, covering a preface, a list of committee members, and the table of content, was published in Springer's prestigious Lecture Notes in Communications Series (LNCS), appearing as Volume 6236, which needed an editorial board decision beforehand to get accepted as a publication media for the 3rd ETM Workshop 2010, organized and sponsored by the SmoothIT STREP and the EuroNF NoE.

6 Standardization

Some standardization efforts relevant to overlay networks were scheduled from the beginning of the SmoothIT project. The goal of those activities was twofold:

- Scouting of concepts and solutions from proposed standardization documents proposed mainly within IETF and IRTF, considering also achievements of ITU or OGF.

- Promoting efforts towards presenting SmoothIT results as IETF drafts and making this as a common platform for discussions within consortium.

It is also appealing that similar to ETM concepts proposed by SmoothIT, aiming at ETM-like solutions for P2P systems interworking with ISPs were also in the focus of new IETF ALTO working group. Within the timeframe of standardization discussion, starting from preliminary document [7], dated July 2008, we were able to follow and profit from this new IETF activity and also submit contributions being the outcome of SmoothIT's internal works and discussions.

6.1 IETF Drafts Submitted

Preliminary objective of SmoothIT project, expressed in Description of Work, was to submit at least one key result of SmoothIT, which includes the writing of one draft standard document. Results of work within standardization activity were better, with 3 submissions to IETF.

Below the brief information on IETF drafts submitted by SmoothIT project to ALTO WG is given.

Filename: draft-racz-bgp-based-alto-service [3]	**Revision:** 00
Title: An ALTO Service based on BGP Routing Information	
Authors: P. Racz, Z. Despotovic	
Creation Date: 2009-06-29	**Number of Pages:** 11

Abstract: Overlay applications, like Peer-to-Peer (P2P) file-sharing and video streaming, attract a lot of users and generate a huge amount of data. Most overlay applications do not take into account the underlying network topology in their routing decisions and connection establishment in general. Due to this fact and the large amount of P2P traffic, overlay applications waste network resources, cause problems in network management, and result in high costs for ISPs, especially because of the expensive interconnection links between ISPs. Therefore, the objective of the ALTO Working Group Charter [ALTO-charter] is to design and specify an Application-Layer Traffic Optimization (ALTO) service that will assist P2P applications in their peer selection process in order to achieve a more efficient usage of network resources, to reduce operational costs of ISPs, and to increase the overlay application performance at the same time.

This draft proposes a possible ALTO service that uses BGP routing information in order to calculate a rating value for peers providing a certain resource (resource providers). The service is operated by the ISP. Since BGP routing information is available in any ISP network and the service accesses the routing information from the local ISP network, the deployment of the service does not require changes in the network and the ALTO server can retrieve routing information automatically.

Filename: draft-despotovic-alto-feedback-cp [4]	**Revision:** 00
Title: ALTO-FCP: Application Layer Traffic Optimization Feedback-Based Client Protocol	
Authors: Z. Despotovic, W. Kellerer, S. Spirou, D. Staehle, M. A. C. Rodriguez, I. Papafili	
Creation Date: 2009-07-06	**Number of Pages:** 18

Abstract: In some networked applications, such as peer-to-peer file sharing, the same resource (e.g., a file or a server process) is available at several potential resource providers. Resource consumers typically try to select providers so that application performance is improved, establishing an overlay topology of direct logical links in the process. However, lack of reliable information about the underlying network can lead to poor choices and suboptimal application performance. In addition, resulting application traffic is largely oblivious to technical, economical, and political constraints at the network level, causing problems for network operators.

This document describes a protocol that facilitates the exchange of information between an overlay and the underlying network. Such information can be used at each layer to make decisions that are not detrimental to the other layer or, ideally, are beneficial to both.

Filename: draft-dulinski-alto-inter-alto-protocol [5]	**Revision:** 00
Title: Inter-ALTO communication protocol	
Authors: Z. Duliński, R. Stankiewicz, P. Chołda, P. Wydrych, B. Stiller	
Creation Date: 2010-06-08	**Number of Pages:** 37

Abstract: The ALTO service provides the information, which can make communication between applications more efficient, especially in case of overlay applications. Such applications can use the information to perform better-than-random peer selection. The ALTO protocol conveys network information to applications. The protocol definition of this document extends the functionality of this ALTO service by introducing a standardized manner of communications between ALTO servers. A new inter-ALTO protocol is proposed, which enables the exchange of information between ALTO servers. The servers can coordinate actions and can introduce policies, which provide communication between applications localized in cooperating Autonomous Systems with a higher performance and a better cost efficiency.

Besides IETF drafts, two presentations to P2P RG were given:

IETF 74

Authors: T. Hoßfeld, B. Kleine (University of Würzburg), Zoran Despotovic (DOCOMO Euro-Labs)

Title: Locality is not a simple solution to P2P traffic management?

IETF 75

Authors: Zoran Despotovic (DOCOMO Euro-Labs), Tobias Hoßfeld (University of Würzburg)

Title: BitTorrent Measurements: Challenges of Locality Promotion

Both talks presented details on the potential impact of SmoothIT's BitTorrent measurements on algorithms to promote locality.

6.2 IETF Meetings

First attempt to define a new charter was made during IETF72 meeting, within P2PI workgroup. ALTO WG met first time on November 18th 2008 in Indianapolis during IETF73, chaired by Jon Peterson, Vijay Gurbani and Enrico Marocco. Since that time ALTO WG is progressing its achievements by discussing new drafts for each subsequent IETF meetings.

- IETF 73: 5
- IETF 74: 9
- IETF 75: 3
- IETF 76: 5
- IETF 77: 7 (2 new, 5 resubmitted)
- IETF78: 8 (2 new , 6 updated)

From above details it can be concluded that SmoothIT contributions to ALTO WG are rather significant.

Currently there are three main drafts within ALTO WG, changed significantly many times:

- ALTO problem statement (promoted as RFC 5693 [8]).
- ALTO protocol (recent version draft-ietf-alto-protocol-06.txt [6]).
- ALTO requirements (recent draft draft-ietf-alto-reqs-05.txt [9]).

6.3 Received Feedback and Discussions Raised

Comments to [4]:

During discussion on the mailing list it was mentioned that this draft gives a new scope of ALTO service to be considered as traffic localization for P2P and optimization of inter-domain traffic using BGP-based ALTO service. It was also raised concern whether such optimization of inter-domain traffic would not violate the policies of ISPs.

Comments to [5]:

The third draft, describing the inter-ALTO protocol draft [5] was submitted on 29 July 2010 to IETF to standardize the inter-SIS protocol developed by the consortium. The protocol defined by this draft extends the functionality of the ALTO service [8] by introducing a standardized manner of communications between ALTO servers. A new inter-ALTO protocol was proposed, which enables the exchange of information between ALTO servers. The servers can coordinate actions and can introduce policies, which provide communication between applications localized in cooperating Autonomous Systems with a higher performance and a better cost efficiency. In particular, the following key aspects motivate the proposal of the inter-ALTO protocol: route asymmetry, different types of business relations, congestion avoidance, proximity awareness, remote ISP preference, and coordination of ISPs' policies.

The draft has been presented by Piotr Wydrych during the ALTO WG session at IETF 78 in Maastricht, Netherlands. The presentation concentrated on motivation and configurability. It was received without enthusiasm, however the discussion rose up. It centered on the questions if the protocol is really needed and if the ALTO protocol [4] cannot be used to address issues presented in the Motivation section. At least some people seemed to be convinced by the answers they had received. Moreover, the draft was criticized that it should be split into three documents: "Problem statement/Motivation", "Requirements", and "Protocol". First of all, the problem and the requirements should be discussed on, and finally the protocol should be designed.

7 Summary

This deliverable constitutes the last report on the external liaisons, standardization and dissemination activities carried out by the SmoothIT consortium from the beginning of the project till the time of writing this deliverable.

The major achievements of the project with respect to external liaisons, standardization and dissemination can be summarized in the following:

- Establishment, organization and co-chairing of the EC DG INFSO's Future Internet Socio-Economics (FISE) workgroup

- Active participation in the Future Internet Assembly (FIA) meetings and other FIA-initiated event, like the 2nd EU-Japan Symposium, so as to represent and express the FISE's perspectives

- Contact with other external entities (academic, research and industrial) for purposes of exchanging information, allowing collaboration and acquiring data that would ease/promote the objectives of SmoothIT

- Large number of dissemination activities, including book chapters, journal and conferences, as well as workshops, including results from the research and implementation tasks of the project

- Members of the SmoothIT consortium were invited to several panels to present the SmoothIT and, more generally, the socio-economic perspective on networking issues

- (Co-)organization of three Economic Traffic Management (ETM) Workshops with the purpose to promote economic methods for the handling of traffic engineering problems

- Submission of two IETF drafts to the ALTO WG

To conclude, the SmoothIT consortium has been proven very active in these activities that disseminate the project results to a wider audience and managed to be established as one of the most well-known European projects in the area of economic overlay traffic management.

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Abbreviations

ALTO WG	Application-Layer Traffic Optimization Working Group
EC-GIN	Europe Chine Grid InterNetworking
EMANICS	European Network of Excellence for the Management of Internet Technologies and Complex Services
ETM	Economic Traffic Management
EuroNF	European Network of the Future
FIA	Future Internet Assembly
FISE	Future Internet Socio-Economics
IETF	Internet Engineering Task Force
NAPA-WINE	Network-Aware P2P-TV Application over Wise Networks
PLNOG	Polish Network Operators Group
SESERV	Socio-Economics Service for European Research Projects
SmoothIT	Simple Economic Management Approaches of Overlay Traffic in Heterogeneous Internet Topologies
STREP	Specific Targeted Research Project
VoD	Video on Demand

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