

# Future Internet Assembly – Thursday, 19 May 2011

*The FIA may have only been running for three or so years, but already some good traditions have been established. The final plenary session of FIA in Budapest certainly followed the standard format including presentations of papers from the annual FIA Book and presentation of the Future Internet Award to a future internet project demonstrating innovation, problem-solving and some of the most exciting potential for internet applications.*

## FIA Book

### Introduction

***John Domingue, Open University, UK***

Children have been mentioned several times in FIA Budapest and John Domingue, editor of the FIA Book, had his own anecdote to tell. When his daughter is asked at school what he does, she tells them “Daddy’s inventing a new internet, but he’s not really sure what it will look like.”

The FIA Book tries to fill in some of the blanks, however. The 2011 edition tries to strike a balance between looking back at achievements so far in this domain and looking forward to the new technologies promised by researchers in this field.

The book covers some of the future internet ‘foundations’ – architecture, security, trust, experimentation and socio-economic issues. It also gives some insight into innovative research covering different areas of the future internet, including networks, content, services and applications.

“We have also followed the spirit of previous books and the FIA event itself; in other words it is cross domain,” said Domingue.

***Ioannis P. Chochliouros for “Challenges for Enhanced Network Self-Manageability in the Scope of Future Internet Development”***

Ioannis P. Chochliouros stressed that the internet is and will continue to be one of the most critical infrastructures of the 21<sup>st</sup> century. The number of users would continue to grow and the demand for wider bandwidth and faster speeds would be relentless. This daunting pressure on networks calls for better management at all levels of the infrastructure.

Currently network management takes place within client stations using protocols such as SNMP. But this approach has limitations in terms of scalability and still requires considerable human intervention. “Our vision,” says Chochliouros, “is a self-managing network, where nodes don’t just have a traditional management framework, but additional features including cognitive capabilities.”

This network management autonomy is the goal of the ‘Self’, which is designing and developing

an innovative paradigm that uses cognitive elements in network management systems. This self-management is achieved using a feedback control cycle: network monitoring gathers information about the state of the network; a decision is made to reconfigure or adapt; the task is executed and then monitoring activities will measure the impact of the decision and lead into another decision-making cycle.

“This is a kind of divide-and-conquer approach to network management that breaks down some of the complexity. It has benefits for network operators and users, for example by helping operators to reduce their operating expenditure while giving users a seamless experience in dynamic network selection.”

“The Self-NET approach offers resilience and flexibility in network management,” Chochliouros concluded.

### ***Pascal Vicat-Blanc for “Bringing Optical Networks to the Cloud: Architecture for a Sustainable Future Internet”***

If Software as a Service and (SaaS) was the big buzzword five or so years ago, the advent of the cloud is not creating a host of new ‘aaS’ acronyms. Pascal Vicat-Blanc described the work of the GEYSERS project which is trying to apply a cloud approach to networks leading to the notion of Infrastructure as a Service (IaaS).

GEYSERS makes it possible for virtual internet operators to provide virtual internet infrastructures to meet the specific demands of individual clients. GEYSERS introduces a logical infrastructure composition layer (LICL) which makes it possible to partition the physical infrastructure (network and IT resources) and to merge the resources coming from different physical infrastructure providers into a single virtual infrastructure.

The approach being developed by GEYSERS aims to overcome some of the many challenges facing today’s infrastructure. It aims to provide businesses (including applications providers) scalable ‘pay as you grow’ bandwidth, coordinate IT provision and networking, and deal with the problem of ‘burstiness’ in traffic flows. On top of these issues are those which are common across the internet such as security, reliability and energy consumption.

### ***Sergi Figuerola for “Renewable Energy Provisioning for ICT Services in a Future Internet”***

You don’t get much more politically correct than this: a water-powered internet. Well, perhaps that is the impossible ideal, but the work of Sergi Figuerola and his colleagues will certainly help the future internet to be powered by as much renewable energy as possible.

Figuerola is participating in a joint European and Canadian collaboration that seeks to optimise the use of data centres and network ‘hubs’ which are powered by renewable sources. “Climate change is not reversible,” said Figuerola, “so we need low-carbon internet solutions which focus on energy efficiencies and use renewable energy.”

The GreenStar network solution uses a virtualised network (Network as a Service or NaaS) to

maximise network activity in data centres with low greenhouse gas emissions and high renewable energy provision. You essentially follow the sun and the wind.

The solution combines the work of the Mantychore FP7 project (which allows European National Research and Education Networks to build their own layered virtual infrastructures including a base optical layer) and link up to the GreenStar Network of worldwide renewably-powered data centres. In a zero-carbon network a virtual machine is migrated from one renewably-powered node to another. A proposed energy-aware routing scheme uses Mantychore to find a virtual machine which is optimal in terms of greenhouse gas emissions.

## **Plenary Session – Cloud Computing**

***Rainer Zimmermann, Head of Unit for Software and Service Architectures and Infrastructure, DG INFSO***

The surge in cloud computing over the past couple of years has forced everyone involved in future internet research funding to step back and rethink their strategies. “How will networks and the cloud work together,” the Commission’s Rainer Zimmermann asked. “Cloud computing has become a political topic. We need a cloud computing strategy.”

But policy-makers are not sure if they are approaching cloud computing the right way. “Bureaucrats don’t know problems,” Zimmermann continued, “they simply have processes – doing things right does not mean we are doing the right thing!”

On 16 May 2011 the Commission opened a public consultation about cloud computing which will remain open until 31 August. The responses to this consultation will feed into the Commission’s EU strategy on cloud computing which it expects to publish in early 2012.

Zimmermann outlined three areas which require more attention: regulation and related issues such as interoperability, data security and liability; the everyday use of cloud computing and the uptake of cloud services; and cloud computing R&D.

Zimmermann then introduced a panel of speakers and experts who would each give their own perspectives on the impact of cloud computing.

**Juan A. Caceres** from Telefónica said that his firm has identified seven vertical markets where it intended to capture growth – the cloud was one of these. The company’s cloud portfolio includes infrastructure services (e.g. virtual PCs and data centres), Software as a Service, and ‘people services’ (covering personal productivity and leisure). “The cloud must be the enabler, a platform to give services that other actors want to provide. The cloud allows telcos to close the cycle and offer X as a service. Telcos will give people confidence in the cloud,” he said.

Through the FI-PPP project FI-WARE Telefónica is involved in various aspects of cloud architecture design. FI-WARE seeks to integrate the results from previous future internet architecture projects and create generic enablers. It will also issue open calls for research that

will fill gaps in architectural knowledge and designs.

**Daniel Pays**, Director of Infrastructure Management Services at Thales called on engineers to build applications ready for the cloud. He described a newly-approved project for the French government called Andromède which works like a digital factory for creating new products and services.

Like so many other speakers during FIA, Pays could not over-emphasise the importance of security and building trust in the user community. The Andromède project would formalise the security requirements and develop the cloud infrastructure for secure business transactions.

One of the big advantages of the cloud is that security operations can be provided by a third-party security operator which can supply global security capabilities.

**Thierry Priol** of INRIA and EIT ICT Labs said that the growth of the cloud meant that the research community needed to look again at some internet basics such as adaptability and resilience. “Clouds tend to centralise the internet and that creates single points of failure,” he pointed out, echoing the previous day’s presentation on network science given by Albert-László Barbási. The importance of autonomous systems was becoming increasingly important.

He also said people were very concerned about privacy; they did not like the way they lost ownership of data when they uploaded to the cloud. He suggested that data should have some kind of self-destruct functionality to prevent its misuse.

Finally, Priol drew attention to the ICT Labs’ ‘Computing in the Cloud’ action line, in particular projects that are investigating new ways to route data in information-centric architectures.

**Jim Clarke** of TSSG Waterford, Ireland, quickly ran through some of the main topics covered by the FIA Ghent session ‘Can the cloud be trusted?’ He reiterated the comments of previous speakers, highlighting the flexibility of cloud services but accepting that trust is difficult to achieve. How, for example, can you be sure that the cloud services have implemented the right security measures? And once data is in the cloud, how do you guarantee to get it out again?

Clarke then proposed a comprehensive list of research challenges for trust and trustworthiness for cloud computing and discussed how to address these to make the cloud a trustworthy environment for cloud service users and operators. The challenges are available in the official [FIA Ghent report](#).

If the perennial fear of the surfing community is to be lost at sea, then the equivalent for the internet world is to be lost in the cloud. **Markus Brunner** from NEC summarised the FIA Ghent session ‘Lost in the Cloud’.

“The main purpose of the cloud is resource sharing for elastic usage,” explained Brunner. “We have seen a lot of progress on cloud *computing* and dynamic IT resource management, but there has been a global trend to forget about the network – the connections between IT resources and data centres.”

Brunner believes that cloud computing is where business meets research today. Businesses

want a one-stop shop, they just need their IT resources and online presence to work, covered with a single service level agreement. EU projects are looking at how to manage the different layers of the cloud and offer a single 'front end' to users.

Brunner also remarked that IT has to look closely at 'consumerisation'. Businesses are increasingly using consumer-level devices and equipment to run enterprise applications and services and this must be taken into account. Finally, Brunner noted a growing tendency to move cloud resource into the network; this improves the quality of experience for certain applications, but complicates how resources and virtual networks are defined and managed.

## **Round-up**

Picking up the different threads highlighted by the panellists, Zimmermann wondered how you transfer the new cloud technologies into everyday use. "What makes me really shiver is hearing about the stack," he admitted. "With all these technologies I worry that the availability of each element is tolerable, but when you put them together, layer by layer, the availability is inadequate. The overall availability is not there. And when everything depends on something very small and apparently insignificant, that very small problem becomes a very big problem."

Caceres agreed that each layer had to prove its reliability and be tested against infrastructure failure. Pays, however, suggested that we should not think in terms of 'layers' but functions. He said there are around 80 'functions' in the cloud and each one must be secure. He insisted that the cloud is helping to accelerate research into business, but there could still be a major breakdown in trust which would jeopardise all progress made so far.

Taking the spirit of FIA, Zimmermann suggested that if there were problems with the cloud then we should go back and redesign the architecture.

From the floor, Stuart Clayman of the RESERVOIR project pointed out that the cloud was never standalone but a federation of physical and virtual resources. He noted that the cloud currently lacks the ability to find the best links between cloud resources.

Finally, Zimmermann asked the panels to say what they thought was the main motivation for moving to the cloud.

Pays said the cloud was a breakthrough and would affect IT products across the board – people were really asking for cloud solutions. Priol said that the cloud was a great playground for researchers and he was very excited about the next generation of cloud applications. Clarke thought the cloud marked the industrialisation of ICT, providing lots of opportunities for innovation, to develop new ideas, to implement them and run them. The largest challenge for researchers now, according to Clarke, is 'roadmapping' the required research activities in terms of 'what' and 'when' they needed to be done - in the FI-PPP, the remainder of FP7 and/or FP8. A perfect opportunity to contribute to this process is via the [FIA research roadmap](#) working group.

## **Closing Plenary Session**

### ***Future Internet Award***

The Future Internet Award is presented each year to a future internet project that has produced outstanding results and achievements in Europe. This year the judging panel received 23 entries involving 10 Member States. The long list was narrowed down to three short-listed projects. However, the judges agreed that Smart Santander was the best project overall, citing its consortium “of extraordinary quality including citizens, scientists and government”, its living labs methodology and its prototyping and testing of new technologies.

### **Invitation to the next FIA in Poznan, Poland**

#### ***Jan Weglarz, Director of Poznan Supercomputing and Networking Centre***

Professor Jan Weglarz invited the FIA to Poznan for the next meeting (26-27 October 2011). Following a now established tradition, the FIA would be an integral part of a Future Internet Week which would include the Future Internet Conference, the Future Internet Forum, Future Internet Poland and the meeting of various clusters and committees.

The week is being organised by the Poznan Supercomputing and Network Centre (PSNC), a leading Polish ICT research institute and the pioneer of Poland’s optical networking infrastructure.

### **Progress on parallel FIA actions**

#### ***Michael Boniface, University of Southampton***

Michael Boniface, speaking on behalf of the future internet coordination action FISA, quickly reviewed the year’s progress in the future internet research community. He again highlighted the FIA Book and asked delegates for their ideas to include in next year’s publication. He also reminded delegates about the work of the FP8 Roadmapping Working Group led by Nick Wainwright. The first draft version of the roadmap is currently available on the FISA website and contributions and comments are being gathered to inform V2 due to be published in September.

The International Cooperation Working Group has produced a consolidated list of upcoming events and is preparing recommendations to the European Commission on possible future international cooperation actions.

The Socio-economics Working Group was relaunched at FIA Budapest following a period of inactivity. This group is planning a workshop for FIA Poznan on the future internet business ecosystem.

FIArch (Architectures Working Group) is focusing on the design principles of the future internet while the Open Linked Data Working Groups is seeking to reflect the requirements for the future

internet in standards bodies.

In terms of pre-standardisation, My-FIRE is now an enlarged group and in direct discussions with ETSI, W3C and ITU. It is looking to create closer links with European Technology Platforms and FI-PPP.

Work is relentless in the Trust and Security Working Group which works closely with other FIA Work Groups as well as holding collaboration and cluster workshops.

The Real-World Internet Working Group has published its latest RWI architecture in the last FIA Book and is continuing to work with the Internet of Things community.

FIRESTATION successfully completed its first and second round of open calls (BonFIRE, TEFIS, OFELIA, Smart Santander and CREW). It continues to engage with relevant research (STREP) projects.

### **Closing comments**

Marió Campolargo thanked all the members of the FIA steering committee and session organisers for their work and contributions to a successful event.

He said that the meeting had demonstrated that the FIA was a vibrant community with lots of ideas and excellent interaction between different research fields. “New topics keep popping up and we already have a lot of new ideas for Poznan. I see a lot of energy here.”

Campolargo said that the launch of FI-PPP was a significant milestone in future internet research and it seemed to be smoothly integrating with FIA.

To conclude, Campolargo had this message: “FIA is switching on the minds of those making decisions about the future internet. There are very important dynamics going on here that can help to ensure that the future internet is driven by Europe. I would like to reiterate the commitment of the Commission. We are ready to listen to this community.”