

EuroView2010

"Visions of Future Generation Networks"

*10th Würzburg Workshop on IP
Joint ITG, ITC, and Euro-NF Workshop
co-located with Official G-Lab Status Meeting*

August 2nd - August 3rd 2010, Würzburg, Germany

Summary of EuroView2010

The EuroView2010 workshop opened on Monday, August 2nd, with an introduction by Prof. Tran-Gia giving an overview on the history of the EuroView event taking place for the tenth time this year and its increasing popularity. As well, he gave a short presentation on the inter-disciplinary Internet Research Center (IRC), founded at the University of Würzburg, which combines research activities of computer scientists with scientists from law and psychology. This year's EuroView was again strongly influenced by the G-Lab project. Hence, a summary on the timeline and development of the G-Lab project (phase 1 and phase 2), its structure, interworking of partners, and a memorandum of understanding for federation with several research initiatives was given.

The technical discussion started with a keynote talk by Prof. Dr. Lawrence Landweber (University of Wisconsin, US) on "The Future (Inter)Network - Challenges and Paradigms". He covered the status of today's Internet and reported on general technology trends regarding access and transmission technology, like „wireless 5G until 2020?“. A critical statement on privacy in today's Internet and social network companies „privacy - already lost? (cf. Orwell's novel "1984")“ and „how will social networks affect the society?“ as well as security problems were considered. The keynote concluded with visions on „the known world - 2020“, „the less known world – 2020“, and „the future world – 2030“. A final conclusion was that new paradigms cannot be predicted, and paradigm shifts need time.

The first session covered „Prototypes and Testbeds“ and was chaired by Prof. Lehnert (Technical University of Dresden). In this session, the way from traditional theoretical research on networks towards testbed-based research was drawn and stated where this is necessary. Different testbed characteristics (various trade-offs, e.g. using original software vs. need for abstraction/adaptation) were compared and problems of testbeds (high cost factor, limited number of testbeds) were stated. The importance of integration of simulated networks, virtual links for the real testbeds was discussed. Furthermore, the federation of different testbeds was a focus to reduce cost (e.g. sharing resources, scale experimentation). In this context, the FIRE project's federation with PlanetLab was presented, as well as an abstract formal definition of federation was given. Also Teagle, a pan-European laboratory project, and its architecture were presented.

The second session was dedicated to the GENI project which was organized by Aaron Falk, being the Engineering Architect and Lead System Engineer for the GENI Project Office (GPO). He presented GENI's conceptual design and how it is intended to be used. Another focus of this talk was on prototypes to provide access to real users and wide-area networks. The Geni Meso-scale prototypes

Openflow, WiMax, ShadowNet, and Openflow backbones were mentioned. Further talks on the GENI project covered the provisioning of End-to-End Virtualization in GENI, sensor networks as an integral part of the Internet, and data intensive experiments. Another focus in the GENI session was cloud computing. The relation of applications and the cloud was discussed: cheap and easy to deploy apps in the cloud, while apps drive the platform. The prediction was made that telcos will deploy the "Dispersed Cloud". The Dispersed Cloud provides application builders with the abstractions of elastic computation and storage, but it relies more heavily on edge nodes and mid-sized clusters than on large data centers. In this session, "Federation as a Service: An Architecture for the InterCloud", i.e. the interconnection of different clouds was presented. The GENI standard for control frameworks was considered for a slice-based facility interface which is already supported by Planetlab, orca.

The third session dealt with Architectures and Convergence and was chaired by Prof. Tutschku (University of Vienna). Regarding architectures, different homing architectures/strategies, their costs and benefits were presented. Furthermore, security enhancements in IPv6 Communications were discussed. The clean slate approaches were depicted to deal with the increasing interdependencies in the architecture of the current Internet. It was stated that a future architecture should integrate long term flexibility, as well as short term flexibility. The other focus of this session covered Convergence of Internet and Telecommunications. It was discussed that such a convergence means to support QoS for Internet service delivery and that a fair business model is necessary for this purpose. It was proposed that from the providers view, a Walled Garden approach could be feasible.

In the fourth and last session of day 1, which was chaired by Dr. Kellerer (Docomo, Munich), New Protocols and Interfaces were discussed. The protocols part focused on the transport layer. It was discussed how the Internet's Transport Layer can be improved and made more application friendly, as well as how the Internet could benefit from a protocol-independent API for transport services. Interfaces regarding control and management plane aspects were presented, like a single Interface for Automated Inter-domain Path Provisioning, e.g. to distribute movies in cinema scales across several domains. Furthermore, a Property and Requirement-based Application Interface for Future Networks was discussed for a future heterogeneous Internet scenario.

On Tuesday, August 3rd, the second and last day of this year's EuroView took place with four different sessions, as well as the demo and poster session. The day started with the fifth session which was chaired by Tanja Zseby (Fraunhofer) and covered Routing and Security. An overview on Naming, Addressing, and Programming in Multicast was given. The G-Lab phase 2 project Forwarding on Gates (FoG) was explained. While IP routing is a hop-by-hop routing, lookups per router, based on routing tables, in FoG it is Zone-by-zone (clustering into zones), lookups per zone, based on routing services. Practical details were shown in the demo Session. With the HiiMap project, an architecture for locator-identifier split was presented. It is a two-tier locator (local part LTA, global part guid) and its mapping system is realized using DHTs. It was discussed "How to name identifiers (user friendly)", e.g. identifier for content/persons (store special subinformation in the identifier) as well as a search strategy to find the identifier; using an n-gram based search mechanism if search for the user id did not match. In a related context, a Testbed-based Analysis of the Incorrect Lookup Routing Attack on the Pastry DHT was presented. In the project G-Lab-DEEP, the Security in a Cross-Layer Composition Architecture was addressed. To this end, a VoIP scenario with composition functionality was presented in the demo session.

In the sixth session, chaired by Max Lemke (European Commission), Future Internet Activities in FP7 were presented. The European Research Strategy towards the Future Internet was presented as a comprehensive EU Approach which is split into CIP/ICT PSP, FP7/PPP, FP7, and FI PPP which differ in the funding and realization periods and the aimed funded audience. In this context, An Overview on FIRE and its Approaches towards Federation and Collaboration was given, presenting a Comprehensive list of FIRE projects and their collaboration efforts. The EU showed its strong interest

in funding OpenFlow in Europe. A definition of OpenFlow was given as a standardized interface between switch controller and hardware (control and forwarding/processing). The OpenFlow related projects OFELIA, SPARC, and CHANGE were introduced. An Overview of two Wireless Sensor Network Testbed Projects, namely Wisebed STREP and Sensei IP, and their Extension were presented. The benefits of virtual testbeds were outline and the complementary nature of the two projects, but both are essential components of a comprehensive "Internet of Things".

The seventh session covered Virtualization and was chaired by Prof. Bauschert (University of Chemnitz). The session focused on challenges in and benefits of virtual networks. During the session a broad field was discussed, including the selection of Communication Services in a Service Oriented Network Architecture and why/whether this is required; Quality-of-Service Signaling for Virtual Networks to dynamically setup virtual links on demand; and Service Characterization for Virtual Routers. The G-Lab phase 2 projects COMCON: Use Cases for Virtual Future Networks (network virtualization, partitioning and aggregating resources) and Ener-G: A Generic Approach for Modeling Energy Consumption (Distribute applications such that energy consumption is minimized, energy based accounting) were presented including first results.

The eighth and last session covered Wireless and Mobile Services and was chaired by Peter Domschitz (ALU). Application- and Context-Aware Radio Resource Management for Future Wireless Networks was discussed which gets necessary due to different access technologies (UMTS, LTE, WiMAX) and to allow context awareness, evaluate users position, sensors, etc. In this session, different approaches from IETF Mobility Solutions to the 3GPP All IP Network were presented. Finally, the Current Status and Future Plans of the G-Lab phase 2 project „Real-World G-Lab“ was presented which covers protocols, algorithms and services to overcome problems like routing, energy efficiency, monitoring and searching.

Overall Qualitative Assessment

The number of participants at the EuroView event over the last years shows that the workshop has gained and maintained a good standing in the Future Internet research community (84 participants in 2006; 84 in 2007; 100 in 2008; 99 in 2009; 156 in 2010). In fact, 100% of the participants, who answered this question in the user survey, claimed to visit future EuroView events. One driver for this development is that the participants get first-hand information of ongoing research work – a long time before such work is published in conferences or journals. Another successor is that the Future Internet research is moved forward. The participants see that different topics in Future Internet research get a more clear focus and take shape now. The format of the workshop has proven to be successfully in providing such first-hand information from key people and initiatives, like GENI, G-Lab, various FP7 projects as well as from the European Commission itself. This is in particular an enabler for industry people to participate in such a workshop. Therefore, beside outstanding keynote speakers, some sessions focusing on particular topics will also be invited in the EuroView2011.

The following topics are of interest to be included additionally / more strongly in EuroView2011 according to the participants' comments (in alphabetical order):

- Cognitive radio ("more attention to wireless issues, e.g. cognitive radio")
- Cyber-physical systems
- Datacenters
- Economic aspects of the Internet ("Another topic which could be addressed in the future is the economic aspect of the internet; are flat rates really sufficient and fair or do we need a load and QoS dependent charging?")
- High-speed routers/switches
- Infrastructure-less communication in large scale catastrophe scenarios

- Internet of Things
- Nodal multilayer integration
- Ontology for network services ("I felt a strong tendency towards service and network description languages. Maybe one should look into ontology for network services a bit more.")
- OpenFlow
- Smart Grid topics
- Use cases for federation
- Wireless Multi-Hop Networks
- Wireless Sensor Networks (6LoWPAN)

The demo session was highly interesting for the participants to see the currently achieved progress in the realization of Future Internet technologies. In addition, the demo session allowed for detailed discussions among the participants and to clarify questions in much more detail. In future workshops, it is recommended to organize again such a demo session and even allocate more time for the demos and the resulting discussions. According to the user survey, we observe that the demo session (20%) and the GENI session (20%) were the most interesting sessions for most of the participants. More details are given below.

The user survey contained four different sections on 1) the quality of the workshop, 2) the organization of the workshop, 3) the personal outcome and impressions, and 4) proposals for improvement. The opinion rating scale is: 5=Excellent, 4=Good, 3=Fair, 2=Bad, 1=Very bad. In the following, the mean opinion scores of the participants are presented:

- General rating of the workshop: 3.79
- Content rating whether the topics are of interest for the participant: 3.53
- Relevance of topics for the Future Internet: 3.69
- Most interesting sessions:
 - GENI Session (20%)
 - Demo Session and Poster Session (20%)
 - Routing and Security (14%)
 - Future Internet Activities in FP7 (11%)
 - Wireless and Mobile Services (11%)
- Most interesting talks:
 - Michael Welzl: "How to Truly Improve the Internet's Transport Layer" (25.0%)
 - Eleni Palkopoulou: "Rethinking Homing Architectures" (11.1%)
- Most interesting demos:
 - A QoE-Aware P2P Streaming System based on Scalable Video Coding (22%)
 - A Demonstrator for Cross-Layer Composition (19%)
 - Improvements to LISP Mobile Node Including NAT Traversal (19%)
- Organization of workshop: pre-workshop organization (4.27), local and on-site organization (4.12), refreshments (4.00), social event (4.37), proceedings (3.86)
- Workshop inspired new ideas for participant's work: 3.14
- Workshop inspired joint projects, development or joint publications: 3.30
- Mix between academia and industry: 3.71 (more partners from industry, network operators are desired)
- 80% of the participants will join another EuroView workshop; 20% gave no answer

According to the user survey, the audience is also interested in representatives from industry, like Cisco, Juniper, Google, etc. since they de-facto define the Future Internet. It is recommended to invite such representatives accordingly for future EuroView events.

The personal outcome of the participants was the following according to the user survey:

- social networking, personal contacts, get in touch with German community / GENI people
- practical hints and new ideas, update on recent developments
- different opinions on own ideas, discussions about viewpoints of Future Internet
- topics of interest: routing, virtualization, service composition issues, test labs
- projects of interest: GENI, G-Lab, overview on FP7 projects

EuroView 2010 in Short

The EuroView2010 workshop comprised

- 8 sessions with 2 sessions organized on particular research topics;
 - Future Internet Activities in FP7 (organized by Dr. Max Lemke);
 - GENI project in US (organized by Aaron Falk);
- 1 demo and poster session with 9 demos and 14 posters;
- 1 keynote talk by Prof. Dr. Lawrence Landweber (University of Wisconsin, US): “The Future (Inter)Network - Challenges and Paradigms“;
- 35 presentations;
- 6 presentations have been held by Euro-NF members.

Several questions and problems in today’s Internet were discussed during EuroView2010:

- concerning privacy in today’s Internet and social network companies: “Is privacy in the Internet already lost?“;
- impact of the Internet on the society: “How will social networks affect the society?“;
- security problems in the Internet.

Some main observations were highlighted and conclusions derived accordingly.

- New paradigms cannot be predicted and paradigm shifts need time.
- Interdisciplinary Internet research is required which combines research activities of computer scientists and engineers with scientists from law, psychology and social sciences.
- For networking research, a shift from traditional theoretical research towards testbed-based research is required which includes
 - integration of simulated networks and virtual networks,
 - federation of testbeds,
 - access to real users and wide-area networks,
 - provisioning of end-to-end virtualization,
 - sensor networks as an integral part of the Internet,
 - data intensive experiments.
- Cloud computing is one of the current major technologies.
 - It allows cheap and easy deployment of apps in the cloud, while apps drive the platform.
 - Telcos will deploy the “Dispersed Cloud” which provides application builders with the abstractions of elastic computation and storage, but it relies more heavily on edge nodes and mid-sized clusters than on large data centers.
 - The interconnection of different clouds has to be managed.
- Convergence of Internet and telecommunications means to support QoS for Internet service delivery which requires a fair business model; from the provider’s view, a walled garden approach could be feasible.
- Move applications not data as a new paradigm in the Internet.
 - (Without fundamental changes) networks will not be able to support predicted increase in traffic.
 - Therefore, move today’s network / computing paradigm from app centric

(centralized) towards network-aware media centric (distributed).

Missing technical concepts and approaches in the current Internet are among others

- security mechanisms e.g. to save the privacy of Internet users,
- support for Quality of Service and Quality of Experience,
- flexibility to realize new innovations
 - long-term flexibility to support evolution of networks,
 - short-term flexibility support of mobility in the Internet,
- transport protocols do not match application requirements nor infrastructure capabilities.

Key technologies / approaches / use cases for the Future Internet are

- network virtualization and programmability of Internet elements
 - OpenFlow as a standardized interface between switch controller and hardware,
 - control plane for resource reservation in virtual networks, e.g. QoS signaling to dynamically setup virtual links on demand,
 - specification of interfaces and protocols for building block interaction,
 - mechanisms for isolation of virtual networks on the same physical substrate,
 - monitor and control for QoE-aware networks
- service-oriented architectures and service composition, e.g.
 - security in a cross-layer composition architecture,
 - as enabler for the convergence of the Internet with cellular systems,
- new routing schemes or transport concepts, e.g.
 - architecture for locator-identifier split,
 - naming, addressing, and programming in Multicast,
 - “Forwarding on Gates”: chained function blocks with edge-based forwarding, using gates as façade for functions,
- wireless access optimization
 - application- and context-aware radio resource management includes evaluation of users’ positions, sensors, etc. as well as various access technologies,
 - plethora of sensor equipped embedded devices will be connected to Internet,
- energy efficiency and monitoring of energy consumption,
- new interfaces and protocols, e.g.
 - multipath protocol mechanisms,
 - protocol-independent API for transport services in the Internet,
 - property and Requirement-based Application Interface for Future Networks,
 - single interface for automated inter-domain path provisioning.