



FUTURE INTERNET ASSEMBLY

**Future Internet Conference &
Future Internet Assembly**

Poznan, Poland

24 – 26 October 2011

<http://fi-poznan.eu>

[http:// www.future-internet.eu](http://www.future-internet.eu)



Introduction

A powerhouse for regional growth

While European leaders grappled in Brussels with the complex and uncertain financial and political context, researchers and policy-makers were gathering in Poznan, Poland, for a week of visionary activity of another kind.

It is not difficult to argue that in the long-term, the Future Internet could be the answer to a number of Europe's problems. Over the past two decades ICT has driven economic growth and innovation in the EU. And the Future Internet holds equal promise.

More information

Slides and videos of presentations at FI Poznan: <http://www.fi-poznan.eu>

Future Internet website: <http://www.future-internet.eu>

For FIA history and EU background: http://ec.europa.eu/information_society/activities/foi

Future Internet Conference – Monday, 24 October 2011

Towards and beyond Europe 2020: the significance of Future Internet for regional development

Preceding the FIA, the Future Internet Conference was a high level event to provide political and social background to Europe's Future Internet research initiatives (FP7 and post-FP7 actions). The day's programme of talks stressed that the Future Internet is the key to Europe's economic recovery and 'smart growth'; research in this field deserves a strong emphasis in the forthcoming programming period 2014-2020. New developments in internet architecture, software, applications, networked media and the Internet of Things will provide the foundation for regional development in Europe and will support healthy innovation and competition not just within the internal market but also on a global scale.

Opening plenary session – Smart specialisation and regional growth

Prof. Maria Elżbieta Orłowska, Secretary of State, Ministry of Science and Higher Education, Poland

- The internet has been and will be the essential driver of Europe's economy.
- Despite the clear need for cuts in public funds, Europe must continue to support ICT research and development and ensure that its vision for full broadband connectivity is not lost.

Officially opening the Future Internet Conference and the Future Internet Week, Prof. Maria Elżbieta Orłowska said she was delighted to be able to participate in the Future Internet Week due to its great importance for society. For Prof. Orłowska there is no argument that ICT and the internet has been a fundamental driver of economic growth over the past. "Every day new networks are added, servers, wireless connections," she enthused. "We see new applications and ways to communicate that we would never have predicted".

"I am glad that this meeting gives us an opportunity to network, chat, share emotions and ideas. There's no end to the invention that the internet brings; we have seen the impact not just on our everyday life, but on our political life too, where debate has moved from television to Facebook and the internet has supported the Arab Spring revolution."

"Now is the perfect time for a huge step forward – the internet has still not been explored to its full extent."

Prof. Maria Elżbieta Orłowska

The dramatic cuts in public funding are certainly a worry, but Prof. Orłowska acknowledged the support the EU continues to give to developing Europe's internet connectivity and capabilities, for example through the recently announced [Connecting Europe Facility](#) which will release €9.2 billion for broadband infrastructure expansion.

“This is a very exciting world,” Prof. Orłowska observed. “Now is the perfect time for a huge step forward – the internet has still not been explored to its full extent. Policy-makers need to work with those who use the internet every day and make it fly.”

Zoran Stančič, Deputy Director General, DG Information Society and Media, European Commission

- The world is changing fast and there are a growing number of threats to economic and sustainable growth.
- The Future Internet can turn threats into opportunities. The Cloud, for example, helps small businesses to expand.
- Horizon 2020 shows Europe’s commitment to ICT and innovation, a pillar of the Europe 2020 strategy.

Picking up on Prof. Orłowska’s call to preserve and encourage Future Internet development and activities, Zoran Stančič highlighted a few of the challenges which this endeavour would have to overcome, not least the complex and uncertain global financial and political context.

“The world is changing – and extremely fast,” Stančič remarked, illustrating his point with three facts:

- China is now the second largest economy in the world.
- The information contained in one week of newspapers is greater than all the information that someone would have acquired in their lifetime less than 200 years ago.
- If Facebook was a country it would be the third largest in the world.

According to Stančič the trick will be to turn the apparent threats we face today into opportunities, which is exactly the intention of Europe 2020, the EU’s strategy for future growth. The Digital Agenda is one of the seven flagships of that strategy which has the objective to exploit the many opportunities for growth using ICT.

Cloud computing, which will provide computing power almost as a utility, is one such opportunity. “For Europe, the Cloud provides a platform for SMEs to develop and sell services without needing a large capital outlay,” said Stančič. “It is an excellent platform for regional growth.”

“For Europe, the Cloud... is an excellent platform for regional growth.”

Zoran Stančič

But despite global financial instabilities and cuts in public spending, Stančič did have some good news which demonstrated the EU’s commitment to ICT as a driver for economic growth. He also pointed to the Connecting Europe Facility proposed by the Commission for the next EU multi-

annual financial framework, and the proposed €80 billion budget for Horizon 2020, the forthcoming research and innovation programme for 2014-2020. “In this economic climate politicians are forced to make radical decisions,” he said. “But the decisions should be to invest in the future.”

Ryszard Grobelny, Mayor of the City of Poznan

- Delays in deploying state-of-the-art infrastructure could damage local economies.
- People should lobby governments and authorities to press on with infrastructure improvements that could work alongside legacy systems during the transition period.

As mayor of Poznan, Ryszard Grobelny welcomed all the delegates to his city, a place which was leading the way in Poland in state-of-the-art internet research and connectivity. “Here, we are connected with advanced networks so researchers can participate and help to develop the Future Internet,” he said.

But Grobelny could not ignore a nagging feeling that internet connectivity was at a tipping point. He said there was a need for new, high speed networks to be deployed, but during the transition period they would have to work alongside legacy systems. However, any delays in implementing state-of-the-art technologies would not be good for local economies and he called on delegates to lobby for infrastructure roll out.

Ending on a lighter note, however, Grobelny encouraged everyone to explore the city and see the sights. “Although the internet is important, Poznan is much nicer than what you get only on videos!”

Jerzy Buzek, President, European Parliament

- Innovation and ICT are at the heart of Europe’s strategy for sustainable growth.
- The future of the internet will affect the future of every citizen across the EU.

In a pre-recorded video, Jerzy Buzek offered his welcome to the delegates. He also emphasised the importance of the Future Internet for smart growth in Europe and the fundamental place of ICT in the Europe 2020 strategy. “We want to be the Europe of Innovation and of the Digital Agenda,” he commented, “but we need to have the infrastructure for future technologies. So it is very importance that this conference takes place. We are talking about the future of every one of us and the whole of Europe.”

Michael Ralph, Adviser to the Director General, DG Regional Policy, European Commission

- ICT is a critical enabler of regional development and innovation.
- Some of Europe's Cohesion Funds, especially the European Regional Development Fund, are being used to support innovative ICT development and the roll out and upgrading of broadband infrastructure to improve internet access.
- "Smart specialisation is a new approach to regional development.

In a lecture theatre full of internet whizzes it might seem strange to invite to the podium an expert on regional development and cohesion policy. What has European cohesion got to do with ICT?

Rather a lot, Michael Ralph, suggests. Just as ICT has driven economic growth, the Future Internet holds much promise for faster, more effective and sustainable growth and development at a regional level in Europe. And greater connectivity should lead to greater cohesion across the Union too.

Future Internet events are typically dominated with talk of 'FP7' and 'FI-PPP'. So it was refreshing to hear more about the European Regional Development Fund 'ERDF' – a fund of some €201 billion which dwarfs even the proposed €80 billion budget for Horizon 2020. ERDF includes a €15 billion allocation for the regional development of ICT, Ralph explained, which was broken down into €12.7 billion for innovative ICT (e.g. e-government, e-health applications, etc.) and €2.3 billion to improve internet access (e.g. broadband infrastructure deployment and upgrades).

Ralph observed that ICT projects funded through the ERDF appear to be having an impact as figures suggest that the economic gap is closing between rural and urban regions and between the concentrated and sparsely populated regions.

Smart specialisation: choices, competitive advantage, critical mass and corporate leadership.

Looking to the future, Ralph said that the Commission has adopted proposals which will shift the emphasis of the ERDF and other Cohesion Funds towards results and projects which will have maximum impact. The 2014-2020 funding programme will reinforce effectiveness and performance by insisting on 'ex-ante conditionality' (i.e. Member States will have to meet certain criteria to receive funding) and implementing a performance framework with measurable milestones and targets. The future ERDF will also try to concentrate resources to achieve critical mass and avoid fragmentation in a number of thematic streams including research and innovation, ICT, competitive SMEs, the environment and sustainability, and employment.

Regions will be categorised according to their GDP per capita. Less developed regions will be those with a GDP per capita below 75% of the European average. Transitional regions will be

between 75 and 90% of average GDP per capita, and more developed regions will have a GDP above 90% of the average. The degree of funding concentration within each category will depend on the theme and the region. Different themes are geared towards different categories of region.

Ralph went on to explain the concept of 'smart specialisation', outlined in the EC's Communication [Regional Policy contributing to smart growth in Europe 2020](#). Put simply, each region is asked to identify its local strengths (in line with the 11 regional themes) and work to develop these strengths to maintain or improve the region's competitive position. Every region is expected to develop a smart specialisation strategy which demonstrates how it will integrate innovation systems and spaces across the region, support knowledge transfer, support entrepreneurship and upgrade the education, skills and training of the regional workforce in the areas of specialisation.

The smart specialisation strategy can be summarised with four Cs: choices, competitive advantage, critical mass and corporate leadership on the ground.

To support regions as they develop their strategies the European Commission is developing the [Smart Specialisation Platform](#) (S3 Platform) which will become operational in 2012. The platform will be managed by the Joint Research Centre's Institute for Prospective Technological Studies (Seville) in cooperation with DG Regional Policy.

The Platform will help the regions identify their strengths and assets in innovation and assist them to design the most appropriate strategy. The Platform will develop a 'toolbox' for regional policy-makers, but also incorporate a peer-review methodology to spread best practice and learning between regions as well.

Mario Campolargo, Director, DG Information Society and Media, European Commission

- ICT has boosted the knowledge economy in Europe.
- 'Knowledge spill over' leads to regional development and the concentration of skills and expertise in geographical areas.
- FI-PPP has been designed to support open innovation and embraces a more complex model for R&D which integrates all stakeholders from the outset.

Mario Campolargo focused on the regional aspects of Horizon 2020, specifically in the area of the Future Internet. "If you talk to anyone about the impact of ICT on the economy then the first thing they think of is globalisation," he stated, going on to say that the internet has greatly improved employment in some regions as they have been able to effectively 'export' their labour or knowledge thanks to the internet.

But the biggest impact of the internet, Campolargo suggested, is how it has expanded the knowledge economy. Businesses and individuals have been able to contribute to knowledge and this has spilled over into the local economy and the development of the region.

The phenomenon of ‘knowledge spill over’ (between firms, research institutions and academic centres) within a region helps to concentrate particular skills and expertise within a region and makes regions hotspots or specialist centres in particular areas of innovation. Knowledge spill over also stimulates economic growth, not least because it generates intangible assets such as software, research innovation, human capital and brand names. “Intangible assets have strong knowledge content,” he explained.

But the importance of intangible assets and knowledge for regional growth makes it difficult to come up with the right policies to support this growth. The traditional linear model, which goes from R&D to prototype to commercialisation, struggles to capture the new realities. Innovation today is a complex processes that engages stakeholders (including end-users, consumers and/or citizens) from the outset. “Today you have citizens who are very skilled and creative – they are ‘prosumers’ and are very important in the innovation process,” Campolargo suggested.

“Today you have citizens who are very skilled and creative – they are ‘prosumers’ and are very important in the innovation process.”

Mario Campolargo

The structure of the Future Internet Public Private Partnership (FI-PPP) reflects this new model of innovation – a joint effort and commitment by government, business including SMEs, and end-users. The FI-PPP is helping to raise pivotal regional actors in innovation and growth; these are being strengthened through cross-European partnerships which may well develop into global partnerships.

And what lies beyond FI-PPP? Regions can take full advantage of the developing system of open innovation and other related methodologies such as Living Labs which seek to narrow the gap between end-users and RTD performers.

Krzysztof Kurowski, Poznan Supercomputing and Networking Centre

- The Baltic Region is heavily involved in regional cooperation and in a good position to test the ‘smart specialisation’ concept through such initiatives as CYBERBALTIC.
- The region has a strong ICT and Future Internet portfolio and has a quite advanced e-infrastructure for research.

So what does smart specialisation look like on the ground? Something like CYBERBALTIC, it would seem. Krzysztof Kurowski described the many cooperative ICT initiatives currently taking place between numerous institutions around the Baltic. Collaboration and participation has been enhanced thanks to the on-going development of an e-infrastructure and supporting policies (for example the recommendation by GEANT to expand the network to form a European Communication Commons).

The Baltic is really on the ball when it comes to cooperation in the areas of ICT and Future Internet. There are at least two research and education networks (NORDUnet and PIONIER) and a Nordic eScience strategy and action plan have already been agreed along with the Baltic Ring scientific initiative. The Baltic is an ideal place to demonstrate smart specialisation.

CYBERBALTIC is made up of five e-infrastructure projects and seven knowledge platforms. The infrastructure projects are tackling problems such as access to broadband across the region. They also hope to develop 'virtual laboratories' which will work jointly on environment and climate research. CYBERBALTIC aims to establish national Tier 1 supercomputing centres in the region to provide the computing power required for research into other scientific domains such as climate change, smart grids and crisis management.

The Baltic knowledge platforms will allow partners to share resources, data and expertise in areas such as the humanities, radio astronomy and tourism. "At the moment CYBERBALTIC is a concept that is open for discussion and comment," Kurowski concluded. "We will continue to work on this and look forward to presenting our progress at the next event organised by the Danish and Lithuanian EU Presidency."

Plenary session – Towards Europe 2030

Consultation on the Europe 2020 strategy only began a few years ago; the programme period does not commence until 2014. Yet in a forum where the emphasis is on the future, there's always room for some healthy speculation and crystal ball gazing. What will Europe be like in 2030 and what will be the role of the internet along this future path? Could the Future Internet be a tool for freedom and equal opportunity?

Ziga Turk, Professor, University of Ljubljana

- Europe had the right liberal political culture to embrace the first communication revolution when paper became cheap and printing brought knowledge to the masses.
- Information and communication revolutions can be empowering – a tool for equality and democracy.
- To take full advantage of the digital revolution Europe must maintain its liberal, democratic values, keeping the internet open and free.

With so much talk about economic recovery, Ziga Turk presented an alternative view of the Future Internet. Not a tool for business, not a tool for growth, but as a driver for social change. Over the past two decades the internet has transformed society, but what could the future hold? Will the Future Internet continue to stimulate social change?

Turk began with the ABC (and DE) of grand transformations in our world today: automation and abundance (we have more than everything we need); BRICs and globalisation (wealth, population and power shifting back to Asia, and the rise of Brazil); climate change; demographic change (demographic changes and an ageing European society); and e-everything.

This ABCDE add up to mark the end of an era, Turk suggested. It is the end of the industrial and information age, the end of Western dominance, the end of 'below ground' energy supplies, the end of population growth and a youth-dominated society, and the end of a paper-based society.

“Paper was the first communication revolution. ICT has been the second... information technology has disrupted social structures and played the role of ‘equaliser’.”

Ziga Turk

But is it all bad news? If we can discover why the West has been so successful for the last 500 years we could find out the secret to a successful Europe in the future. “It all boils down to information technology,” Turk asserted. “The dawn of the West in the Renaissance was due to paper and printing. Paper technology came from Asia, but Europe had the liberal social and political culture in place which gave individuals the political

and economic freedoms for paper-based communication to flourish.”

Paper was the first communication revolution. ICT has been the second communication revolution. And with each revolution we observe how information technology has disrupted social structures and played the role of “equaliser” between the powerful and powerless. With the paper revolution religion and the aristocracy were no longer the keepers of knowledge. And with the digital revolution information could be at the fingertips of every citizen.

But what happens next? Turk outlined three possible scenarios. The techno-romantic viewpoint argues that the digital revolution makes communication and goods cheaper; it puts power in the hands of the people (to self-organise) and away from the state.

Techno-realists, however, argue the opposite. Yes, they say, costs are lower, but they are also lower for governments who can control and monitor the internet at certain hubs. The digital age increases the power of the state, as we observe in places such as China and Cuba and organisations such as News International, he suggested.

Finally there are the techno-pragmatists who take the middle ground. In a democratic society the internet can empower citizens and NGOs, but under totalitarian regimes it empowers the state and the people with privileged access.

“[On the Future Internet] Europe has a choice: reform or decline.”

Ziga Turk

So this is the nub: can information technology bring about change from a totalitarian to a democratic system? Using elements of institutional theory (which sees institutions as social structures) Turk argued that institutions are very stable, but they can change, especially when challenged by innovation. Innovation leads to habitualisation (widespread adoption by people), then objectification (adoption by organisations) then sedimentation (becoming part of the norms). For example, before the paper revolution power lay in the hands of just a few people who could meet and make decisions face to face; paper and printing triggered a political revolution and the birth of democracy. Similarly the electronic revolution first put power in the hands of a few – those who could get on television and radio – but the internet and most recently social networking has once again shifted the balance of power to the masses, as demonstrated by the Arab Spring.

“Throughout history ICTs were empowering,” Turk observed. “Exclusive technologies empowered the centre. Democratic technologies empowered the masses.” So there are two possibilities for the Future Internet. It could remain a mass media/consumer good that is available to most and will be a driver for social equality. Or it splits into a number of ‘walled gardens’ (Google’s community, Facebook’s community, Apple’s community) with distinct audiences and circles, but where does this place the power?

“Never before,” said Turk, “have people had access to so much information, so much processing power and so many other smart people to work with. Never before have such a

small percentage of innovators worked for companies, such a small percentage of intellectuals worked at universities, such a small percentage of writers worked for newspaper and book publishers, and such a small percentage of people empowered with knowledge, worked for the government.”

The challenge is how to use the digital revolution to change the norms and allow people not just to contribute to economic growth, but contribute to public affairs.

Commenting on the findings of the Reflection Group on the Future of Europe, Turk stated that Europe has a choice: reform or decline.

Further reading

Project Europe 2030:

http://www.reflectiongroup.eu/wp-content/uploads/2010/05/reflection_en_web.pdf

Knowledge without Borders: Géant 2020 as the European Communications Commons:

<http://cordis.europa.eu/fp7/ict/e-infrastructure/docs/geg-report.pdf>



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Future Internet Assembly – Tuesday, 25 October 2011

Following a day exploring the political and social context for Future Internet research as a driver for regional development, economic recovery and social and political change, the FIA tended to take more of an end-user perspective. What exactly do people want? What do they expect from the internet today and how do they want to use it in the future? What are the most urgent research priorities which will help to fulfil these expectations and build the Future Internet to allow innovators and entrepreneurs to use ICT in way we could not possibly imagine today?

Opening plenary session

Opening address

Prof. Maria Elżbieta Orłowska, Secretary of State, Ministry of Science and Higher Education, Poland

- The Future Internet research community is a valuable human resource which should be “treasured”.
- Innovation will involve global collaboration between public and private bodies.
- Researchers should investigate the commercial feasibility of their proposed solutions rather than spending large grants and then later finding inconclusive results.

Enjoying her second day at the Future Internet Week, Prof. Maria Elżbieta Orłowska was clear about her enthusiasm for spending time among Europe’s foremost internet researchers. “If we all agree that ICT is the main driver of the economy in Europe then perhaps it is not an overstatement that ICT researchers are an irreplaceable human asset,” she noted. “We should treasure this group, and I say this not to make you feel good but to highlight the importance of this human capital.”

But it is no time for researchers to feel smug. “With the economic downturn we talk about the need for innovation,” Prof. Orłowska continued. “But innovation is not something that can be ordered or commissioned or written into legislation. We know that ICT has an impact; there is pressure on ICT researchers to make further progress and create an impact.”

“Innovation is not something that can be ordered or commissioned or written into legislation... there is pressure on ICT researchers to make further progress and create an impact.”

Prof. Maria Elżbieta Orłowska

But what does innovation look like in the real world, when you step away from all the “policy-speak”? Prof. Orłowska described how the automotive industry has stayed ahead of its game by building on its strengths and looking at how it could provide solutions for problems in society. Today cars have just about everything – radios, heating, entertainment systems, even wireless

internet connectivity. There seems to be little scope for adding much more functionality. But a new collaboration between the European Joint Research Council and US car manufacturers is looking at new concepts for cars such as e-mobility and eco-transport.

“This is a stimulating partnership which is trying to achieve something special,” said Prof. Orłowska, “and it is the same with the internet. People are asking how much farther we can progress. The question for the FIA community is ‘What next?’”

Prof. Orłowska has three golden rules for effective innovation: keep it simple, virtual experimentation (check out the feasibility of an idea before investing) and physical experimentation (i.e. trying out real applications). You can see this model throughout the EU’s Future Internet research portfolio.

“This assembly has a great mission,” Prof. Orłowska noted. “But before undertaking projects let’s ask the question ‘is this feasible?’ rather than taking €20 million and then only being able to answer ‘perhaps’.”

Progress on Future Internet research – Towards deployment and innovation

Megan Richards, Director Converged Networks and Services, DG Information Society and Media, European Commission

- Europe is showing tremendous support for Future Internet research and deployment.
- Smart cities are a perfect framework for testing Future Internet applications in areas such as energy and city management that address some of our most pressing societal problems.
- Standardisation will have an important role in Future Internet research.

In the face of glum news coming out of Brussels, Megan Richards remained upbeat. “There is money available,” she assured the FIA delegates. “We’ve heard about the Cohesion Funds, the Connecting Europe Facility and the forthcoming Horizon 2020 programme. But we need to use this money well and get results.”

Richards also reminded people about the FI-PPP; this initiative is still in its first phase (i.e. a technology platform and a limited number of use cases), but it has the potential to expand into two further phases if the first phase proves successful. Richards highlighted the R&D currently focusing on smart cities, a priority area because 80% of Europeans live in urban areas and are responsible for three-quarters of EU CO₂ emissions and energy consumption.

“Smart cities are an ideal ‘playground’ to test, develop and deploy the Future Internet in regional and local contexts...”

Megan Richards

Current funding programmes, including FP7, the ICT Policy Support Programme of the CIP, and the Smart Connected Electro-mobility initiative are looking at ways and means to reduce energy consumption and address other societal challenges, and the application of the Future Internet in urban environments.

Similarly these programmes are also funding research into holistic ICT enabled city management. “Smart cities are an ideal ‘playground’ to test, develop and deploy the Future Internet in regional and local contexts and to benefit from the new EU policy approach, with tighter integration between research, innovation and regional deployment.”

Standardisation is an important element of innovation. The Commission has taken steps to reform the ICT standardisation landscape of Europe to make it faster, better and more internet relevant. It will also support a holistic perspective by fostering tighter integration between research and the standards making process. Researchers are invited to contribute to this move.

The economic and societal impact of future internet technologies, services and applications in Europe and elsewhere

Jonathan Cave, RAND Europe

- In 2010 the total internet economy in Europe was valued at almost €500 billion (4% of EU GDP).
- Realistic projections for 2020 suggest that the FI-PPP could have an annual positive impact of €28 billion or an accumulative effect of €126 billion. The contribution of the internet economy rises to 5.7% of EU GDP.
- The Future Internet is a “grand challenge” for Europe in which the FI-PPP has an important role to play in the future growth of the internet economy.

Jonathan Cave evaluated how current trends could have an impact for the next generation of Europeans, focusing on the FI3P project which has been working to identify the longer-term impacts of the FI-PPP and what is still needed to realise the potential of the Future Internet.

“There is emergent behaviour and effects that you cannot predict simply by looking at the individual components. And we have to also recognise that the internet is a social construct – it is as much about how people use it as the technology that makes this behaviour possible,” noted Cave.

“The internet’s economic contributions are not always obvious, but they are profound, pervasive and complex,” he added. He highlighted three waves in internet development: first PCs were connected by fixed lines, today the internet is mobile, highly functional and intelligent. The third wave will come with the uptake of IPv6 and more machine-to-machine interactivity and self-organising behaviour (which could bring us to the brink of chaos, he notes, citing the “flash crash” in the US market in 6 May 2010).

Figures suggest that the total internet economy in Europe in 2010 could be valued at almost €500 billion (4% of EU GDP). Projections show that this economy will continue to grow although the dominance of telecom services will diminish as the market continues to diversify (there are opportunities in areas such as cloud computing and RFID) and more SMEs provide mobile apps (there are around 850,000 companies involved in developing apps for iOS and Android).

FI3P has constructed several scenarios for the future economic growth of the internet. Its most realistic projections suggest that the Future Internet economy could grow as much as seven times faster than it has to date. Cave suggested that the FI-PPP will rebalance the driving force from today's focus on consumption towards much greater emphasis on productivity. He also foresees a clash of the titans between the telecom and IT giants.

But other scenarios are possible, he warns. In his "tipping point" scenario where there is demand-led recovery across sectors and competition on open platforms, projections show wide and balanced diffusion of innovation and triumph of what he calls the mammals – technical service providers rather than internet-based incumbents. A less palatable scenario is one of faltering growth where spending does not recover and investment is weak and fragmented.

But returning to the realistic scenario, Cave had good news for everyone who supported the FI-PPP. The FI3P study predicts that by 2020 this initiative could have an annual positive impact of €28 billion or an accumulative effect of €126 billion. The contribution of the internet economy then rises to 5.7% of GDP. FI-PPP raises production through gains in productivity and investment, which in the medium term increases unemployment, but after 2022 employment is expected to bounce back to even higher levels. Cave also stressed that a successor to the FI-PPP is necessary to sustain the benefits of the FI-PPP.

Internet-enabled social transformation: social networks, crowd-sourcing and opinion formation

Boleslaw Szymanski, Rensselaer Polytechnic Institute, USA

- The internet is about people: this must not be forgotten in the technical fog that can sometimes dominate discussions.
- The dynamics of (social) networks is complex and fascinating, it's about human interaction and the Future Internet and "Internet of Things" looks set to magnify this.

Delegates have been sitting in the auditorium for nearly two hours. Thanks to the FIA WiFi some have caught up on their work emails, some have booked flights and accommodation for their next trip. Others have speedily typed notes on their laptops and tablets or taken snapshots of the presentation slides on the screen.

But has anyone listening been swayed by the presentations? Have their opinions changed. What does it take to influence an individual's viewpoint? What about the majority view of a large community?

You have to remember that the internet is about people, Boleslaw Szymanski reminded his listeners. The social view of the internet is extremely important and should not be ignored in favour of more technical discussions.

He suggests that the internet is at the intersection of three worlds: the natural world, the engineered (man-made) world and the world of social interactions (which is just as real as the other two, Szymanski insisted).

“How does the existence of information networks change the dynamics of human interaction?”

Boleslaw Szymanski

Szymanski’s big question is this: how does the existence of information networks (social networking tools, cell phone networks, and so on) change the dynamics of human interaction?

He observes that there is a strong drive in people to be surrounded by people who hold similar views, either by actively seeking and networking with those people or by trying to change the views of the people in their networks. Previously this happened geographically, now it occurs at a global scale through internet-enabled networks.

But do people’s opinions change? Szymanski has looked at the role of “influencers”, people who are strongly committed to a particular view and who do not change their opinion. If the proportion of influencers is small then they linger around, perhaps they change the opinions of a few people around them, but the majority view prevails. However, if only 10% of people in a network are influencers then their minority view spreads and rapidly becomes the majority view.

Although you could argue that it would be easy to change the views of people around the globe through internet-enabled social networks this may not be the case, Szymanski explained. The larger the community the less likely “full conversion” becomes possible.

Szymanski described two features of social networks that co-exist to create complex interactions. Homophily is the tendency of individuals to form social connects to people who are similar to them. Link persistence is the tendency of social connections between people who are similar to last longer than those between dissimilar individuals. Szymanski observed in his mathematical models that social networks rewire as people’s opinions change to cut off “non-conforming” individuals and maintain similarity within the network. This rewiring helps to slow down the formation of consensus.

Szymanski has also asked about how we trust people within our networks. Evolution means that we place a lot of emphasis on facial expression and features to judge trustworthiness (even criminals can look affable). In social media we often have a picture of the person we interact with. Exactly how much does looking trustworthy counteract non-trustworthy behaviours, Szymanski asked? What can be done to guard against this “appearance bias?”

To conclude Szymanski pointed out that the “people’s internet” is about to get more complicated as the Future Internet will also incorporate the Internet of Things. What happens at the intersection between the networks of interacting people and the networks of interacting devices is really anyone’s guess.

Future Internet Assembly – Wednesday, 26 October 2011

Two days of technical discussions, catching up on the latest developments in Future Internet projects and intense networking. The FIA is undoubtedly a busy few days for delegates. When FIA first began in 2009 there was one word you heard everywhere: architecture. Today it seems that this is just one piece in a much bigger jigsaw.

Closing plenary session

Panel on architecture

Chair: Theodore Zahariadis (Synelixis)

Panellists: Dimitri Papadimitriou (Alcatel-Lucent, Belgium), Giovanni Pau (University of California, Los Angeles, USA), Paul Muller (TU Kaiserslautern, Germany), Werner Mohr (Nokia Siemens Networks, Germany)

Theodore Zahariadis introduced the panel and explained that it had been put together to present to the FIA some of the most important development in Future Internet architecture since May's FIA meeting in Budapest. "We've seen and heard a lot about the Future Internet, but we need to look at what it is going to support," he explained, outlining one challenging scenario that combined networked-media, augmented-reality and social-networking to deliver a new user experience: A user could take some pictures of a location, use them to create an entire virtual environment in which he could then interact with friends and share experiences.

But the scale at which these kinds of internet-enabled interactions will occur is almost impossible to comprehend. In 2014, global IP traffic will reach 767×10^{16} bytes/year or 64×10^{16} bytes/month. "That's the equivalent of 32 million people streaming Avatar in 3D, continuously for an entire month," Zahariadis noted, "It would take 72 million years for one person to watch the amount of video that is forecast to cross global IP networks during 2014."

Zahariadis pointed out that the architecture of the Future Internet would also have to support mobility and a vast range of different devices, not to mention 'things'. It would also have to address issues related to security, federation and reliability. "There are lots of keywords," Zahariadis admitted, but hoped that the panellists would shed some light on ways in which the Future Internet would handle these diverse requirements.

Before we start building new architectures, **Dimitri Papadimitriou** insisted that architectural modelling is a crucial step in the design and development process to circumvent architecture limits. He compared the development of TCP/IP and OSI RM. The former was developed in what he called an "empirical iterative" fashion. A system based on design principles which met certain objectives, but the solution was development in a stepwise fashion, specific problems were solved with specific solutions and no long-term planning, foresight or contingency. OSI RM, on the other hand, has remained largely theoretical with no actual deployment. Mr Papadimitriou advocated taking the best from these two approaches and basing the Future Internet architecture on designs derived through systematic analysis.

“When you look at the principles of the current internet it is easy to derive a long list of design principles which would apply equally to the Future Internet. But there are a few new characteristics that also need to be thrown into the designer’s brief. Modularisation, for example, is an important principle which will help to overcome the inherent inflexibility of the existing protocol stack structure and replace it with dynamic and variable bindings between different modules to support any protocol stack.”

Papadimitriou went on to outline some seeds for new design principles as specified by the EC Future Internet Architecture (FIArch) group of experts. “The Future Internet must be inherently dependable, for instance, using self-adaptation and self-learning to cope and learn. It must accommodate heterogeneity of needs and sustain brain and resource investment towards an overall positive return (not to sustain detrimental conflicting interests),” he suggested.

With these principles in mind, the FIArch group of experts is now in a position to develop an experimental architecture model and components. “The architecture resulting from independently designed components is already the main limiting factor of internet growth and deployment of new applications. We need a holistic approach at design time,” Papadimitriou asserted. “We need a strong foundation when taking and evaluating design decisions that will impact a large portion of the internet. Systematic modelling can create a common framework and tools for network architectures that will ensure the Future Internet is not constrained like it is today.”

Coming from UCLA – proud to be the birthplace of the internet – **Giovanni Pau** observed that in 40 years the internet has barely changed. Sure, there are many more users and many more networked objects, but little has changed in terms of its structure. “If you can pick just one single feature for the Future Internet, I would say it is mobility,” he argued. “We want the Future Internet to disconnect the location from the address

“...Scientists have substituted mathematics for experiments, and they wander off through equation after equation, and eventually build a structure which has no relation to reality...”

Nikola Tesla

(whatever that means), a native ability to route data on-the-go seamlessly for 10 billion nodes and beyond. And we even want intermittent or ad hoc connectivity.”

And then, he suggested, there is the usual list we have seen many times before – a list that reads like the parallel sessions of a typical FIA: content-centric, reliable, resilient, trustworthy, etc. So how can the architecture of the Future Internet take into account all these factors? Pau advocated a “thin waist” architecture because it “makes the original internet design so powerful”. At the waist you have a universal network layer (IP) which implements the minimal functionality necessary for global interconnectivity.

Other design principles, he said, should include mobility (today it is just a patch), security (it needs to be built in, not a fix) and adhere to the end-to-end principle (which allows applications to continue running in the face of network failures).

Pau argued that we need a clean slate. “Forget about IP, forget about OSPF, BGP,” he declared. “Build up from the ground, reduce the number of layers,” he recommended, “but above all build it! Deployment is the single most important challenge we face today.”

Following this call for action, **Paul Muller** took a sideways look at internet architecture and proposed a radical rethink – certainly one way to clean the slate. He suggested that the advent of cloud computing means that the Future Internet could take a service-oriented approach to architecture. Quoting Einstein, he argued that “you can’t solve problems with the same thinking we used to create them”.

“On the one side, we have seen the demand for services and applications increase, and on the other side we have seen a rise in the capabilities which the internet can offer,” said Muller. “And in between is a glue which maps the demands to capabilities. This glue, originally the stack, is now very complex. Today the internet only just works and no-one knows why.”

So Muller stated his premise: “We assume that the internet is a large, distributed software system.” From this simple assumption you can then use the principles of service-orientation (interacting services replace the concept of layers) to develop the architecture. The big benefit of designing architecture in this way is that you build in long- and short-term flexibility. The system is able to adapt and react to network conditions, but also evolve over a longer term with updated protocols and network capabilities. “It is easier to introduce new functionality without being dependent on agreements with vendors and/or providers,” Muller explained.

Muller enthused about these advantages, but he was careful not to get overexcited. “Service-oriented architecture is an architectural proposal, not an implementation!” he warned.

From forward looking research proposals to concrete applications, **Werner Mohr** presented some preliminary results from the FI-PPP FINSENY project in the domain of smart energy. Decentralised energy generation (through domestic PV panels and wind turbines, for example) makes the energy network more volatile; the energy grid needs a new architecture involving the integration of two complex energy networks (high-energy transmission networks and distribution networks) and the internet.

The existing internet does not support all smart grid requirements. For example it lacks the security necessary for such a critical infrastructure and still can only provide limited advanced services to end customers. Moreover, the internet of today is separated from the energy grid, but ideally it makes logical sense to merge the two and have only a single physical infrastructure.

The existing internet also has several technical weaknesses, for example guaranteed latency and bandwidth and the absence of end-to-end quality of service across provider boundaries.

FINSENY has proposed an architectural model (SGAM) which considers the FI-PPP FI-Ware core platform and is aligned with the Smart-Grid Coordination Group. SGAM comprises four layers: services/functions, information, communication, components (devices), and an additional security layer. There are several cloud technologies of interest (e.g. for computing-intensive algorithms and processes), but it is important to remember that security and quality of service

are paramount and must be guaranteed for critical infrastructures and their applications.

Having presented their positions, the panellists then responded to questions and comments from delegates.

Q: What is the end point when you take an end-to-end design principle? Are services and/or content an end point?

A: Dimitri Papadimitriou replied that the research community was still debating the definition of an end point, although everyone agreed that the interface-host model no longer applied. The Future Internet would be extended to objects, hosts, even processes so it was hard to settle on a good definition of an end point. "The real issue is about the evolution of architectural principles," Papadimitriou commented. "We have to build an architecture that allows definitions to evolve."

Theodore Zahariadis added that the concept of end-to-end has changed a lot, although he thought it was clear that this principle remains important and that its definition should be extended. Perhaps "end to end" could become "end to many ends" in the Future Internet, he suggested.

Q: The number of broadband subscribers is expected to rise to over 100 million. How will this growth be taken into account?

A: Giovanni Pau said that if the architecture of the Future Internet is designed correctly this should not be an issue. "The network does not need to know who is at the other end. I see no need to design a system that knows what is happening," he said.

Paul Muller pointed out that when you add new capabilities to the network it is necessary to create new services on top of the physical network. He suggested you could combine new functions with existing functionalities (e.g. security). A service-oriented architecture makes it easier to react, bring to market and create new business models.

Werner Mohr added that the growth in numbers was not just a question of technology. The broadband network needed to be deployed in the first place and that would require billions of euros in investment.

Q: How long will it be before these ideas about architecture are actually deployed in the network?

Muller was ready to concede that his ideas about a service-oriented architecture were untested and would be the subject of a research project. Any new architecture would have to cooperate alongside the existing internet so the transition phase might last as long as 10 or 15 years.

Papadimitriou wondered how you know when an architecture is ready to be deployed. The best way, he suggested, is to try different alternatives and use simple trial and error. Pau added that something that works well would deploy itself.

Mohr argued that, from a use case perspective, it would be important to use existing systems in

more clever ways. He highlighted the situation in Germany where the government wants to change energy systems by 2020. "That's the timeframe we have for introducing changes," he stated. "Change is possible in the existing architecture."

Q: We have to do something with the layering model, but is the modular approach better? The good thing about layering is that each layer only needed to think about what is above and below it. A modular system could be very complex and perhaps chaotic.

A: Papadimitriou pointed out that the existing system was already extremely complex, but this complexity is hidden because the system is so limited. The current system only looks *simple*.

Q: It is good to argue about architectures and discuss possibilities in different projects. But what about the real issue: how to deploy them?

A: Zahariadis took the opportunity from this question to round off and summarise the discussion. "Architecture must reflect the business roles and models that people have. When the internet started there was nothing else. Now we have a huge legacy system and that leads to inertia. We must not lose momentum."



Poznań character ©Andrea de Polo-Alinari, 24 ORE, Italy

FIC session A/B – Innovation potential of e-infrastructure

Rapporteurs/organisers: *Gudmund Høst (e-Infrastructures Reflection Group; Research Council of Norway)*

Other contributors: *Norbert Meyer (Poznan Supercomputing and Networking Centre), Roger Williams (Erisa)*

Session summary

Gudmund Høst introduced the session and spoke about the case for e-infrastructures. He explained that the e-Infrastructures Reflection Group (e-IRG) was one of the main advisory bodies on e-infrastructures in Europe.

Important components of European e-infrastructures are networking services, high performance computing services, distributed computing (grid) services and data services. Høst maintained that a general-purpose European e-infrastructure is an essential component of the European Research Area (ERA). In the context of the EU2020 Strategy, the Digital Agenda and the Innovation Union are driving interest and publications about e-infrastructures and the work of e-IRG. In this context, e-infrastructures will contribute to an open innovation model, help narrow the digital divide and support European cohesion.

Høst said the research and higher education community was a truly international group of leading-edge users and early adopters and developers of new ICT components and services. Close interaction between these users, providers and developers helps to incorporate innovation into new services. Frequently e-infrastructures, such as GÉANT, act as “innovation engines”, accelerating the development of new ICT services and products.

The governance of e-infrastructures must encourage commercial and academic users to collaborate in research projects. E-infrastructures should contribute to lower energy consumption and better use of alternative energy sources. The new paradigm of large-scale, data-driven research creates new challenges for networks and e-infrastructure governance.

Norbert Meyer talked about the multisource financing of Poland’s research infrastructure. Access to EU Structural Funds since 2008 has given a significant boost to the expansion and improvement of Poland’s national e-infrastructure, especially the integration of infrastructures at all levels. All academic users have access to all e-infrastructure services, including international resources such as EGI and PRACE. Organised groups can also apply for dedicated communication channels nationally and internationally. Services include remote data archiving, cloud/campus computing, scientific HDTV, teleconference facilities and “eduroam” access.

Meyer observed that the availability of e-science services and infrastructure in Poland really pushed the growth of the internal market; co-operation with telco operators has also decreased the costs of joint investments. New technologies implemented and tested by PIONIER/MAN have been to develop telco networks. Finally, European Structural Funds have also enhanced cooperation between governmental institutions and industry.

Roger Williams from ERISA presented various funding models for broadband deployment, and described some outcomes of these approaches. He reminded delegates about the new €9 billion fund which was recently announced by the European Commission. However, he also noted that the targets of the Digital Agenda would only be achieved if private business were willing to invest €290 billion in capital. To reach these targets key stakeholders must discuss the local, regional and national opportunities offered by fast broadband solutions. Furthermore, Williams added, we need to create and communicate the vision at a local level and get government, business and citizens to buy into it. You have to build awareness among consumers while appointing a leadership team to “make it happen”, he remarked.

The European Broadband Portal can support local broadband initiatives. It can help with assessments and facilitate stakeholder workshops, assist organisations and businesses to access funding and help with marketing and communications.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=257

FIC session C – Technology challenges for smart growth

Rapporteurs/organisers: *Krzysztof Zieliński (AGH University of Science and Technology, Poland)*

Other contributors: *Marv Schwartz (Case Connection Zone), Hagen Woesner (EICT), Marcin Werla (PSNC)*

Session summary

Following a short introduction by **Krzysztof Zieliński** (the session chair), **Marv Schwartz** presented Case Connection Zone – the first gigabit home internet connectivity program in the USA. The project is developing a portfolio of applications and services built on next-generation network connectivity and infrastructures which will transform home internet usage. The new services focus on health and wellness research, STEM education, energy management and conservation, and public safety. Schwartz observed that in the USA the broadband home internet infrastructure will operate at 1Gbps; in European broadband infrastructures limit their throughput to several Mbps. The much faster broadband in the USA paves the way for HDTV, multipoint videoconferencing and healthcare services.

Hagen Woesner outlined some of the research going on in Europe looking at the concept of software-defined networking hardware. Emerging Future Internet services require new communication protocols, Woesner remarked, but these protocols are difficult to implement effectively over the existing hardware stacks in networks. Woesner argued that the features of such stacks should be partially redefined in software to provide better flexibility. These issues surrounding the creation of such a ‘split architecture’ are being explored in the Ofelia EU project.

Marcin Werla described several research activities in the Poznan Supercomputing and Networking Centre which are addressing ‘information digitalisation’ including, for example, the preservation of national heritage in museums and building digital object repositories. Werla described the progress they have made since 2002. To date some 80 Polish digital libraries

have been set up, storing 750,000 digital objects. But Werla also highlighted some difficulties that still need to be overcome, especially the perceived lack of common standards which is hindering further development in this domain.

The presenters then participated in a panel discussion on the question “*Is current technology mature enough to foster the development of smart specialisation, or are there still big challenges to be solved through research projects?*”

The debate drew the following conclusions:

- High-speed content distribution is a challenge when you take scaling and economic factors into consideration. The available bandwidth remains insufficient.
- Existing networking protocols, such as TCP, are not effective enough for high-speed networks. More flexible and tunable protocols should be provided.
- While basic technologies are in place, further research is required to investigate the issues associated with massive deployment of services for the Information Society.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=258

Ofelia project: www.fp7-ofelia.eu

FIC session D – Good practices, smart specialisation

Rapporteurs/organisers: *Witold Abramowicz (Poznan University of Economics, Poland), Tomasz Kaczmarek (Poznan University of Economics, Poland)*

Session summary

This session explored the topic of ‘smart specialisation’ in more depth and discussed the characteristics and heritage of the different regions of Europe and how this could be exploited as the basis for specialisation. The speakers also provided some insight into the possible criteria that EU Structural Funds would set to qualify specialised regions for investment.

Kieran Sullivan (CeFIMS) presented interim results for an EU-funded project that is compiling data about the different regions in Europe, finding out about the institutions in the regions that participate in European research and the types of projects in which they are involved. The benefits of this detailed regional view of the research landscape in Europe were discussed. Delegates commented that this project would highlight the achievements of different institutions.

John van Pol (incas3) introduced the session to the Drenthe region in the Netherlands, a good example of a specialised region. Pol showed how the region’s expertise in sensor technologies has grown, beginning with just one small but ambitious project involving a few highly skilled scientists and engineers. From this original project, the region is now highly successful in sensor

research. Pol observed that specialisation had brought many benefits and regional development.

According to **Karol Wieloch** (Poznan University of Economics) Greater Poland is one of the most active research and innovation regions. The region's capital is a large university hub that is rich in small and medium-sized enterprises and innovative spin-offs. Speaking about his experience from eXtraSpec, Wieloch described how the project has created a web-based system that can help companies and researchers identify and contact experts with specific knowledge or particular skills. The region has a buoyant jobs market and the web system will help the region to make the knowledge of its experts more accessible and continue to strengthen the region's areas of specialisation.

The session concluded that specialisation (in particular in the domain of ICT) requires skilled people, the availability of higher education and research organisations (universities, research institutes) and a business-friendly atmosphere. From an administrative perspective, regional specialisation must be based on a well-defined vision and follow a strategy to harmonise education, business opportunities and environmental factors towards the areas of specialisation.

On the European level it would be beneficial also to support coordinated actions in the education, business and environment sectors to drive specialisation. The delegates also discussed the advantages of collaboration between regions that have complementary areas of specialisation.

The participants also emphasised that regions and their institutions must disseminate information about their areas of specialisation and their successful involvement in R&D projects, especially to stimulate cross-regional cooperation.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=259

FIC Session E – User-driven open innovation

Contributors/organisers: Manuel Monteiro (European Commission), Pieter Ballon (ENoLL), Dave Carter (Manchester Digital Development Agency), Alvaro de Oliveira (ENoLL), Jarmo Eskelinen (ENoLL), Nuria De Lama (Atos Research and Innovation), Miriam Magdala Pinto (Habitat Living Lab, Brazil)

Session summary

The purpose of this session was to explore how the end users, through Living Labs, could shape the Future Internet for smart ICT applications and contribute to the development of a better society.

The session looked at recent initiatives launched by the community of Living Labs in Europe and globally. It also focused on the area of Smart Cities and the involvement of Living Labs and the Future Internet research community in this domain (most recently within the FI-PPP). A portfolio of 15 EU-funded smart city pilot projects is already using Living Labs as a tool for innovation.

Manuel Monteiro (Deputy Head of Unit, European Commission DG INFSO) wanted to convey some key messages to the Living Labs community. He argued that the current economic crisis presents an opportunity for a different 'European innovation system'. To preserve European competitiveness, he said, we should focus on new digital businesses and knowledge-intensive services and facilitate a bottom-up movement towards smart innovation ecosystems.

He further stressed that the Future Internet was not just about technology or the economy; it will have a major impact on societal, psychological and even legal issues. Progress should be measured in terms of well-being, environmental sustainability and the quality of life of citizens, as well as economic growth. Monteiro said that Living Labs have every good reason to be part of the Future Internet movement and will make a contribution to smart regional development.

User involvement has become a core part of R&D and the Commission is keen to support initiatives that combine aspects of technology and society through Living Labs or Public Private Partnerships (PPPs). Living Labs can bring the fourth 'P' into the equation, namely 'people' Monteiro stated. "Users, citizens and entrepreneurs are central drivers and key resources in the European innovation process. Users today are actively contributing to generate knowledge and technological solutions and can themselves become a source of innovation."

Monteiro informed the audience that new calls for proposals will also be available for Living Labs in the next CIP ICT PSP opening early next year as well as in the future European research and innovation funding programme, Horizon 2020.

ENoLL President, **Alvaro de Oliveira**, spoke about the current activities and recent achievements of the Living Labs network and how ENoLL's future endeavours are aligned with those of the European Commission. ENoLL has gone global, Oliveira remarked, with partners in Latin-America, Africa and finally China. There are now almost 25 000 participating organisations.

Oliveira stressed that as user-driven open innovation ecosystems Living Labs offer solutions because they engage and motivate all the stakeholders, stimulate co-design and the co-creation of technology, products and services. This and social innovation also stimulates lead markets and behavioural change.

Looking to the future Oliveira emphasised the newly signed Memorandum of Understanding between the World Bank and European Network of Living Labs concerning collaboration through the Open Development Technology Alliance, established by the World Bank in 2011 as a new global initiative to facilitate knowledge sharing. The aim of the collaborative forum is to use ICT to transform the way governments deliver services to citizens.

Miriam Magdala Pinto, a Brazilian member of the European Network of Living Labs, talked about the social innovation initiatives of the Habitat Living Lab in Brazil. This introduction was followed by a panel presentation which highlighted how various Living Labs are currently shaping the Future Internet for a better society.

Jarmo Eskelinen (Forum Virium Helsinki) introduced the new CitySDK 'service development kit'. It is trying to work out how to combine communities with services in the chaos-like environments of cities.

Nuria De Lama (Atos Research) explored why the FI-PPP FI-WARE project is important for Living Labs. She highlighted the opportunities for getting involved in the FI-PPP initiative, saying that FI-PPP partners are eager to collaborate with the Living Labs. Industry understands the importance of user-driven innovation.

Dave Carter (Manchester Digital Development Agency) leads the portfolio of EC-funded smart cities pilots. He highlighted the links between the Future Internet, Open Innovation and Living Labs, the emerging smart cities network and the APOLLON and FIREBALL initiatives. According to Mr Carter, cities are important but he warned people to beware "the urban operating systems bearing gifts". Mr Carter highlighted the importance of technology research, policy and people.

Pieter Ballon (IBBT) presented snapshots of how the Living Labs approach is incorporated in one of the smart cities pilots, namely the EPIC project (European Platform for Intelligent Cities) and the APOLLON project, one of the first generation of CIP-projects doing Living Labs testing through the ENoLL community. In EPIC, three different applications are being piloted simultaneously in Manchester (energy monitoring), Issy-Le-Moulineux (3D city community platform for urban planning) and in Brussels (augmented reality application for expat relocation services). The common denominator for all these pilots is that they are all using the Living Lab approach, incorporating user behaviour, crowdsourcing, large-scale community involvement and real-life business model testing and experimentation.

The session closed with the announcement of the European Network of Living Labs Sixth Wave for Membership applications, which would remain open until 29 February 2012.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=260

FIA session 1.1 – Value creation, value flows and liability over virtual resources

Rapporteurs/organisers: Michael Boniface (IT Innovation Centre)

Other contributors: Man-Sze Li (IC Focus Ltd), Makis Stamatelatos (University of Athens), Marcus Seifert (University of Bremen)

Session summary

An industry perspective

The session kicked off with a motivating talk by **Mick Haynes** from Hitrail about the evolution of networks and service infrastructures within the railway industry. With the recent push by EU legislation for greater interoperability, cooperation and competition between railway operators, Hitrail are looking to Future Internet technologies such as Cloud and IPv6 to deliver reduced costs and greater efficiency. Haynes said the major challenge is to open his company's infrastructure to new types of services yet still deliver connectivity, security, QoS guarantees and service reliability across critical applications such as reservation, availability, interchange management and freight consignment notes.

Reducing infrastructure costs

Makis Stamatelatos argued that “virtualised resources” are the foundation of the Future Internet. However, now that the internet is so complex it is extremely difficult to identify who is responsible for what within the network and across the infrastructure. With management costs now running at around 30%, cost-cutting measures are becoming increasingly important. **Sergi Figuerola** (i2CAT) said that the goal of the GEYSERS project is to reduce CAPEX using and interconnecting virtual infrastructures. He argued in favour of a common information model and greater flexibility in the roles played by different actors in these new infrastructures. Indeed, role assignment and the analysis of different scenarios in the value chains of virtual infrastructures come under scrutiny from UNIVESELF. This project aims to develop a unifying network management system. **Martin Waldburger** (University of Zurich) highlighted how the move towards high-speed networks is a significant cost driver. Moreover, given processing time on a 10G link is in just nanoseconds per package, the risk that some information may be lost is also increasing – at a time when the legislative requirements for data management are becoming ever-more stringent.

Innovation and service commodities

Man-Sze Li introduced the session on ‘Services and business’. He outlined the vision of the FI-ES Cluster for Interoperable Service Utilities and Open Business Ecosystems. The delegates also heard from VLASTUIN, a European SME, which argued that Europe needed to create some kind of network environment for open innovation. In this environment the neutrality of services would have to be preserved; people would also have to adopt a new approach to intellectual property rights which would end the current patent wars. **Sergi Gusmeroli** (Txt Solutions) issued a challenge to the FI-PPP: Are generic enablers enough to bootstrap a universal business ecosystem? When a service is commoditised it becomes the enabler for innovation, such that even micro-enterprises can join in. Gusmeroli called for participants in FI-PPP initiatives to commoditise their service capabilities through open enterprise processes rather than just trying to protect value in their service assets.

Marcus Seifert concluded the session by chairing a discussion which explored what different players could do to ensure that the benefits of the Future Internet would be felt Europe-wide. The discussion examined the following areas:

Businesses: Look out of the box, at entertainment and the virtual world for example, to try and get new business models and innovations – value is not just about money. “Serious gaming” has great potential for new business models. Games have been a forerunner of many internet services, and research is always trailing behind the games market. We need to increase the collaboration between games developers and the research community.

Software industry: The right to fail is important, but in Europe we do not admit to failure easily. Innovation and failure go hand-in-hand, although failure comes with a responsibility to learn from mistakes. A big question at the moment, for example, is how to use the power of Facebook in an enterprise. It seems like a simple issue, but it has proven to be difficult to translate social networking into the enterprise setting.

Research: The R&D community needs to develop new ways to link students within Europe, but go beyond traditional student exchanges and publications. We need to find ways to connect people with different backgrounds and experience. The community must also be ready to challenge and question the trends proposed and led by industry.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=136

Motivation and relevance to FISE-WG: Michael Boniface, IT Innovation (SESERV)
<http://www.slideshare.net/ictseserv/value-creation-value-flows-and-liability-over-virtual-resources-infrastructure-perspective>

The Hermes network - Railways transition to a digital future - Mike Haynes (Chair of GPH, European Railways) <http://www.slideshare.net/ictseserv/hitrail-the-hermes-vpn-network-for-railway-services>

The Infrastructure Perspective - Makis Stamatelatos, University of Athens
<http://www.slideshare.net/ictseserv/management-aspects-of-virtualisation-business-scenarios>

Management issues in virtualisation business scenarios, Vânia Gonçalves¹, IBBT
<http://www.slideshare.net/ictseserv/management-aspects-of-virtualisation-business-scenarios>

High Speed Accounting in the Future Internet Martin Waldburger, Univeristy of Zurich
<http://www.slideshare.net/ictseserv/highspeed-accounting-for-virtual-resources>

Business models for dynamic optical infrastructures - Sergi Figuerola, i2CAT
<http://www.slideshare.net/ictseserv/geysers-business-modelling>

Value of Virtualized Programmable Network Infrastructures - David Hausheer, TU Darmstadt
<http://www.slideshare.net/ictseserv/value-of-virtualized-programmable-network-infrastructures>

The Societal and Business Application Perspective - Man-Sze Li(IC Focus), FInES Cluster
<http://www.slideshare.net/ictseserv/the-societal-and-business-application-perspective>

Internet as Universal Business System in SME Jasper Lentjes, Business Innovation Manager, Vlastuin Group <http://www.slideshare.net/ictseserv/internet-as-universal-business-system-in-sme>

The Internet as Universal Business Systems - Sergio Gusmeroli, Corporate Research Director, TXT e-Solutions SpA <http://www.slideshare.net/ictseserv/the-internet-as-universal-business-system>

FIA session 1.2 – The future of networked media and the internet: facts, reflections and the road ahead

Rapporteur/organiser: Paul Moore (Atos)

Other contributor: Krzysztof Kurowski (Poznan Supercomputing and Networking Center)

Session summary

The NextMedia project and the NEM initiative have both recently released roadmap documents; speakers in this session presented a selection of topics and areas of research which feature prominently in these roadmaps. The session was also planned to continue and supplement the ongoing and more general FIA road-mapping task.

The presentations looked at the place in the roadmap of architecture, 3D media, connected TV, social media and business models for the future media internet.

Theodore Zahariadis (Synalixis, Coordinator FIArch Working Group) and **Bogdan Ludwiczak** (PSNC, Poland) gave a number of different perspectives on the needs and requirements of architecture and the evolution of the Future Internet. It was remarked that software performance and scalability would only be achieved if algorithms and application characteristics were designed and applied in harmony with the hardware and interconnection architectures. This is particularly important for networked multimedia platforms.

Virtual worlds, 3D video, 3D multiview, simulators, gaming, and many other rich media experiences are now a part of everyday life for many people on the internet, asserted **Jani Pirkola** (Cyberlighterning, Finland) and **Federico Alvarez** (UPM, Coordinator of NextMedia). But there are still many challenges to address – multimedia search, network efficiency and real-time rendering to name just a few. The speakers outlined some of the possible future scenarios for 3D technologies and applications, and introduced the audience to the open source 3D platform realXtend.

Federico Alvarez was joined by **Ralf Neudel** (IRT, Editor NEM Strategic Research Agenda), to talk about the evolving landscape of connected TV. Delegates listened to an overview of technologies and the current market situation in Europe. **Oscar Mayora** (Create-Net) and **Paul Moore** (Atos) then reminded everyone that media and social networks are also converging; it is becoming more and more difficult to separate clearly social networks from the media internet.

Finally, all these changes make people wonder how business will work in the future. Moore said that discussions about business models are becoming increasingly common in any talk about the Future Internet. The battle between Apple, Google, Facebook, Amazon, etc. for the hearts and minds (but especially wallets!) of 'internauts' over the next 10 years will be partly a struggle for technological supremacy, but just as important, a struggle for business model supremacy.

Links and info

FIA programme http://www.event.fi-poznan.eu/online/?view=session&session_id=137

NextMedia Project <http://www.gatv.ssr.upm.es/nextmedia/>

NEN <http://www.nem-initiative.org>

realXtend <http://www.realXtend.org>

FIA session 1.3 – Standardisation

Rapporteurs/Organisers: Franck Le Gall (inno), Didier Bourse (Alcatel Lucent), Gaby Lenhart (ETSI), Tomas Piatrik (QMUL), Lyndon Nixon (STI International), Jean-Charles Point (JCP Consult)

Other contributors: Mikko Riepula (Aalto), Walter Waterfeld (SoftwareAG)

Session summary

The session was planned to continue and build on the presentations and discussions of previous FIA meetings. It aimed to look at both the strategic orientation of the FIA standardisation working group and at the way processes could be developed to make it easier for people to exploit of data.

Discussions in this session clearly showed that the lack of standards and the 'gaps' in available standards are still an issue which must be tackled by a concerted effort. Standardisation should not be a 'one-shot' contribution from research projects; instead the community should look at developing an efficient and effective standardisation process and avoid the time and expense of developing standards that are then not used.

Pre-standardisation activities within and across projects should be tightly coupled to exploitation and tackled as a business issue, always bearing users (consumers/customers and also researchers) in mind.

Over the past years, standards development organisations (SDOs) have been establishing new tools and processes to cope with these challenges. For example, it has been recognised that the creation of a dedicated industry specification group (ISG) within the European Telecommunications Standards Institute (ETSI) would help to centralise Future Internet architecture discussions.

The session also heard that the European Commission has invested a lot in Future Internet research, but a business push is needed to exploit research results; the contribution of projects to standards is one way that results may be exploited. Researchers, industry and SDOs are called to mix top-down and bottom-up approaches to organise and fill the Future Internet standards pool. The session warmly welcomed the recent opening up of the FIA standardisation work group to new initiatives (ETPs, FI-PPP); it was also suggested that the work group should create additional links with regulatory bodies and organisations.

But how can projects find synergy between them? First you need to collect contributions from projects, then identify possible synergies between contributions. This kind of exercise has already revealed different existing and potential classifications between projects.

Session participants reiterated the need for a light and sustainable process for contributing to standardisation. For example, rules should be set-up to validate data sets or a data source. It would also be helpful to monitor how much a standard or pre-standard is used so that the research community can focus on the areas of greatest interest.

Finally, the session recognised that data collection will have to be supported by the community, mainly through dedicated workshops or concentration/cluster meetings.

Links and info

FIA session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=141

FIA standardisation working group wiki: http://fisa.future-internet.eu/index.php/FIA_Standardisation_Support

Read more: http://fisa.future-internet.eu/index.php/FIA_Poznan_session

FIA session 1.4 – Building a trust framework for Future Internet services and infrastructures

Rapporteurs: *Laurent Ciavaglia (Alcatel-Lucent, FP7-IP UNIVERSELF)*

Other contributors: *Amardeo Sarma (NEC, TDL consortium), Aljosa Pasic (Atos, FP7-NoE NESSOS), Henning Arendt (@BC)*

Session summary

The three dimensions of trust addressed in the session were

- *Network-centric trust*, dealing with autonomic networks and their behavioural models, in terms of compliance/conformance to operator and service strategies
- *Component-centric trust*, dealing with software components, services and their respective security aspects
- *User-centric trust*, dealing with authentications, identity management, operational issues, socio-economic and psychological factors, and a growing number of stakeholders including vendors, end-users, etc.

Amardeo Sarma introduced the session with a comprehensive overview of the multifaceted nature of trust. He stressed that the Future Internet had to ensure end-to-end trust across applications, services, systems and devices. Trust frameworks need to go beyond trusted systems, he argued, and include the people who use, operate or access the systems. This approach would create multiple 'Levels of Assurance' (LoA) for different end-to-end environments and application scenarios; trust should be perceived as a continuum requiring total trust management. Sarma presented the Trust Framework Provider (developed within the Trust in Digital Life consortium) which focuses on the role of the 'novel attributes provider'.

In his presentation, **Aljosa Pasic** argued about the relationships between assurance and assumptions management. He described the proposals of the NESSOS project which has devised mechanisms to validate or manage assumptions relating to architectural design and engineering for secure services; design- and run-time validation; simulations; ability to monitor, measure, test and

predict the security status of a system; reputation and similar mechanisms. And we must not forget the links with the physical/real world, Pasic reminded his audience.

In decentralised and autonomously controlled systems, trust should be dealt with through network-centric approaches, **Laurent Ciavaglia** suggested. She listed five requirements:

1. Trust must be measurable
2. Trust must be domain-specific
3. Trust must be model-driven
4. Trust must be propagated end-to-end
5. Trust must be certified

The UniverSelf project has developed a model based on trust predicates that are defined at the design phase as abstract behaviours, but verified at run-time as fully qualified ones. These predicates have the power of policies – you check them once but re-use them many times and you can rewrite them to cater for new behaviours.

Henning Arendt closed the session with a presentation which highlighted the perspective of users. He looked at how goals for protecting users can be achieved using “privacy by design” and “privacy by default” paradigms. Privacy by design needs to be explicitly included as a general binding principle into the existing legal framework of data protection. This approach would compel data controllers and ICT designers and manufacturers to implement privacy measures and protection. Enforcement authorities would also have greater legitimacy to use their powers to ensure that privacy was applied effectively in practice.

A panel debate tackled the following key questions:

- What needs to be protected?
- What is the end-to-end trust model?
- What are the metrics?
- How to enable end-to-end trust?
- Is trust an element to consider only at design-time or run-time?
- What actions should be taken towards research and standardisation?
- What is changed by the introduction of software and autonomic systems?

A sequel of the session will take place at the next FIA meeting in Aalborg, Denmark (10-11 May 2012) based on the feedback received from this session.

Links and info

FIA session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=145

Trust in Digital Life <http://www.trustindigitallife.eu/>

NESSOS FP7 NoE <http://www.nessos-project.eu/>

UniverSelf FP7 Project www.univerself-project.eu/

FIA session 2.1 – Mobile cloud

Contributors: *Lucy Setian (TCS Digital World), Uwe Herzog (Eurescom), Calin Curescu (Ericsson), Piotr Cieszyński (ZETO S.A.), Jarosław Jackowiak (IBM)*

Session summary

The mobile cloud gets a lot of coverage; it is an emerging topic, but it is still not clearly defined. Depending on your point of view, the term may be synonymous with access from mobile devices to applications running in the cloud from mobile devices. But it may also be used to refer to all kinds of advanced mobile services with distributed online and offline (data) processing and storage. More generally, people talk about the mobile cloud as the application of cloud computing principles (scalability, elasticity, etc.) to mobile networks and devices.

Lucy Setian (TCS Digital World) talked about the growing opportunities for mobile services. She focused on a service approach which combines the abstract concepts of “social, location and mobile”, and new near-field communication (NFC) technologies. NFC will provide mobile services with connectivity even without mobile network coverage; the technology is beginning to blur the boundaries between on- and offline. “You can be online even if you are offline,” she said.

Setian suggested that NFC would usher in a new generation of services, which would be particularly useful for a number of public-sector domains. The services described by Setian all used NFC to transfer data and information, which has been or will be processed somewhere in the cloud, to or from a mobile device. This essentially enables services to go beyond the processing capabilities of individual devices. Although NFC and these types of services create several regulatory issues regarding security and privacy, Setian thought solutions would be found over the next five years.

Uwe Herzog (Eurescom) summarised the results of a study which looked at the opportunities open to operators in the mobile cloud. The study started from the perspective that the adaptation of cloud computing to the mobile environment would make secure data access possible from anywhere at any time. At present mobile network operators (MNOs) are still unable to benefit fully from the growth in mobile access to cloud services. Although the use of mobile cloud services is increasing data traffic in mobile networks, the revenues of MNOs are shrinking as profits are being made elsewhere.

The Eurescom study recommended that MNOs form alliances, especially with developers, and provide access to the relevant network APIs so that developers could create unique and differentiating service. Operators should also make the most of their “assets” (such as customer proximity and trust) and support standardised solutions and standardised APIs for mobile cloud services. Finally, the study advised MNOs to review their existing pricing models for data plans and network usage.

Calin Curescu (Ericsson) took a much broader perspective. He argued that the idea of the mobile cloud goes beyond mere mobile access to cloud services; instead it would be

understood as an extension of the cloud infrastructure to the wireless world and mobile devices. But how do you create such a mobile cloud? First, Curescu suggested, the mobile cloud would have to span heterogeneous processing and storage locations – from classical large data centres via edge devices to mobile devices – and heterogeneous fixed and wireless networking infrastructures. Second, mobility often leads to connectivity problems and “lost” data, so the mobile cloud should support distributed execution of applications to fulfil the expected QoE/QoS levels. Mobile cloud applications will therefore require a compositional approach. Finally, if the mobile cloud infrastructure is to span multiple business entities, a variety of business tools (e.g. service descriptions, market places, revenue sharing) should be readily available.

Concluding the session, **Piotr Cieszyński** (ZETO S.A.) and **Jarosław Jackowiak** (IBM) gave an example of how mobile access to a cloud application can enhance the daily productivity of mobile workers.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=134

FIA session 2.2 – Research roadmap

Organisers/contributors: Nick Wainwright (HP Labs, EFFECTSPLUS project), Annika Sällström (TEFIS and FIREBALL), David Carter (Manchester Digital Development Agency), Amardeo Sarma (NEC and TDL Consortium), Jonathan Cave (RAND Europe), Bolesław Szymański (Rensselaer Polytechnic Institute), Julian Seseña (Rose Vision), James Davey (Fraunhofer Institute), Rahamatullah Khondoker (University of Kaiserslautern), Lucy Setian (TCS Digital World), Mikko Riepula (Centre for Knowledge and Innovation Research), Alfredo Sanchez (Spribo), Tonny Velin (ROSE Vision), Roberto Carlos Mayer (BRAFIP), Luis Cuellar (NESSI-MEX)

Session summary

Research roadmap review

Nick Wainwright (HP Labs, EFFECTSPLUS project) presented an overview of the FIA Research Roadmap. He noted that, in something as complex as the Future Internet – a socio-technical system of interconnected and interdependent systems – we have many overlapping roadmaps; simply combining these would not be very useful. How could some of the cross-cutting topics of Future Internet research be identified and highlighted? A four-part model (covering changes, vision, challenges and solutions) was discussed. Wainwright also noted that the research roadmap was based on a collection of contributions and that it was certainly incomplete.

In a panel session, **Annika Sällström** (TEFIS and FIREBALL projects and the European Network of Living Labs), **David Carter** (Manchester Digital Development Agency), **Amardeo Sarma** (NEC and TDL Consortium) each commented on the research roadmap document in its current form.

Annika Sällström: The roadmap provides a full view of the future internet (economy, technology, people and society) and discusses its impact and added value. It presents “an internet everywhere for everyone”, where users don’t even have to think about technology. Data is at the very core as a natural resource for the future. Like the living labs, which think a lot about innovation, the roadmap addresses the idea of the internet as a source for experimentation, risk taking and entrepreneurship.

Sällström noted that the issue of ‘control’ of the Future Internet was implicit in the roadmap, but perhaps it should be addressed directly. Control is related to security; the more we use and rely on the internet, the more we are at risk. At the same time, society is built on trust and perhaps we need to combine trust and control which leads to an important question: should there be only one internet or several? Perhaps there should be a “secure internet” alongside another internet with less security and which is less controlled.

Sällström looked at user-driven innovation and observed that the internet empowers users and individuals to get involved. The generation that is now aged 18-20 must be involved in helping to shape the future of the internet – these people have used it since they were born and don’t know what life is like without it.

Finally, Sällström raised the issue of governance – not just of data (which is covered in the roadmap) but also of the internet itself (which is not covered by the roadmap). As the internet becomes increasingly important and as more of society depends upon it, then governance becomes crucial. Who has the right to take decisions and control it, she pondered as she looked forward to the “borderless internet” – a dynamic environment without borders.

Amardeo Sarma: The research roadmap rightly puts people at the centre of the internet, enabling us to “build our own internet” with the access rights and the capabilities that we want, mirroring the way in which we separate our private, social, and public lives in the physical world. In a Future Internet, people should be able to retain their own “private spaces” and operate with multiple public identities. The internet is a complex environment, Sarma suggested, and as the Future Internet unfolds, users may need lessons on “how to drive” it. What resources are required to help people understand how to live in an internet-connected world? With the Future Internet our “social infrastructure” should not have to rely on a particular provider to be part of a community – we should allow people to build their infrastructures and communication themselves.

David Carter: In cities there are many challenges related to poverty, employment and social exclusion. The research roadmap recognises the importance of smart cities, but we don’t really need an “urban operating system” – we have one already, it is called “people”, he noted. Instead, what we need is an “urban open system” where people are very much at the centre. This open system would enable people and communities to set up their own networks. There is not a natural empathy or much understanding between the research community and the people who run cities, so it is important to work together to build that trust and understanding between these communities so we can build smart cities, he stressed.

Looking beyond smart cities, Carter called for three topics to be addressed in the roadmap:

- The built environment (e.g. intelligent buildings) – low carbon neighbourhoods should be explored further as an aspect of the Future Internet research.
- Engaging the younger generation in the Future Internet – the curriculum in schools gives no chance for young people to develop the kind of advanced skills needed for the internet age. We need to develop a new idea of “digital literacy”, from the age of five, which allows young people to be creative and innovative with the internet.
- Future science – we also need to look even further ahead, for example the roadmap has nothing about quantum computing. What about the “cyborg” ideas which seem fantastic now but some time after about 2020 people may be implanting digital technology in their bodies. What does this mean for the Future Internet? There needs to be some really “far out” future thinking in the roadmap.

A number of points were made by delegates which supported the idea that the research roadmap should look wider and address some of the new and disruptive technologies. It was also noted that the future of the internet will take place against a backdrop of resource constraints and sustainability concerns and that this should be reflected in the research roadmap.

Jonathan Cave (RAND Europe) observed that superstructures – human and organisational – are as (or more) important than infrastructures. We should be concerned that in an internet saturated with information we are not just having our behaviour profiled (a privacy issue) but also manipulated. Our human and organisational infrastructures need to reflect this; we must recognise that, for example, security and trust may not be efficiently discharged at the collective level. We should also recognise, Cave added, that Future Internet business models are not necessarily about making money. The business models of the past didn’t set out to be business models – they started out as things that we learned to do together. Perhaps by recognising this we will be able to develop future business models.

Bolesław Szymański (Rensselaer Polytechnic Institute) observed that we are not neutral to the technologies that exist and which we use. Children who have grown up with new technologies think differently because of their experience of new communications systems. People build new cognitive models, new trust models and new defences against manipulation. Szymański admitted that it is extremely difficult to predict these kinds of cognitive and behavioural developments – there are many feedback loops and interdependencies – but we will certainly see evolution, not just of the internet but also the ways in which people are willing to interact. We cannot predict these changes, but we can lay down a strong foundation and rules that encourage “good behaviours” and make “bad behaviour” difficult, he suggested. We can also encourage more research into how people use and are affected by the internet.

Finally, **Julian Seseña** (Rose Vision) pointed out that, as we think about smart cities in the future, we should take note of population movements and the ways we have moved to be closer to economic drivers (i.e. transport, jobs, industry); if we just focus on smart cities we may not be addressing the needs of people outside the cities. Perhaps we should talk about “smart societies, smart towns, and smart villages” and not just smart cities, he remarked.

Presentation competition – “Novel ideas”

Five presenters shared their novel ideas for possible inclusion in the Future Internet research roadmap. The most “thought-provoking presentation” was awarded an HP netbook computer.

James Davey (Fraunhofer Institute) introduced a variety of techniques for visualising the massive data sets which would be associated with the Future Internet. He presented two areas of application: visual text analysis for seeing the development and cross-pollination of news stories, and the visualisation of network attacks.

Rahamatullah Khondoker (University of Kaiserslautern, Germany) looked at how to engage and involve users in the shaping of the Future Internet; Rahamatullah argued that developments in Future Internet research should be driven by the needs of the end user, and that there should be a conscious effort to (a) elicit requirements from all classes of user, and (b) educate users about the possibilities and perils of the Future Internet. Rahamatullah’s presentation was awarded the prize at the end of the session.

Lucy Setian (TCS Digital World) argued that the impact of information and communication technologies on the workings of society had been extensively studied, but the converse has been largely ignored. In other words, the so-called “information society” that we have created has little say in the direction that ICT development takes shape. She posed various questions regarding the role of the EU citizen in the information society. Are citizens participants or observers? Are they activists or consumers? Do they drive change or demand it? She also suggested that in our technology-based society there is a fundamental trade-off between social welfare and profit.

Mikko Rieppula looked at the research possibilities for the development and standardisation of services. He spoke about the notion of service innovation, and how it is extremely difficult to design new services that will be profitable. There seems to be little effort to standardise services even though service innovation will be a fundamental in the Future Internet.

Alfredo Sanchez (Spribo) introduced the session to Spribo, a social knowledge platform inspired by social networking sites. The product (still in beta development) is trying to develop “knowledge communities”. More information can be found at www.spribo.com.

Latin America cooperation

The final part of the session was dedicated to the Latin America cooperation strategic research agenda. It highlighted a number of international cooperation opportunities between Europe and Latin America countries.

The FIRST project is a Support Action funded by FP7 to foster international cooperation between Europe and Latin America in the areas of Future Internet and ICT components. FIRST has set up Latin American Technology Platforms (LATPs) in Argentina, Brazil, Chile, Colombia and Mexico. **Tonny Velin** (ROSE Vision), the project coordinator of FIRST, said that Europe needs to engage in international cooperation so it can optimise its research priorities.

Representatives from two of the LATPs talked about possible cooperation opportunities.

Roberto Carlos Mayer, the president of the Brazilian Technology Platform (BRAFIIP), spoke

about the impact of ICT and the internet for government transparency all over the world. **Luis Cuellar**, president of the Mexican Technology Platform's thematic working group NESSI-MEX talked about Mexico's Future Internet vision and the opportunities for collaboration in his country.

Comments from delegates emphasised the need to establish good working relationships for collaboration and the importance of dialogue to ensure that research priorities were developed together.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=138

FIA research roadmap: http://fisa.future-Internet.eu/images/0/0c/Future_Internet_Assembly_Research_Roadmap_V1.pdf

Common EU-LatAm Future Internet Strategic Research Agenda: http://www.latin-american-technology-platforms.eu/uploads/FIRST-D4.3-Common_EU-LatAm_Future_Internet_Strategic_Research_Agenda_v1.0.pdf

FIRST Website: <http://www.latin-american-technology-platforms.eu/>

Regional LAMP Vision 2020 on Future Internet cooperation: http://www.latin-american-technology-platforms.eu/uploads/Vision-2020_Regional-LAMP-Vision-2020.pdf

National reports on potential areas for cooperation between Europe and Latin America in the field of Future Internet: http://www.latin-american-technology-platforms.eu/docs/FIRST_D2.1_National_reports_v1.0.pdf

FIA session 2.3 – International cooperation on testbeds

Contributors/organisers: Anastasius Gavras (Eurescom), Timo Lahnalampi (DIMES), Jacques Magen (FIRESTATION), Daan du Toit (South African Mission to EU), Halid Hrasnica (Eurescom), Sotiris Nikolettseas (University of Patras), German M Fajardo Muriel (Ohmtel), Michael Stanton (RPN, Brazil), Julian Sesena (ROSE Vision)

Session summary

The session involved short presentations from the speakers and a panel discussion moderated by **Anastasius Gavras** (Eurescom). Delegates heard an overview of the initiatives, programmes and projects related to the development of the Future Internet around the globe, with a strong focus on infrastructures for experimentation.

The session did not cover testbeds under development in the US or Japan because several recent events (e.g. the FIRE-GENI workshops and the EU-Japan symposia) have specifically addressed this topic and looked at the potential for links between the EU and these two nations.

Delegates who were new to the work of FIRE and the development of testbeds were informed that there are numerous infrastructures around the globe that can support Future Internet experimentation. These infrastructures may be interconnected to support global experiments where this is necessary and desirable.

Jacques Magen from the FIRESTATION project presented a full picture of the on-going interactions between projects in the EU other regions. He highlighted collaborations with groups from the US, Japan, Australia and South Korea.

German M Fajardo Muriel from Ohmtel, Columbia, provided insight into market developments in South America and emphasised the potential for Future Internet experimentation collaborations with South America. **Michael Stanton** from RNP Brazil remarked that Brazil is extremely advanced compared to other regions, noting that the EU recently published a joint EU-Brazil call for projects (such as the FIBRE project).

Continuing the geographic theme, **Philippe Cousin** gave a brief overview of how the MyFIRE project is collaborating with BRIC countries to develop international standards for testbeds.

Daan du Toit, Minister Counsellor of the South African Mission to the EU, demonstrated the market potential for Future Internet collaborations in South Africa. He asked the audience to consider Africa as a whole for partnerships in Future Internet experimentation. The continent has not been visible in European projects on experimentation, he remarked, although he hoped that this would change in the near future.

The presentations were concluded by **Sotiris Nikolettseas** from the HOBNET project who outlined the project's work on global testbeds for sensor networks, including relevant applications of IPv6.

Panel discussion

The session moved into a panel discussion between Andrey Ivanov (Russia), A Paventhan (India), Daan du Toit, Magen, Josep Martrat (Atos), Vasilis Maglaris (NTUA), and German M Fajardo Muriel.

The panellists agreed that, within FP7, cooperation with other regions is limited; it tends to take place via support actions. The participants called for more instruments to bolster collaboration and launch bilateral R&D projects.

The motivation behind these collaborations and the expectations of each participating region in a bilateral project must be carefully considered and agreed. If industry and SMEs are to get involved then the potential market opportunities and routes to market must be clear as business opportunities play a significant role.

In many cases it is useful for an organisation to act as a catalyst for interregional or bilateral collaboration. Sometimes industry leads, witnessed in many fruitful cooperation projects between companies in the EU and in BRICS.

The panel said administrations (e.g. Japan and South Africa) are already discussing the possibility of joint calls (such as the EU-Brazil call). Activities also already exist with other regions at a practical, working level, but more political support is needed.

The panel expressed its enthusiasm for joint activities and called for discussions between regions to speed up. The session participants generally agreed that negotiations and

discussions between national administrations / governments and the EU should be accelerated, although these top level talks are a prerequisite for successful bilateral programmes.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=142
and <http://www.future-internet.eu/home/future-internet-assembly/poznan-october-2011/s23-international-cooperation-on-testbeds.html>

FIRE: <http://www.ict-fire.eu>

FIA session 2.4 – Architectures

Rapporteur: Alex Galis (University College London, UK)

Other contributors: Theodore Zahariadis (Synelixis, Greece), Dimitri Papadimitriou (Alcatel-Lucent, Belgium), Bernhard Plattner (ETH, Switzerland), Paul Smith (University of Lancaster, UK), Laurent Ciavaglia (Alcatel-Lucent, France), Gerard Nguengang (Thales, France), Panagiotis Demestichas (University of Piraeus, Greece), Miguel Ponce de Leon (TSSG, Ireland)

Session summary

Alex Galis (University College London) argued that the Future Internet would require a new network model moving from just design guidelines and protocols towards a service-aware infrastructure. He explained that this new paradigm would require software defined networks and a move away from the KISS (“Keep it Simple, Stupid”) principle. “Today’s optimisation is tomorrow’s bottleneck,” Galis claimed. The alternative KII (“Keep it intelligent”) principle is fundamental today but tomorrow will become a secondary issue.

Galis presented the ITU-T Recommendation Y.3001 of April 2011 on Future Networks. The recommendation is defined by four objectives and 12 design goals.

Dimitri Papadimitriou (Alcatel-Lucent) presented the latest work of the FIAarch project which has analysed the design principles of the current internet and their taxonomy. He went on to outline the next steps for those working on Future Internet architecture.

Paul Smith (University of Lancaster) focused on the importance of network resilience and the work of the ResumeNet project. “Resilience is the ability of the network to provide and maintain an acceptable level of service in the face of various faults and challenges,” Smith explained.

Panagiotis Demestichas (University of Piraeus), meanwhile, argued for the design and introduction of a new management framework (UMF) for the Future Internet, as proposed by the UniverSelf project. Demestichas stressed the need for the use of autonomics in the Future Internet which touches on autonomics consolidation, unification, federation, governance, knowledge, and network embodiment.

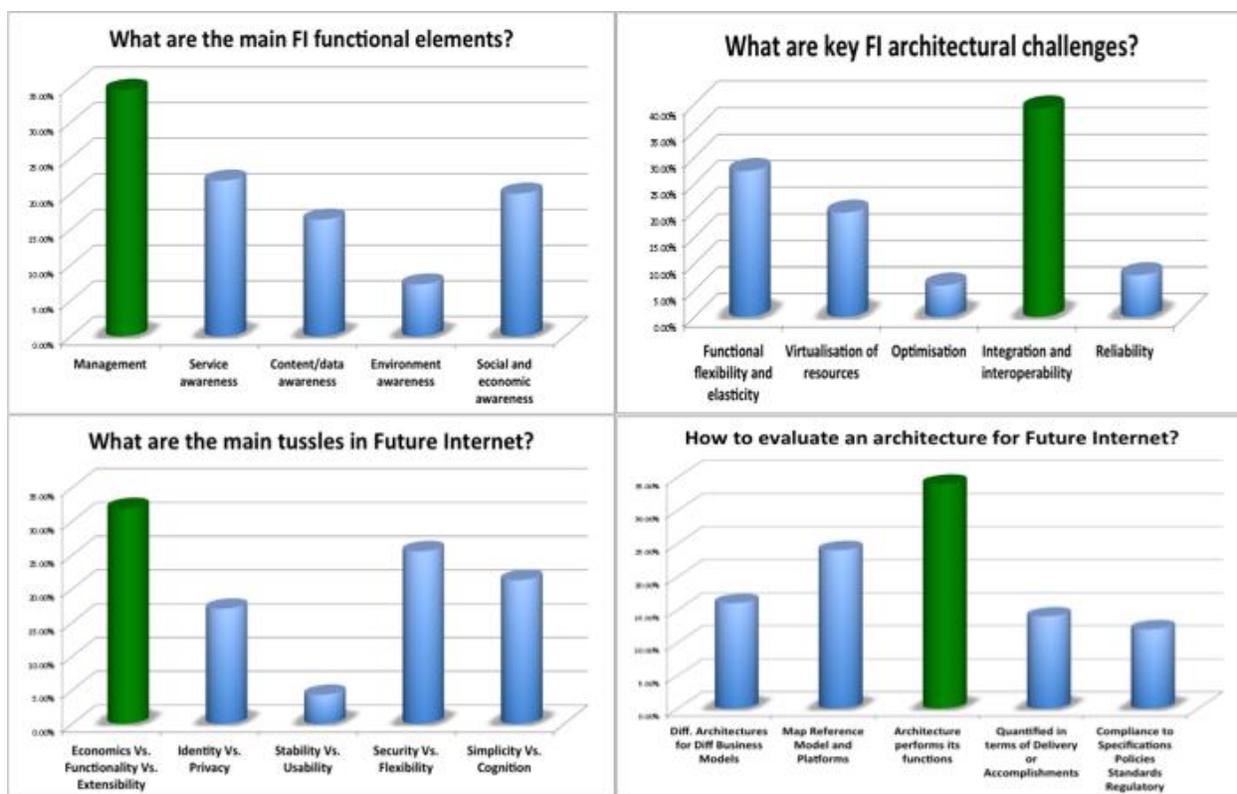
To conclude the session, **Miguel Ponce de Leon** (TSSG) presented some initial experiences on an implementing of RINA (Recursive Inter Network Architecture). He also highlighted the research opportunities and challenges for a full RINA implementation and validation.

The question and answer session looked at four aspects of Future Internet architecture, namely:

- the key design tasks in Future Internet R&D;
- the functional elements of a Future Internet and key architectural challenges;
- the main tussles;
- how to evaluate proposed Future Internet architectures.

Members of the audience were also polled for their position on these questions (results presented in the charts below).

The outcomes from this session will be used to develop a research orientation related to Future Internet architectural design.



Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=145

UniverSelf project: <http://www.univerself-project.eu/>

ResumeNet project: <http://www.resumenet.eu/project/index>

FIArch: http://ec.europa.eu/information_society/activities/foi/research/fiarch/index_en.htm

Recursive Internet Architecture (RINA): <http://csr.bu.edu/rina/> and http://ec.europa.eu/information_society/activities/foi/events/fiarch-23052011/8-20110523_design_principles_rina.pdf

FIA session 3.1 – Embedded systems for the ‘Internet of Things’

Rapporteurs/organisers: Irene Lopez de Vallejo (Tekniker IK4, Spain; ARTEMIS), Augusto Júlio Casaca (Instituto Superior Técnico and Inesc-ID, Lisbon)

Speakers: Luis Miguel Pinho (Instituto Superior de Engenharia do Porto (ISEP); CISTER Research Center), Pauli Kuosmanen (Tivit, Finland), Jose Manuel Hernandez Munoz, (Telefonica I+D), Sylvie Couronée (IIS Fraunhofer Institute, Germany)

Other contributors: Walter Buga (Smart Connected World, Huawei Technologies)

Session summary

Presentations

Luis Pinho (CISTER Research Center) introduced delegates to the ARTEMIS-funded EMMON project, which is exploring ways to monitor geographical areas using wireless sensor network devices. His talk looked at the communication and programming issues associated with large-scale networks.

Pauli Kuosmanen (Tivit) presented the SOFIA project (also funded by ARTEMIS), which is looking at how to link embedded information in the Future Internet. Kuosmanen discussed the problems of interoperability between devices from different domains and solutions for making available embedded information.

José Manuel Hernandez Muñoz (Telefonica I+D) described the latest work of Smart Santander, a project that is turning smart city concepts into reality, for instance by deploying a WSN infrastructure in the city.

Sylvie Couronée (IIS Fraunhofer Institute) concluded the project presentations with her talk about the LocON project. This project is developing a solution for controlling and monitoring large infrastructures. The LocON platform is currently being tested for monitoring people and vehicles in an airport.

Q&A and discussion

The session attendees generally agreed that life in our society, including our security and safety, will increasingly depend on embedded systems technology. These embedded systems will be like a neural backbone in the environment that will allow people to build a rich set of innovative applications. Future applications will take advantage of the communication primitives provided by the backbone infrastructure; these infrastructure connections are therefore strategic components for any smart environment (e.g. smart cities). Delegates also noted that despite all the ongoing research into embedded systems and on WSN, there are still major technical challenges that researchers need to solve, such as scalability, spatial and temporal data transfer in indoor and outdoor environments, battery life (or how to develop ‘everlasting’ power sources), systems security, privacy, and the cost of solutions.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=135

FIA session 3.2 – Linked data in the cloud

Rapporteurs/organisers: Manfred Hauswirth (DERI), Stefan Decker (DERI)

Session summary

This session looked into linked data and its relations with cloud computing, discussing and exploring trends and challenges in cloud computing. What can linked data do for the cloud, and what can the cloud do for linked data?

Erik Elmroth (Umea University, Sweden) outlined the state of the art in cloud computing, and described some future trends and challenges. He introduced different scenarios for multi-cloud infrastructure and service provision, illustrating his scenarios with examples.

Martin Bauer (NEC Labs, Germany) then discussed how services from different providers and their data can be linked by using cloud infrastructures. He emphasised the importance of user identities in bridging services.

Giovanni Tummarello (Digital Enterprise Research Institute, NUI Galway, Ireland) described some linked data ecosystems and how cloud computing infrastructures could support these ecosystems. He also described a 'linked data search engine', and specific challenges and technologies associated with the cloud that were used to implement it. He gave examples of how cloud infrastructures support the search engine.

The session was then handed over to the delegates who split into a number of groups to discuss aspects of the cloud, linked data and some possible applications of linked data in the cloud.

The group discussing data interoperability and cloud standardisation pointed out that linked data need cloud computing infrastructures to remain scalable, while cloud computing providers can use linked data to increase interoperability. The group also highlighted some possible action on standardisation and future opportunities for collaboration.

The group which focused on open linked data in the cloud and for enterprise concluded that there is an urgent need for standards and best practices regarding access control, security and trust of linked data. More focus needs to be put on linked data beyond public linked data, the group agreed.

The cloud management and infrastructures group discussed architectures and management issues in the context of cloud infrastructures. The group looked at how current and upcoming Future Internet projects could map these requirements.

A fourth group debated the composition of cloud services. The participants discussed model-driven approaches to services in the cloud. They acknowledged that formal modelling is extremely complex, but has a close relationship to standardisation activities.

Links and info

FIA session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=140

FIA session 3.3 – When infrastructure meets the user

Rapporteurs/organisers: *Petra Turkama (AALTO University), Ana Garcia (ENoLL AISBL), Cezary Mazurek (Poznan Supercomputing and Networking Center)*

Other contributors: *Anna Kivilehto (ENoLL AISBL), Herman Rucic (IBBT)*

Session summary

The session aimed to identify assets and priorities held in common between different Future Internet communities and explore how research, development and innovation projects can grow into sustainable businesses. **Petra Turkama** (AALTO University) represented the FI-PPP community, **Jarmo Eskelinen** (ENoLL vice president) spoke on behalf of Europe's Living Labs and offered an end-user perspective and **Cezary Mazurek** (Poznan Supercomputing and Networking Center) provided the viewpoint of the e-health community.

The presentations of the three speakers revealed several goals and priorities which these communities have in common, such as:

- the importance of the learning process;
- doing things differently in the Future Internet community to really trigger entrepreneurship and bring value to society and different areas of application;
- making failure acceptable, and a key aspect of innovation, but turning failure into learning and improvement;
- the need to work across programmes and communities.

Mazurek also suggested that e-health applications for the Future Internet could only be built if Future Internet researchers and health professionals work together. Infrastructure is the driving force which will bring innovation and innovative solutions to the users, he stated.

Also from the Living Lab community, **Pieter Ballon** (ENoLL secretary), brought three new ideas to the discussion:

- transforming user behaviour;
- crowdsourcing;
- developing new business models.

Federico Alvarez (FI-PPP community and INFINITY project) also emphasised the need for innovative business models. He described some of the links between technology and business innovation.

Jose Jimenez, coordinator of the FIWARE which is developing the core FI-PPP platform, emphasised the comments made by earlier speakers, arguing that we need to do things differently with more flexibility and openness and always accepting failure.

It is certainly a challenge to work with real users, whether e-health professionals, end users or citizens. The problems that projects were likely to experience were described by **Juliusz Pukacki** (pMedicine), representative of the e-health community, and **Annika Sallstrom** from the Living Lab community. These speakers talked about how researchers would have to deal with:

- individuals' idiosyncrasies;
- fear of new technology;
- regulatory aspects;
- the importance of ethics;
- respect for individual needs and demands (users cannot be controlled).

When working with people you have to take account of the chaotic aspect of societies and human beings.

Nick Wainwright, who is coordinating the development of the Future Internet Research Roadmap, highlighted three important points and challenges for the FI-PPP and Living Labs communities:

- for the technology suppliers: "tell us your plans";
- for users: "demand more, be specific, and tell us what you need";
- for everyone: engage with the community of developers because they are the ones who are really innovating with the infrastructure and bringing solutions to users – they are the vehicle for knowledge transfer.

Álvaro de Oliveira (vice chair ENoLL) described Smart Cities as the arena to bring together the Future Internet and the Living Labs community and brought up the view of the non-European community already using Living Labs as a tool for Innovation in the ICT sector.

Another important point raised in the discussion is the need for a platform to support the whole value chain (assisting developers, executing services, and helping to bridge the gap between sellers and customers). **Antonio Olivan**, representative of the FI-PPP usage area community, emphasised the importance of a platform that provides capabilities to deliver something useful for the end users.

Following an interactive discussion, it was concluded that the FI community needs to communicate better and to define concrete activities to build bridges among all the different players before starting to build results together and develop further.

Links and info

Session overview: www.fi-ppp.eu

Living Labs: www.openlivinglabs.eu

FIA session 3.4 – User in control

Rapporteurs/organisers: Andrea de Polo (Alinari 24 ORE spa), Nick Papanikolaou (HP Labs)

Session summary

Presentations

Andrea de Polo (Alinari 24 ORE) discussed cloud storage as an example of users being in control, citing several established cloud services including Apple iCloud, CloudMe and Adobe Carousel. He then presented some of the key features and benefits of these offerings, but suggested that some aspects of security and privacy hinder the wider take-up of these services.

Gianluca Ripa (CEFRIEL) explained that it is difficult to adapt online service offerings to resist the threats that exist and deal with the different actors that emerge dynamically in the internet as services are created and used. Ripa highlighted EXPO 2015 and INDENICA as examples of such services and associated events. He argued that we need to develop techniques for modelling goal-based requirements that can cope with users' needs.

Sofia Rute (University Lusófona) spoke about user-centric wireless loop services (ULOOP), and how user-centric networks are changing the way internet access is provided and costed/charged in the real world. She acknowledged that ULOOP raised some problems about trust, but presented an architecture that would help cope with these.

Finally **Amardeo Sarma** (NEC – TDL Consortium) discussed some solutions for identity management and suggested ways to make identify management more user-friendly and effective; he proposed a hierarchical model for trust and showed how this could improve identity management systems in the future.

Q&A session and panel discussion

The Q&A session highlighted two main issues raised by the speakers:

1. How do people use internet technology and the cloud (what is their behaviour, their access and their privileges)?
2. What can be done to address the concern that end users might have about usability?

The panel discussion explored several ideas that users might find particularly interesting, including events, online storage, personal content archiving, and the storage and presentation of memories. The panel tried to answer two questions:

What do you think about the trade-off between usability and security?

Responses from the delegates were wide ranging. Some people felt that security was too simple to implement, others thought that it was too hard. Some people felt that there were different levels of usability, but that there should be more information about, and user settings for, adjusting privacy and protecting personal data. Different levels of trusts for different usages/services/purposes should be available to the end user.

Generally speaking the audience agreed that it is important to think and provide more extensive and long-term user support and provide more options/personalised settings for the end user. But the big dilemma is whether this greater personalisation required users to be more educated before or during their online experience.

Why is Apple so unique?

Some people thought that Apple had top notch and unique designs, and cared about every single detail, from packaging to the final product. Others suggested that Apple really thought about usability from the perspective of end users and developed products that gave a truly unique experience. Apple is a vendor that has successfully turned products into status symbols and award winning objects.

The Q&A ended with a general consensus that iCloud and personalised access can work if trust and user privacy are guaranteed. Trust is the key to the latest cycle of technical development.

Links and info

Session overview: http://www.event.fi-poznan.eu/online/?view=session&session_id=144

Thank you to all contributors to this report and delegates attending FIA Poznan.

Mark your calendars for the next FIA in Aalborg, Denmark (10-11 May 2012)!