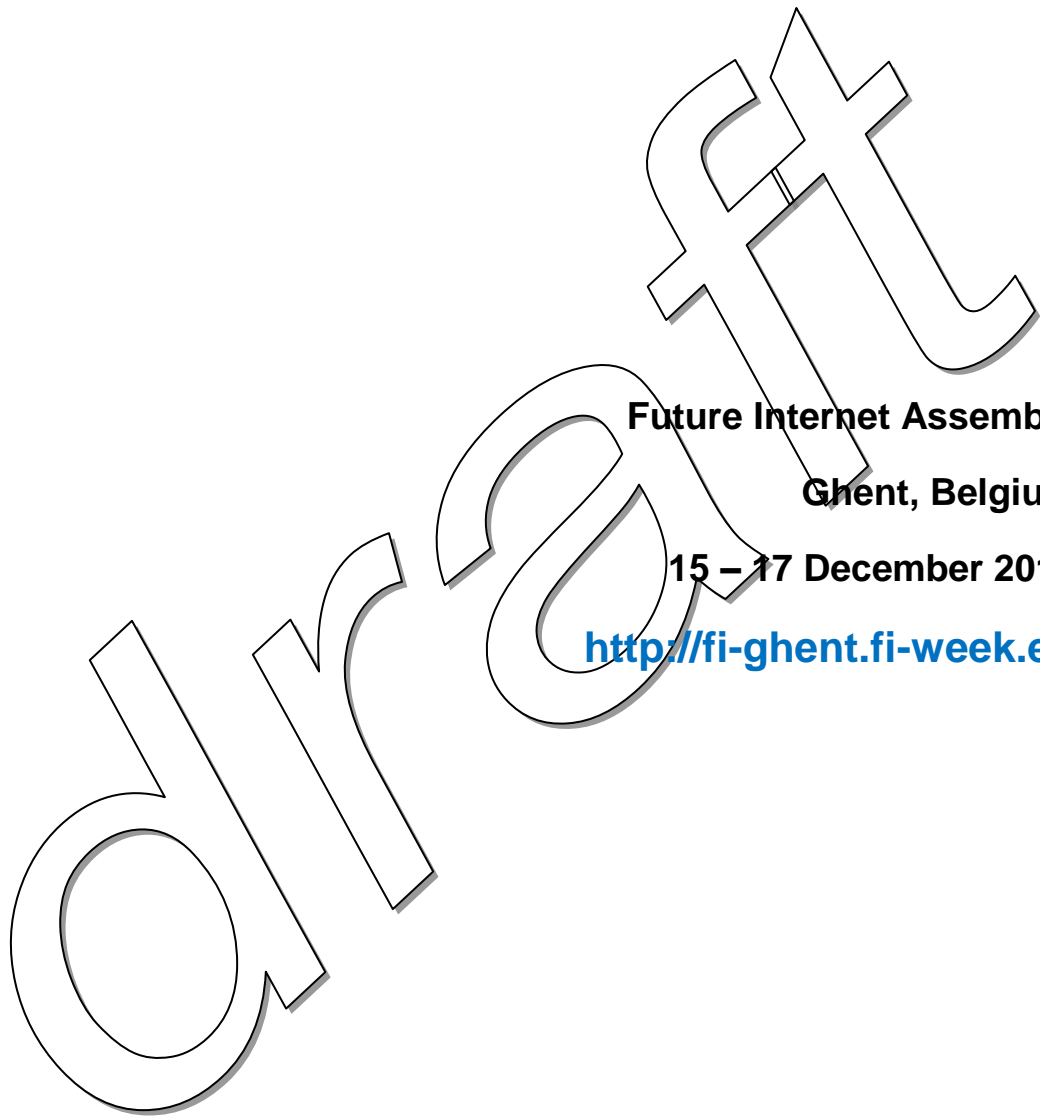




FUTURE INTERNET ASSEMBLY



Future Internet Assembly

Ghent, Belgium

15 – 17 December 2010

<http://fi-ghent.fi-week.eu>

Introduction

The story so far – FIA and the internet are growing up

If the inaugural Future Internet gathering and resulting 'Bled declaration' during the Slovenian EU presidency in 2008 marked the birth of the Future Internet Assembly (FIA), it is fair to say that the subsequent biannual congregations of major research actors in this field are the baptism, communion and lessons of 'internet life' all rolled into one.

Successful FIAs or related events in Madrid (also 2008), Prague and Stockholm (2009) and Valencia (earlier in 2010) have cemented the notion that greater foresight, understanding and preparation surrounding the Future Internet (FI) is not just a good idea, but a must for Europe in order to map out, meet and master the challenges thrown up as the internet reaches an all-important adolescence. Stakeholders now know that Europe and the world need to take a fresh look at internet basics like underlying design, infrastructure and management, but also address new and emerging internet challenges, including privacy, new media dimensions, security and robustness, energy consumption, wireless/mobility, quality of service, connectivity, speed and throughput, and more.

FIA in Ghent, 15-17 December, at the tail end of the Belgian presidency, was an opportunity to lay some ground rules for the potentially unruly adolescent to continue living in harmony with its family and community. As the internet enters adulthood, it will be a time for learning but also a time for some experimenting and innovating, and if the past nearly two decades have shown anything, the future will also be quite a ride, with all the usual hits, misses and in-betweens. Europe and FIA plan to be in the thick of it.

More information

Slides and presentations at FIA Ghent: <http://fi-ghent.fi-week.eu/slides>

Photos and videos at FIA Ghent: <http://fi-ghent.fi-week.eu/photos> and <http://fi-ghent.fi-week.eu/video>

Future Internet Week home site and next issue: www.fi-week.eu and www.fi-budapest.eu

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

Opening plenary welcome – Thursday, 16 December

Mario Campolargo, European Commission (Luis Rodriguez-Rosello, absent)

- Inspiration, incubation and innovation should be more present in FIA thinking, helping to reach the Europe 2020 vision
- Opportunities for a 'restart' where brilliant minds can cooperate on future developments and the Future Internet

Mario Campolargo of the European Commission introduced the policy dimension and provided a snapshot of the background behind Europe's initiatives and efforts relating to the internet. He said the Future Internet (FI) is an important part the EU's Europe 2020 vision of "smart, sustainable and inclusive growth". It is also part and parcel of the new Digital Agenda, which is driving EU efforts, among other things, to create a true single market for cross-border services, ultra-fast internet, and enhanced digital literacy. The Agenda is also keen to deliver a host of ICT-enabled socio-economic benefits, as well as better online security, interoperability and standards-setting, and to reinforce Europe's research and innovation in this field.

Whether it is the internet of things, the internet of services, or the traditional internet of people brought together in ever-more-creative ways, it is important that it helps European industry remain competitive, Campolargo suggests.

"The Digital Agenda is not just another document from Brussels, but a 'guiding piece' for all of us," he stresses.

"The Digital Agenda is not just another document from Brussels, but a guiding piece for all of us."

Mario Campolargo

Indeed, he suggests that the FI has something of a symbiotic relationship with innovation in today's economy in Europe, providing a "dynamic ecosystem" of small enterprises supported by venture capital funds and other small and young company incentives.

Looking down the road at future FIAs, he says strategies are needed to increase coordination efforts at the EU level towards reaching a broader critical mass, as well as to strengthen industrial leadership and policy-making towards this goal. He sees FIA playing a growing role in pushing the frontiers of R&D, to achieve what he calls "better cross-technology synergy".

Here, he emphasises the combined importance of the public-private partnership (PPP) initiative – which harnesses €300 million to mobilise resources to develop further the FI – and the FIA as a forum of discussion and coordination. A number of slides showed the growing momentum of FI research endeavours under the European umbrella.

There are 134 ongoing FI-related projects involving 690 (unique) organisations, ranging from

academia to small and large telecoms companies. Further details on the breakdown of participating organisations by country (Germany with the most, at 240) and the companies involved in 10 or more projects (Alcatel-Lucent and Telefonica in top spots) were presented.

Brilliant minds

On the tie-up between FIA and iMinds in Ghent, he notes that they "bring innovation and entrepreneurial spirit together with FI research" – in other words, a good match. This also fits well with the strategic goals of the FI PPP as it follows the general trend/demand for bringing research and innovation closer together. He feels the cohabitation is a chance to stimulate spillovers between diverse communities in this fast-changing domain, which will lead to "interesting fruit in years to come".

He speaks about European Technology Platforms (ETP) and how they have helped to galvanise the FI community, and that they, too, are having to evolve in line with this fast-moving sector which rolls with the changes in society, the economy, technology, and community dynamics.

FIA has come a long way since Bled, he says, including work on FI architecture, research road mapping and pre-standardisation, as well as efforts to disseminate its results, including books and reports. With every year, FIA is growing and maturing as it tackles new projects and challenges, and takes in more active participants. New support and coordination actions underway and others on the table, should reinforce this good work. He mentions the proposal for a stable steering committee and chair to look at FIA's longer-term goals and to help shape future events and working group themes as important means to reinforce FIA's ambitions.

He thanks the local organisers and delegates for attending and concludes: "Today will be a new restart for brilliant minds to cooperate on developments in the future and for the FI." Noble ambitions indeed.

Reminder of FIA's ambitions:

- Coordinate European efforts to foster cross-disciplinary innovation and creativity
- Develop the FI knowledge base in Europe
- Design and build the technologies and networking architecture for the FI
- Encourage collaborative business models and social network applications
- Create conditions for the development of innovation-friendly service-oriented architectures
- Ensure network robustness and create/foster online trust and security
- Develop capabilities for creating, sharing, searching and delivering new-media content
- Advocate the economic, policy and regulatory aspects of FI

Wim De Waele, Interdisciplinary Institute for Broadband Technology (IBBT)

- Ageing populations, fading resources, global pressures... how R&D can help
- How concrete and pragmatic actions can bring R&D closer to the market

It's not every day that your cleaning lady can give you the secret to surviving a stressful ordeal, but Wim De Waele is clearly not an everyday kind of guy. His cleaning lady says that the secret to pre-performance nerves – the sort he was suffering ahead of the first session at FIA Ghent, on 16 August – is to imagine the audience naked. It's an oldie but a goodie. And in the IBBT director's case, it worked.

With the ice-breaker over, he launches with the question: what role can information and communications technology (ICT) play in our society? Answering this question is partially why his organisation co-hosted the FIA Ghent in the first place, to share a vision with the Future Internet community, a vision that will help society meet some of the pressing challenges of today but also to provide a platform for good things to sprout from.

He cites several of the "enormous challenges", including the fact that Europe's population is ageing which has socio-economic and health services implications. He mentions that the economic growth model pursued by many governments worldwide is depleting the planet's resources, and that globalisation trends are ushering in uncharted cultural changes. These and other issues are also changing the media landscape that we live in, he suggests.

"Clearly, we have a lot of work on our plate," he says, "So, let's reflect on what R&D can do." He also speaks a little about what IBBT does to stimulate innovation in ICT, and how its overriding rationale is to promote pragmatic R&D that is close to the market and close to the needs of the people.

IBBT takes good, practical ideas all way to value propositions using world-class international research. Living labs are a key tool for doing this, he suggests, helping to build up the technology and know-how to support FI programmes, such as sensor networks. The idea is then to convert this knowledge into "real companies and socio-economic projects" that IBBT helps to support through seed and venture funds. "We take a market driven and pragmatic approach to our research," he confirms.

"The bonzai is beautiful but small... We tend to nurture them but not grow them... We do not create enough of these growing companies."

Wim De Waele

Several slides show the scope of the organisation and its efforts. IBBT has an annual budget of some EUR 30 million and more than 100 staff and 1000-plus researchers under its wing, 200 of which are funded directly.

IBBT's success, suggests De Waele, is a culmination of a number of actions geared towards

maximising the positive socio-economic impact of ICT research. These include making sure the end-user of a potential technology is involved in the development process from the beginning and focusing on projects closer to the market, thus evaluating the projects on both academic and technological merit. He also believes that lowering the barriers and administrative hurdles to greater SME participation in projects is a key success factor.

"Scientists are not auditors," he stresses. To illustrate the problem of red tape he shows a picture of a plant as a typical metaphor of company growth and potential. It looks like it could grow into a big, strong tree but the next slide is of a bonzai – the stunted Japanese tree.

"The bonzai is beautiful but small," he points out. "We tend to nurture them but not grow them," he concludes, citing a venture capitalist. Then to prove the point that big trees grow elsewhere, such as presumably in the States, he shows a picture of building-sized secoya. "We do not create enough of these growing companies." He mentions that several sessions at iMinds can help with this.

He also calls for concrete action to help seed startups in his home land of Flanders but also pan-European networks for this. To ensure Europe's research results make it to the market and become leading companies, we need to tackle market fragmentation and deal with the financing gap in Europe, he suggests, showing examples.

We can tackle these challenges, he says with an air of optimism, and the future could be bright. "But it will be competitive!" he cautions.



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Opening plenary keynote – Thursday, 16 December

Peter Hirshberg, entrepreneur, venture capitalist, futurist

- Innovation is not something you can prescribe... it thrives in a culture of 'emergent learning'
- Imagining a time when the internet of things is not just data but actually begins to create things, the next horizon of the internet

Today, films like *Back to the future* always look quaint and misguided. It's the same if you look back at what even the smartest minds on the planet thought the internet would become.

Now as we celebrate more or less the 16th birthday of the commercial internet, we can see how much it has changed and, as is usually the case, try once again to imagine what it will grow into. It is in this reflective setting that Peter Hirshberg, eminent thinker and doer in the internet-age, takes the floor of the FIA Ghent event on 16 December.

He shows some of the now seemingly hokey ways that some early internet players like Yahoo viewed their product, as a mass of 'pages' with the 'metric of metrics' at the time... page ranks. Now, says Hirshberg, it is about people, "you and your friends".

He remarks on a pre-adolescent period when the internet hit its mischievous 11th birthday, marked by the arrival of blogs. It is an example of how the community first takes a defensive pose until new understanding brings clarity and ideas on how the power of such innovations can be harnessed.

"First people wanted [blogs] to go away but now we think it's a good thing," says Hirshberg. Since then, the net has helped to elect a president. But, Hirshberg warns, the power cuts two ways, like the sourcerer's apprentice. And now we are asking what's next for the internet, what's out there beyond the people dimension? No doubt, it has changed how we live but also the fabric of value creation, the roles of government, entrepreneurship and much more. But how do we marshal this potential?

He goes on to explain some of his visions and experiences on where the internet is going. And apparently it's not going to be "all about us", the people who built and once inhabited this space. The internet will not be the sum of its human parts, as the number of internet addresses is set to far outstrip the planet's population. The exponential growth in sensors and transistors out there monitoring everything from appliances to individual health, taxi rides, biking habits, energy consumption and much, much more, it gives us an idea of what sort of a connected world we live in. "Anything that can be instrumented will be," he predicts.

It's a scale thing

The FI will not necessarily be measured by its scale but by the imaginations of its denizens and the exciting ways it can be interpreted for the benefit of society. In one of many short clips he shows during the presentation, he offers the example of an MIT application called 'Trans-trash' which tracks rubbish... yes rubbish! What the eminent academic institution learned was that the e-trash travels thousands of miles before being recycled, or indeed trashed. This gave insight

"We're in the middle of the social media boom but we have just begun to 'instrument' the planet and understand the scale of what we're doing.

Peter Hirshberg

into reverse supply chains, Hirshberg reveals. We see more mash-up examples like the Copenhagen snap-on bike wheel tracker which talks to smart phones, stores and shares information with city transport authorities on the scale and trajectories of bike use, which when cross-analysed gives detailed understanding of transport and environment. And a film on Hertz rentals' foray into electric cars, and how e-car

chargers in New York not only recharge the car but are hooked to the net, which gives much more real-time information about the status of the vehicle, the fleet, the nearest charge station, and even if it's already fully occupied. In San Francisco, an application for "shot spotting" is helping police track and home in on gun shots (using triangulation) and then match the gun signal (size, other known factors) with known offenders using such weapons.

He shows other applications like Nike's embedded sensors that record running data. It's a great business for the sport's apparel company, suggests Hirshberg, and it's leading to the idea that anything biometric can be tackled by the internet of things, from devices reminding you to take prescription medicine to drink bottles telling you to rehydrate.

It's a (future) internet of possibilities, and the opportunities are coming from the bottom up (demand-led) and top down (China's "chaotic pragmatism" towards internet innovation).

It's an internet of things, not just data. The next horizon of the internet is where the digital world actually begins to create things. "This will be a golden age for innovation," suggests Hirshberg, with ecosystems emergence, mash-ups, greater fault tolerance and systems security coming out of internet intelligence, and coming from the most unlikely sources (hacker and P2P communities) and with the least top-down investment.

He speaks about an event 'Hackathon' which asks the rhetorical question: "We love the wheel and we love the suitcase, but we are really interested in the guy who put the wheel on the suitcase." That kind of thinking is key. He cites (quite unlikely) sources of inspiration and users of internet apps, from the CIA's invoking of the idea of "emergently learning" to Lego's Brikiwiki which invites the users to help create future products. It saved the company.

He talks about important publications in the IT venture sector, how connections (people, things, networking events in San Francisco) are critical, and that ideas are only placeholders. "No product, no funding" is the rule of thumb, he suggests. He says early-stage investors like angels

"run in packs" and know within 10 minutes the potential of a venture and if they will back it. He mentions how weakness can become strengths, like Finland's primacy in lighting technology (i.e. it's a dark place), and that government can only really wax the surfboard not ride it for the entrepreneur. He shows films to illustrate this about MIT's "ready, aim, fire" approach to innovation (it's not a programme but a case of "social engineering" which does not separate work and place).

When it comes to the internet, the lessons never stop. He illustrates with a promotional film how far off the mark he and his early internet pioneer colleagues were 20 years ago when they first tried to envisage the 'future internet' back then.

"That's what the innovation process is like and the reason I'm so excited about all this new stuff we're playing with, that by allowing innovation to happen at the edge, we'll take advantage of it," he notes.

"That's what brings us here today... on the 16th birthday of the internet [which] is really in its infancy. We're in the middle of the social media boom but we have just begun to 'instrument' the planet and understand the scale of what we're doing. We created an environment where we have so many people, so connected and technically adept and creative that there are incredible ways of expressing and organising to build new value and do so globally and here in the EU, that I'm delighted to have spent some with you today to take a look at where we are and where we are going."



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Joint plenary – Thursday, 16 December, 17:00-18:15

Ben Verwaayen, Alcatel-Lucent, presenting the Future Internet 'business view'

- Need to free up knowledge "buried in all of us" through more cross-fertilisation
- So much money thrown at the old economy – how to convince the analogue society to "go digital"

Seasoned conference-goers know the last slot on any day is a tough one to draw a crowd, let alone keep them interested after a full day under their belt. So the CEO of Alcatel-Lucent was under no illusions that his job of presenting the FI business case would be a doddle. Indeed, he complimented the large number of delegates present on their endurance and clear passion for the industry simply by showing up for the 17:00 plenary session on day one of FIA Ghent.

Perhaps more likely, everyone present knows how important the business end is to the Future Internet, Verwaayen reflects as he comfortably paces the stage without notes or slides. But the only problem is you (the FI faithful) are not the people who need convincing... "you already know its important".

The most important resource in Europe, he continues, is knowledge and the continent's determination to use it for competitive advantage. But how can this best be done? The recipe for new competitiveness is relatively simple to explain but much harder to achieve, he says.

Look at the schools, research institutes, private companies, public agencies, etc., in Europe. They are massive and impressive, but if they're not linked up to start-ups, growing companies, etc, their relative value is diminished.

"We need to free up this knowledge," he stresses, with cross-fertilisation opportunities created at the "knowledge level" and institutional level. This means businesses working with public institutions in new dimensions, and different sectors 'cross-talking', where big business meets small business, government meets companies, and people meet people, he explains.

"The problem is most knowledge is institutionalised... behind closed walls and buried in all of us." We need more interaction to unlock competitiveness in Europe's knowledge-based economy.

What's needed?

While there is no silver bullet to achieve this, there are clear lines that should be pursued, believes Verwaayen. Investing in knowledge (education) is obvious but critical, and building more and better infrastructure which is broadly accessible, not just to city dwellers, is a good place to start. He asks how much this would cost, and puts forward the EU price tag of some EUR 500 billion over seven years as a fair estimate. But government funds aren't enough.

So, is private R&D funding out there in these tough times? Yes it is, according to Verwaayen,

but it's "waiting for the right opportunities". The next challenge, then, is to foster the right environment for innovation to propel European R&D to market, the right criteria to "free up the money", he notes.

He explains that the FI is not going to be about technology or design, but about the consumer and business models. "The consumer is king," he states, and he has chosen. The era of words is

"The era of words is now becoming an era of video and pictures... Go to Facebook and you can see it!"

Ben Verwaayen

now becoming an era of video and images. You only have to visit Facebook and you can see this happening. He speaks about changing paradigms and what content people are prepared to pay for and in what format. For example, we still pay to see films on the big screen and home screen (TV) but we're less keen to pay on the even smaller screens (PC and mobile).

This throws up sticky questions. How can we programme our customers into thinking about content and price? How can FI stakeholders be paid for investing in innovation?

Verwaayen's answer: "If we want to succeed [in this] and to enhance Europe's competitiveness (its fundamental market-driven approach), we need to understand how to work together to bring value to life," he says. The issue is to "convince an analogue society to go digital" because at the moment so much funding is wasted on the old economy. But this is something for further debate, he concludes before passing the floor over the Constantijn Van Oranje Nassau to present the 'government view' of the FI, stepping in for Neelie Kroes who could not be present.



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Constantijn Van Oranje Nassau, for Digital Agenda Commissioner Neelie Kroes, presenting the Future Internet 'government view'

- R&D focused on “science for society”, “science for competitiveness” and “science for science”
- Europe needs to be in the driver’s seat of FI developments to tackle such issues as privacy, security and socio-economic challenges

Constantijn Van Oranje Nassau stood in for Neelie Kroes who was drawn away on Commissioner duties to the United States. In a video message to the FIA she underscores the importance of the Digital Agenda and how the internet plays a pivotal role in helping Europe achieve its ambitious goals regarding the knowledge society, and in delivering sustainable, smart and inclusive growth through to 2020.

Van Oranje Nassau says that it should come as no surprise that, due to economic crisis, public spending is under considerable scrutiny. But he underlines that innovation is the key to long-term recovery, according to the Commission. But while this is obvious to the FI community, it is not obvious to Member States which are having to tighten their belts. This means future research programming – looking down the road towards the next Framework Programme beyond 2013 – must deliver the highest possible return at the lowest possible cost.

He speaks openly about the shortcomings of the current Framework Programme (FP7, 2007-2013) in meeting the aims of the ‘Europe 2020’ strategy. It needs to be simpler with clearer goals focused on the links between research and concrete outcomes, he suggests.

To this end, R&D should concentrate on meeting socio-economic challenges (“science for society”), helping to achieve industrial leadership in key technologies that underpin innovation and growth across the economy (“science for competitiveness”), and further strengthening scientific excellence (“science for science”).

It’s an open question how the instruments can be changed to meet these goals, but the “consensus is that we need to avoid fragmentation, and that access to funding and administration should be simpler and less costly”. He speaks about a “trusted environment for public research funding” which implicitly accepts that there are risks involved in R&D, especially for ‘blue sky’ and ‘disruptive’ ideas which are part of the FI terrain.

It can be expected that the next framework programme will fund constellations of projects in a focused programme developed by partnerships with major stakeholders. This initiative will build on the lessons learned and bring improvements to instruments like the Public Private Partnerships (PPP) and Joint Technology Initiatives (JTI). This will be complemented by an “open, light and fast scheme” that can capture new trends, meet capacity needs, nurture skills and talent, and help get research and technology to market (through pilots and tests), so that there is wider uptake and better use made of the R&D investment. It is important that the FI community organises itself and starts developing research roadmaps to meet these challenges.

He stresses that the Commission needs no convincing that research funding for the internet is vitally important. Citing Commissioner Kroes, he says Europe “needs to remain in the driver’s seat of Future Internet development” to preserve the values Europe holds dear, and address issues like privacy, security and socio-economic challenges.

We need to communicate the value of these to the community, he says. And for this, the Commission looks to the FIA to get the message out, to help overcome the bottlenecks and obstacles holding FI back – fragmented and duplicated R&D effort, a lack of innovation and investment in riskier R&D, too much red tape, lack of standards-setting, etc.

“With the Digital Agenda and the Innovation Union, we will try to diminish these obstacles. Our main response in [this] area is the Future Internet PPP, and related initiatives on smart cities and smart care,” he notes. With the PPP, the Commission has several objectives:

1. To take novel internet application opportunities to reposition our industries and innovators as prominent actors in the internet of tomorrow. “There is no point in playing in the second league.”
2. To bring the innovations and the benefits of the internet of tomorrow straight to citizens, which is why public application domains are so relevant.
3. To ensure that profound European values like privacy and transparent governance are embedded in the design of the next-generation internet.

“I believe in you [the FIA] and your abilities to keep the ‘Future Internet’ at the top. You are making Europe’s prosperity possible and you have my full support.”

Neelie Kroes

The PPP will not start from scratch. It will build on initiatives like Stockholm whose smart tolls cut traffic by 22% and CO₂ emissions by 20%, and boosted public transport use by 40 000 user, Amsterdam’s smart energy delivery system, Nice’s intelligent waste disposal systems and Rome’s and Paris’s smart transport solutions.

These experiences need to be scaled up to European level and complemented by the forward-looking research results of the FIA, Van Oranje Nassau believes. He mentions the debates that are taking place during this FIA provide very interesting ideas for future research and innovation, but warns that, while such debates are useful, they are not ultimately enough. The talk needs to be galvanised into a coherent vision which convinces governments to continue to invest in this important field.

“I hope this inspiring conference has helped to step up efforts in this direction,” he concludes.

FIA plenary closing session – Friday, 17 December

Against the scenic and snowy backdrop of Ghent, which combines picturesque medieval architecture with cutting-edge knowledge and science, the FIA gathering came to a close on Friday afternoon. During lunch, participants got the opportunity to reflect over two packed days of inspirational and enlightening debate on the Future Internet's present challenges and future possibilities, then it was on to the final plenary to grapple with some complex and tricky questions, such as how do you define, let alone protect, online privacy, and whether there was any value in integrating social values into internet architectures.

Fundamental issues of the Future Internet that took place in meetings supported by Eiffel support action

Dirk Trossen, Cambridge University

- Eiffel seeks to create a pan-European community and dialogue focused on challenges related to the Future Internet
- Future Internet community willing to invest in Eiffel even after EU funding ended

Gustave Eiffel is undoubtedly one of the legends of modern engineering, with the spectacular Eiffel Tower in Paris among his most famous works. It is hardly surprising that Eiffel has inspired generations of engineers and designers, including those developing computer systems. In fact, one of the most versatile object-oriented programming languages is named after him.

Similarly inspired, the EU-backed Eiffel project seeks to create a European dialogue among scientists and technical experts – through the establishment of a pan-European community – that will lead to cooperative exchanges relating to the engineering and evolutionary investigations for the future networked society.

Dirk Trossen of Cambridge University's Computer Laboratory introduces Eiffel to the audience and explains how it functions, its structure and the issues it deals with. "Eiffel tried to establish an international community and the project organised meetings for this growing community," Trossen explains to the assembled audience.

To illustrate just how international and diverse Eiffel's membership has become, Trossen fires off an impressive list of members which included MIT's David Clark, UCLA's Lixia Zhang, Jörg Ott of the Helsinki University of Technology and BT's Bob Briscoe.

Finding ways to ensure the post-funding survival of the network was among Eiffel's implicit aims. "There's a hidden objective behind Eiffel, if you will: is such a think tank sustainable without funding and will people invest their own time and money? The answer: yes, they are!

In its efforts to promote dialogue and map the challenges ahead, Eiffel has been facilitating regular debates between its members. Some of this debate has been summarised in a 2009 White Paper. “We have been trying to get community members to formulate precisely the challenges and disagreements we face,” emphasises Trossen.

To demonstrate and illustrate the kind of debates undertaken under the auspices of the think tank, Trossen introduces two debates in the “disagreement” format favoured by Eiffel. The first debate relates to online privacy issues, while the second focuses on whether specific social or moral values should be embedded into internet architectures.

“We have been trying to get community members to formulate precisely the challenges and disagreements we face.”

Dirk Trossen

More information

Eiffel project: www.fp7-eiffel.eu

Eiffel FI White Paper: http://www.fp7-eiffel.eu/fileadmin/docs/Report_TT2008.pdf



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Debate 1 – Privacy in cyber society: lost forever or a contextual interpretation aided by technology?

- Privacy must be protected to ensure that internet users trust the web enough to engage in business, social and civil interactions
- Given the information stored about us in various databases, online privacy is compromised at one level or another. The question is who do we trust with the safeguarding of this private data?

The first debate saw MIT's Karen Sollins and Rui Aguiar of the Universidade de Aveiro lock horns on the issue of online privacy, and whether it is an issue worth protecting or a quaint artefact of the past.

The two speakers consider what privacy actually means in today's 'cyber society', whether it can be protected and enforced or whether it has been lost forever. By delving into these issues, the debate fleshes out the technological and societal difficulties related to this question.

Karen Sollins, Massachusetts Institute of Technology (MIT)

In the pro-privacy corner, Sollins begins by attempting to define privacy. "Privacy is about identity. It is about a set of attributes or claims about a person or entity," she explains. "There is a separation between inherent or assigned attributes. It is important to remember that privacy is not about complete isolation. We wouldn't have the internet if we wanted to live in complete isolation."

Sollins then outlines some interesting attributes of privacy. These include:

- Identification: name, ID no, address, etc.
- Authorship: linking identities to resources
- Communication: who am I communicating with and can this be tracked?
- Usage: objects, services and other resources used

Sollins then considers whether or not we could afford not to have privacy by imagining what a world without any privacy would be like. "In the case of complete exposure and lack of privacy, others would be able to replicate my various attributes and pretend they are me," she describes. "This would shake business confidence, because it would be impossible to know who's signing transactions and contracts. In addition, lack of privacy would limit and compromise freedom of thought and freedom of association."

Sollins considers the ramifications of the absence of privacy for the four areas identified above. When it comes to identification, it would lead to invasions of privacy and the failure of business

relations. In terms of authorship, it would cause the failure of legal contracts and compromise freedom of speech when it comes to communication.

“If online privacy were not possible, this would mean that there would be no commercial, social or civil substrate,” she suggests. “In the absence of privacy, we’re likely to see ‘walled gardens’ developing, where those on the inside are well-protected and excluded from those on the outside.”

“If online privacy were not possible, this would mean that there would be no commercial, social or civil substrate.”
Karen Sollins

So, paradoxically, in order to ensure that the internet remains an open and public place in which people are confident to share information, it must also be able to protect the privacy of users effectively and robustly. “We can never provide perfect privacy. Privacy is not about complete hiding; but controlled sharing with enforcement,” explains Sollins.

This, of course, raises the question: at which level of architecture should we integrate privacy dimensions? According to Sollins, the transport level is well-protected through sophisticated encryption of packets, protecting at this level, she suggests, would lead to those exclusive ‘walled gardens’, so the optimal level is to integrate privacy into applications.

Rui Aguiar, Universidaire de Aveiro

Rui Aguiar of Aveiro University’s Institute of Telecommunications in Portugal presents a contrasting argument to that of Sollins. “It is clear that privacy is a social concept. It is a political term that is not so clearly defined,” he believes. “Notions of privacy differ from one society to the next, and from one generation to the next, so how do we translate a requirement that is not clear into a technology that has not been developed yet.”

Observing that technology is “law neutral”, he notes that there are social, economic and technical costs associated with providing privacy services, especially if they are really complex and flexible.

Suggesting that online privacy has something of the illusory about it, he explains that our internet privacy is already quite compromised: “Privacy will be broken. It has to be broken. It is broken currently.” To illustrate, he describes how networks undertake a huge amount of background measurements of which the user is generally unaware, such as indexing by search engines, and these are effectively a breach of privacy. “Lawful intercepts are also invasions of privacy,” he adds, as are all the databases containing our private information held by service providers and governments.

Aguiar also points out that many people will voluntarily compromise their own privacy in order to customise their online experience. “Sometimes people don’t want the world to be private but to be personalised. Many people want to have whatever information they need to be available when they need it, automatically.”

Then there is the question of who has the right to privacy and who decides this. As an example, Aguiar poses the hypothetical question of whether teenagers have the right to online privacy from their parents or whether parents have the right to access their children's online information and know their location and, if so, to what extent.

Aguiar stresses that he is not against online privacy but realises that someone, somewhere will always have access to your online information and so the question relates to whether or not we trust these parties. "We want to develop a privacy architecture that provides us with privacy, except for certain parties at certain times. If we can agree on who should oversee privacy and access our information without us knowing, then we can design such an architecture," he concludes.

"Notions of privacy differ from one society to the next, and from one generation to the next, so how do we translate a requirement that is not clear into a technology that has not been developed yet?"

Rui Aguiar



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Debate 2 – Should specific values be embedded in the internet architecture?

- Societal values are, by their nature, subjective while internet architectures should be ideologically neutral
- Universal and fundamental values should be integrated into internet systems to help protect and uphold them

The second debate saw Leslie Daigle of the Internet Society (ISOC) take on Ian Brown of the Oxford Internet Institute on the question of whether or not specific values should be built into internet architecture. The question of how neutral or value-specific internet technologies should be represents one of the most controversial issues in the Future Internet debate.

Should a network's architecture incorporate inherent values that have been widely accepted through societal debate or should it be adaptable once deployed to a wider range of stakeholder values, and against the backdrop of an ever-evolving societal context?

Leslie Daigle, ISOC

The Internet Society's chief internet technology officer, Leslie Daigle, argued that the systems on which the web runs should be ideologically neutral territory. "The internet architecture should not be expected to reflect or support a particular value set however robustly debated," she asserts. "Architecture should be agnostic to societal values."

"Architecture should be agnostic to societal values... Aligning an architecture with a value system is problematic because values are not absolute or universal."

Leslie Daigle

She believes this is necessary because values are, by necessity, subjective, and differ from place to place and from one time to another. "Aligning an architecture with a value system is problematic because values are not absolute or universal. Even those recognised as 'universal' are interpreted and viewed differently

in different places," Daigle observes. To support her case, she cites the example of how, despite the general acceptance of the notion of freedom of information in western democracies, Wikileaks has elicited such controversy and conflicting opinions.

Daigle also holds that trying to shoehorn values into the architecture is not only akin to forcing the square peg through the round hole because systems evolve more than they are designed, but it could also act as a brake on innovation. "Generative technologies mean that the properties of the network and its uses are emerging. They are not defined in advanced nor particularly controlled," she notes. "Is this a bug or feature? It is a feature because it allows adaptation and innovation."

This is the internet's strength which also makes it somewhat anarchic: "The power of 'generativity' opens more futures and supports more realities than can be captured for enforcement through any given architecture."

Daigle is not against the presence of societal values online; her objection relates to integrating them into the core systems. "I'm not saying that the use of the internet should be value-free. I just don't think that it should be built into the architecture, which should be value neutral," she asserts during the Q&A session. "[A value system] should not be built into the operating system or other architectural building blocks, it needs to be integrated into the experience level," she believes.

"Key constitutional protections should be extended into the technological domain as a way to strengthen the upholding of these rights."

Ian Brown

Ian Brown, Oxford Internet Institute

Ian Brown – a senior research fellow at the Oxford Internet Institute whose work focuses on public policy issues such as privacy, copyright and e-democracy – began his defence of integrating fundamental societal values into internet architectures by describing the online tussle between different interests groups.

"On the privacy side, we've seen problems regarding privacy between governments, even liberal democracies – who have been collecting more info for national security issues, such as counter-terrorism – and their citizens," he reflects, referring to the Patriot Act in the United States and the EU's Data Retention Directive.

In addition, debate on online freedom of expression is almost as old as the internet itself, he notes. Then, there is the question of freedom of information. "The internet facilitates access to information globally, but do governments want this?" he poses to the audience. The examples he cites – such as US attempts to limit online obscenity, the so-called Great Firewall of China and the disconnecting of Burma/Myanmar from the outside world during the monks' protest – would suggest that many governments are uncomfortable with this increased freedom.

Despite these polarised debates and in a world where fundamental freedoms are under threat, Brown is of the view that integrating universal values into internet architecture can help protect and uphold them. "Key constitutional protections should be extended into the technological domain as a way to strengthen the upholding of these rights. Technologically, this involves designing for privacy," he argues.

According to this outlook, fundamental freedoms – such as freedom of expression, association and thought – are best protected by ensuring that internet architectures collect and retain the minimum possible amount of personal data. Brown also argues that protecting these freedoms means regulating the production and consumption of data rather than its distribution.

“Technology may appear neutral but it often has enormous societal and cultural impact,” he concludes, citing how the Gutenberg printing press unintentionally helped to democratise knowledge.

Future Internet Awards

Joan Batlle i Montserrat of Barcelona City Council was on hand to announce the lucky winners of the Future Internet Awards. “The quality of the entries was very high and diverse which made choosing a winner very difficult,” he notes before tearing open the envelope containing the victorious projects in the awards’ two categories.

The EU-funded project Pan-European Laboratory Infrastructure Implementation (PII or PanLab www.panlab.net) won the prize for best ongoing initiative. PanLab is developing large-scale testing facilities in the communications area by implementing an infrastructure for federating testbeds.

The award for best initiative that is about to start went to Strategic Research in Advanced Geotechnologies (StratAG) which will study mobile spatial interaction in the Future Internet and in the internet of things.



FIA session I and VI – Linked open data

Rapporteur: Stefan Decker

Session objectives

The 'Future Internet architecture' does not currently include means to achieve interoperability at the level of data. Perhaps this gap can be filled by existing technologies. For instance, Linked Data, based on W3C standards, is becoming an accepted way of exchanging information in an interoperable and reusable fashion. This is strikingly illustrated by the dramatically growing Linked Data cloud (<http://linkeddata.org>) encompassing more than 25 billion interconnected facts.

Linked Data is built round a strong European community consisting of industry, academia and the public sector (such as in the UK) which is recognising its importance for data publishing on the internet.

Linked Data is currently emerging as an independent layer – on top of the networking layer, but below the application layers – in the internet architecture but it should become a fundamental building block of the Future Internet.

Given the growing importance of Linked Data, now is a good time to discuss how it can be built into the Future Internet architecture stack, together with other architectural components. Ideally, this integration should extend networking interoperability towards data interoperability, making it possible not only to transmit data seamlessly, but also use it in new and innovative ways. It also cuts across many other issues, such as interoperable services, trust and security and search, since entire new applications are enabled or enriched by Linked Data.

These two sessions had the following objectives:

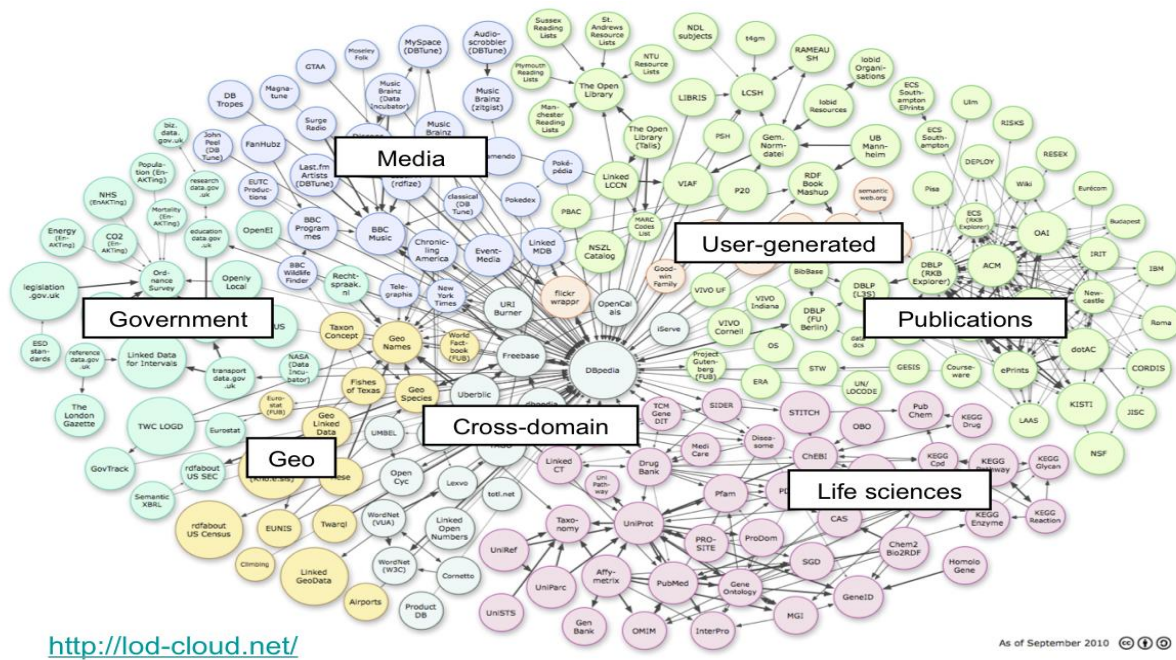
- **Education:** the session introduced the Linked Data concept to people working in other parts of the internet architecture
- **Interconnection:** the session sought to identify interconnections between Linked Data and other parts of FI architecture.
- **Community building:** Setting goals for joint contributions to the Future Internet

Presenters	Title	Organisation
Stefan Decker	Linked Data and the Future Internet architecture	DERI, NUI Galway (IE)
Tim Berners-Lee	Linked Data as a network layer	World Wide Web Consortium, MIT (US)
Soeren Auer	DBPEDIA and Linked Data	University of Leipzig (DE)
Vassilios Peristeras	From open to linked government data	European Commission, Informatics Directorate-General (BE)
Thomas Steiner	How Google is using Linked Data	Google (DE)

	today and a vision for tomorrow	
Peter Mika	The role of Linked Data in search and online media	Yahoo! Research (ES)
John Domingue	Linked Data and the Internet of Services	KMi, The Open University (UK)
Jose Manuel Gomez-Perez	Trust and Linked Data	ISOCO (ES)
Mirko Presser	Real World Internet, Smart Cities and Linked Data	Alexandra Institute (DK)
Dennis Pfisterer	FIRE and Linked Data	Institute of Telematics, University of Luebeck (DE)

Stefan Decker, *Linked data and the Future Internet architecture*

The introduction by Stefan Decker stressed the need to make information on the internet more easily process by machines by highlighting the fact that online information cannot be adequately exploited, since aggregation is a manual process. To create a true knowledge society, cheaper ways to combine and deploy available knowledge is necessary. He then went on to speak about whether the Linked Data concept could help to make data interoperable.



Linking Open Data cloud diagram, by Richard Cyganiak and Anja Jentzsch.

Figure 1 Linked data cloud

Although Linked Data is used in many practical applications and also in Future Internet developments, it has not yet recognised as being a core component of the Future Internet architecture.

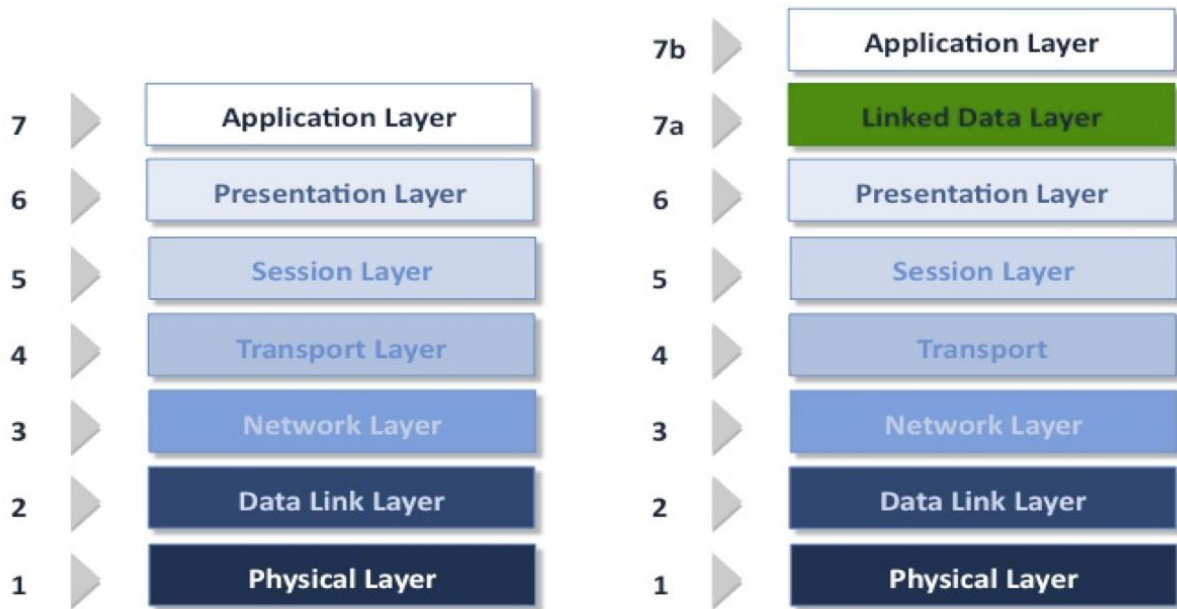


Figure 2 Linked data layer

Therefore, Linked Data's relationship to the emerging Future Internet architecture needs to be clarified – one possibility (proposed in this talk) is that Linked Data is set up as a new layer in the internet architecture. This may be conceptually visualised by introducing a new layer in the ISO/OSI mode, although it needs to be stressed that this by now means endorses or requires the ISO/OSI technology stack. The graphical visualisation above highlights the need to clarify the relationship between Linked Data and other (not necessarily depicted) parts of the Future Internet architecture.

Tim Berners-Lee Linked data as a network layer

This talk by Tim Berners-Lee, father of the web and director of the World Wide Web Consortium, focused on introducing Linked Data as a networking layer and explained some of the underlying mechanisms and benefits.

- Linked Data abstracts from documents
- Allows mixed vocabularies and information from many different communities
- Decentralises development of ontologies and cost sharing among the internet community, with a boundary cost of zero for average users
- Scales from small heterogeneous information providers to large communities and data sets
- Can integrate the available information and knowledge with low effort

The talk concluded with some of the necessary infrastructure building blocks and examples of novel applications.

Soeren Auer, DBpedia and Linked Data

This talk by Soeren Auer from the University of Leipzig, initiator of the DBpedia project, introduced the rationale, current status and plans for DBpedia, one of Linked Data's largest repositories.

DBpedia was inspired by the availability of structured information on Wikipedia and currently contains 3.4 million descriptions of entities with more than 1 billion items of information. As such, it has become a central interlinking hub on the Linked Data web. It has also enabled the integration of other datasets.

The talk concluded with some proposals for integrating Linked Data into the Future Internet architecture:

- Domain name systems and HTTP/HTTPS should become distinguished protocols, while the resource description framework (RDF) should become the *lingua franca* of the Future Internet architecture
- Everything should be identifiable through internationalised resource identifier (IRIs). All IRIs should have an associated resource description in some RDF serialisation. All IRIs should be 'de-referencable'

Vassilios Peristeras, from open to linked government data

This talk by Vassilios Peristeras from the European Commission presented current efforts within the EU to establish interoperability using linked government data. He focused on some of the motivation for moving from documents to datasets, and especially linked datasets: accessibility, discoverability, cross-referencing, handling and costs, as well as the reusability of public data.

However, a number of unresolved issues remain, such as the publishing, querying and browsing of Linked Data, vocabulary management systems, and URI management systems which are currently tackled disparately.

Thomas Steiner, how Google uses Linked Data and its vision

Thomas Steiner from Google highlighted some of the challenges that web search and data deployment currently face and possible solutions to them. Google is currently using a resource description framework (RDFa) and Microformats mark-up to provide structured "rich snippets" for Google search results.

The volume of search results with rich snippet impressions (using information from RDFa and Microformats) quadrupled between October 2009 and June 2010, but is still small compared to the overall size of the web.

Steiner added some private thoughts on how searching and the internet architecture may develop, such as towards presenting aggregated search results and content-centric networking using Linked Data.

Peter Mika, the role of Linked Data in search and online media

Peter Mika presented Yahoo's position on Linked Data. For Yahoo, search is much more than just links, it is also about providing answers. Yahoo's SearchMonkey solution was the first system which sought to create an ecosystem of publishers, developers and end-users.

The deployment of RDFa leads to a better user experience, Mika noted. From September 2008 to October 2010, the percentage of web pages with available RDFa data grew from almost none to 3.5% of all pages. As a next step, Yahoo is aiming to create a content optimising knowledge engine, integrating various information sources and media content within and outside Yahoo, providing a much improved user experience by enabling hyper-local results, machine learning, and context.

John Domingue, Linked Data and the internet of services

John Domingue from the Open University's Knowledge Media Institute presented the position of the internet of services community on Linked Data. Internet services are defined as Linked Data, which consume and produce RDF and establish a process layer on top of the web of data.

Domingue explained how a variety of efforts are creating infrastructure for Linked Services. Possible description mechanisms for services include MicroWSMO and WSMO-Lite, SOA4all supports the process lifecycle, Envision provides support for linked open services, with a special focus on environmental services. The Ponte project, for example, is studying the process of discovering and integrating data sources on-the-fly in the medical domain.

Jose Manuel Gomez-Perez, trust and Linked Data

Jose Manuel Gomez-Perez from SOCO explained how Linked Data can contribute to supporting trust in the Future Internet architecture, but also highlighted that trust mechanisms are necessary for the vision of Linked Data.

Recoding provenance is key in many domains, he stressed, and this means the recording of sources of information, including entities and processes, involved in producing or delivering data, as well as keeping a history of subsequent owners (chain of custody).

He noted that establishing provenance was necessary so as to establish trust to clarify author/attribution, manipulation, access, and verification. Provenance metadata can be

published on the web following the Linked Data Principles. Examples include personal cloud services and preservation of scientific knowledge.

Mirko Presser, real world internet, smart city and Linked Data

This talk by Mirko Presser from the Alexandra Institute presented the use of Linked Data within the smart cities and real world internet initiatives. Cities need to integrate their datasets in order to maximise the benefits the data can provide.

The real world internet (RWI) is a realisation and integration of the physical world into the digital world and poses additional challenges for data management, integration and deployment. Linked Data provides additional context information besides raw sensor readings, he explained. Both the RWI and smart cities need Linked Data for trust, privacy, security, integration, discovery, etc.

Dennis Pfisterer, FIRE and Linked Data

Dennis Pfisterer from the University of Luebeck presented the use of Linked Data within FIRE: Future Internet Research and Experimentation. FIRE has two related dimensions: experimentally driven long-term visionary research, and the building of large-scale experimentation facilities.

For the first dimension, Linked Data is used for the description of facilities, traces, users, devices, etc. (and inter-linking these descriptions) and to support federation. For the second dimension, Linked Data is used for the self-description of 'internet of things' devices, dynamic composition of network stacks and cross-layer optimisation.

Other uses include privacy, and the decoupling of applications (such as separating data providers from users).

Session conclusions

Linked Data is an emerging potential component of the Future Internet architecture. It has been adopted by many different companies and organisations (Google, Yahoo, the BBC, the European Commission, the K government, etc.) and used in many different projects. Different research initiatives within the Future Internet have adopted Linked Data for interoperability purposes. Coordinating between these different efforts can enable the development of a new layer in the networking architecture. Future work will need to focus on a variety of issues including layer interdependencies, layer services provided, and layer implementations.

More information

Several position papers have been submitted to the session which, along with are available at: <http://linkeddata.future-internet.eu>

FIA session II – Smart infrastructures

Rapporteurs/organisers: Alex Galis, University College London; Nick Taylor, Heriot-Watt University; Marcus Brunner, NEC Europe's Network Laboratories

Session objectives

The current internet has been described as “no longer fit for purpose” and “obtuse”. Smarter solutions and greater functionality is needed to meet changing, additional or increasing demands on internet infrastructure. The exponential growth in internet services and smart objects (the ‘internet of things’) linked together or integrated with enterprise applications is putting more and more pressure on infrastructure. The Future Internet needs to cope with these trends; to find an architecture or solution which unifies the rapidly growing interconnection and inter-working of smart infrastructures or “smarts”, as they have called.

A number of research topics are part of the smart infrastructure functionality including self-adaptation of the infrastructure, changing functionality on demand, pervasive and ubiquitous systems, energy efficiency and management, smart and embedded systems, and life-cycle management of the infrastructures. Efficiency, scalability, reliability, programmability, energy management, optimisation, security and overall system management are obvious areas in which this smart functionality will be felt.

An example of a smart functional component is context-awareness, particularly in the form of sensing devices and sensor networks. Context-aware computing is a class of mobile systems that can sense their physical environment, and adapt their behaviour accordingly. Developments here are likely to lead to an expansion of the number of internet nodes, which is likely to be even greater than predictions by the FI community when talking about needing IP addresses for every appliance.

Context-awareness is invariably used to personalise a user's experience at the application layer. “If I know more about your context, I can better configure my service (including network and path provision) for your needs” is the guiding rationale. The FI needs to develop methods and eventually standards, which support such dynamically changing ‘personalisable’ parameters and systems.

So the smarts will have extra significance for – and make extra demands on – internet infrastructure, especially if context-awareness is going to deliver on its promise. For this, minimal service guarantees will also be required.

Presenter	Title	Organisation
Nick Taylor	Context-aware infrastructure issues	Heriot-Watt University, UK
Christian Destre	Facing Future Internet service and network management complexity	France Telecom, France
Marcus Brunner	Network of information as a base for a smart infrastructure	NEC, Germany
Paul Polakos_	Network virtualisation	Bel Labs, Alcatel-Lucent, USA

Adam Kapovits	Programmability of the infrastructure	Eurescom, Germany
Andreas Fischer	Resilience in networks: elements for trustworthy infrastructure	University Passau, Germany

Session summaries

Context-aware infrastructure issues (Persist and Societies projects)

The basic requirements of context-awareness are the rapid and reliable transmission of an increasing volume of data, possibly continuously streamed, the merging or fusion of data from multiple context sources, the inference of higher level context attributes, and ability to address vast numbers of sensors and actuators.

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Facing Future Internet service and network management complexity (Univerself project)

The major management issues include what has been described as “designing in silos” and “ossification”. What’s more, development – from service requirement through to network configuration – typically takes place using dedicated (not reused or recycled) processes and largely manual operations, with static features resulting in more cost, delays, and consistency issues. Thankfully the situation is improving – today’s systems are more dynamic which changes the service and application. Therefore network management must be more dynamic and on-demand, and it needs to deal with many more entities (like machine-to-machine, M2M, and the internet of things), and it calls for additional functionality to deal with energy efficiency and energy management. There is also the need to deal with ‘virtualisation’ on all levels, which might ease management issues, due to its smaller scope, but it may make it more complex, due to cross-layer, cross-domain management requirements. The jury is out on that.

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Network of information as a base for a smart infrastructure (SAIL project)

The imminent traffic-volume explosion brought on by the proliferation of video and multimedia over the internet is (literally) a killer application. The resource management issues that follow this development remain unsolved today. The SAIL project is proposing a new paradigm called information-centric communication or the ‘network of information’ (Netinf). Basically, the evolutionary path can be seen from interconnecting cables (telephony), to interconnecting hosts (internet), to interconnecting information elements (Netinf). The Netinf approach can be seen as evolutionary and a generalised version of peer-to-peer (P2P), content delivery network (CDN), M2M, or it can be seen as even more radical – potentially replacing IP with an information-centric architecture, but probably first deployed as an overlay as the internet was an overlay over the telephone network. Netinf is a basic, global information infrastructure for many applications and usage scenarios – working on the principle of bringing what the speaker called the “right information to the right place at the right time”. The computation can be performed on that information at many places in different ways.

[Download pdf](#)

Network virtualisation

This talk showed different use cases where virtualisation is helping to extend current approaches to networking in the direction of combined network and computing systems. The key elements include a language to specify network and computing needs, resource-mapping mechanisms, the virtualisation of network and IT equipment, and a software system for deploying applications.

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Programmability of the infrastructure (Change project)

The programmability of next-generation network infrastructure is critical to being able to adapt to dynamic changing environments. In order to adapt or prepare the networking part, the Change project proposes to use the OpenFlow paradigm for programming the network's control paths, in such a way that different flow-processing elements can be dynamically deployed and used on demand.

Resilience in networks: elements for trustworthy infrastructure (Resumenet project)

The Resumenet project proposes a general architecture for resilience in future networks. It is built around the 'Defend, detect, remediate, repair' paradigm as a real-time control loop for quickly reacting to infrastructure changes, using diagnosis and refinement as long-term actions to improve overall resilience during the life-time of a system, and still be able to react to "unknown challenges". A more detailed use-case was built around virtual service migration.

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FIA session III – Privacy and citizenship

Rapporteur: Nick Wainwright, HP Labs, UK and Jim Clarke, Waterford Institute of Technology, Ireland

Session caretakers: Jim Clarke, Nick Wainwright, Volkmar Lotz, Michel Riguidel

Other contributors: Peter Ljungstrand, Demosthenes Ikonomou, Roger Torrenti, Peter Stollenmayer, Magnus Erikson

Overall chair: Jim Clarke, Waterford Institute of Technology, Ireland

Panel moderator: Peter Ljungstrand, Interactive Institute, Sweden

Session objectives

To introduce the session, Jim Clarke described the setting that led us to this topic. During FIA Bled through FIA Valencia, the trust and security sessions have concentrated heavily on trust and e-identity. However, there were always strong underlying discussions in these sessions on citizens' privacy. Delegates at FIA Stockholm strongly supported the idea of elevating the subject to the programme level for future FIAs.

There have also been a number of key items, reports, events, projects and initiatives dealing with these topics in the recent past, including the following (see 'More info' for links):

- RISEPTIS Report, Trust in the Information Society, October 2009
- Trust in the Digital Life
- Conference on Trust in the Info Society, 10-11 February 2010, León, Spain.
- PRIMCluster and FP7 ICT projects Think-Trust, INCO-TRUST, PrimeLife, PICOS, FIDIS, TAS3, TA2, SWIFT, ...
- ICT 2010, 27-29 Sept. 2010 in which both the necessity for innovation in the EU was stressed while at the same time the protection of fundamental rights to privacy were mentioned time and again.

The two-hour long session had to be divided into two topics related to privacy and citizenship: (i) User/citizen issues related to privacy and (ii) Economics of privacy. The keynotes and panelists were selected accordingly with expertise in these topics.

The objectives and expectations of the session were highlighted, including giving the FIA an opportunity to take a leading role in 'enlightening' the community on privacy matters – so that users make the right choices regarding their private data, not just blindly hitting the 'accept' button. The session also sought to bridge the gap between the various stakeholders on this vitally important topic of the Future Internet. Stakeholders include research communities – not only those working in trust and security but also software and services, networks, etc. – industrial players who strive for innovation whilst protecting their customers' rights, legal/policy/regulatory communities, and the citizens themselves. We need to discuss ways in which we can involve them better and empower them to have more control and rights over their own data usages. Additionally, an expectation of the session was to enable a balancing between innovation strategies and adherence to privacy, which goes both ways: privacy policies

that are cognisant of business benefits and business models that are cognisant of privacy needs. The session sought to provide an opportunity to build a clear strategy and goal for progressing on implementation within the EU FI R&D communities by providing input for the various FIA Working Groups (architecture, roadmap, standardisation, international cooperation, and others).

Presenter	Title	Organisation
Peter Hustinx	Perspective of the European data protection supervisor	European Data Protection Supervisor
Innocenzo Genna	Perspective from the European ISP	ICT Independent expert, AIIP Director, EuroISPA Council Officer (European Internet Services Providers Associations)
Gabriel Yoran	Perspective from an industry – social networking	Founder, Head of Social Network, aka-aki networks GmbH.

Session summaries

Perspective of the European data protection supervisor: Peter Hustinx, European Data Protection Supervisor

Peter Hustinx observed that there are an increasing number of news stories focusing on privacy and the media and politicians recognise this. People rely now on ICT in their daily lives more so to work, interact, etc. In doing so, they provide data more or less voluntarily, and sometimes in circumstances without their full knowledge or awareness.

There are some negative effects to this behaviour:

1. A seemingly insatiable hunger for data and data collection, covered recently in a report in *The Economist* entitled 'The data deluge'. There is uncertainty over whether all this data is needed, but it is gathered because it is technically possible.
2. An individual's ability to know, or control, the data is diminishing. There are technological functions incomprehensible to the average user. Privacy policies are difficult to read and to understand.
3. Massive collection of data is not accompanied by sound information practices. Information managers are not in control of their data. Arguably there is not a "high standard of care" being exercised by information controllers over this data.

Whilst this is being driven by innovation and the desire to create new products and services, this innovation should not be at the expense of human rights. The question to be addressed is "what should be done to ensure that individual privacy is respected as we go forward?" The EU Data Protection Directive is under review at this time. Further action is required in this area which addresses an individual's ability to know, and consent to, what happens to that data. This is covered in Articles 10 and 7 of the directive.

There is a need for greater transparency in data management practices. We should clarify what 'informed consent' means and when it should be obtained. Very often 'implied consent' is inferred or presumed, for example as a notice to users when data is being gathered. An example is Google Streets cameras, where notice is given and if someone goes for a walk at that time, it's presumed that he/she has consented to having their picture taken and uploaded to the internet. Consent may also be inferred from silence or inaction and failure to tick a box declining consent may be deemed as consent. According to the European Commission, consent must be informed, and specific and – taken in context – it must be unambiguous, so there is no doubt that the individual has in fact consented. However, this is not what happens in practice on the internet, and there are even business models built on this presumption of consent. This model of consent must be clarified and shared across the EU, according to Hustix.

The Article 29 working party is addressing this and will provide a comprehensive communication on it in early 2011. The solution to this will require creativity by regulators and data managers. We also need to look at where 'express consent' must be used. For example, for 'sensitive data', this must be expanded but this must be done with care.

Putting users in control is only part of the solution. The principles of the data protection directive are still very relevant. They require that data is kept secure, prohibit use for different purposes from that for which it was gathered, and require that people are given access to their own data. There is now a need for a more proactive approach. There is a need to integrate data-protection and privacy from the inception of new technologies – i.e. 'privacy by design' which minimises data use. Privacy by design also calls for 'privacy by default', and for the implementation of the necessary tools that will empower citizens, giving them more control over the data. It's an example of good data management practices. The principle of privacy by design should be included in new policy in this area, and this is the view of the Article 29 working group.

The principle of accountability should also be reflected in a future framework. This requires data controllers not only to comply with the principles but also to take measures on putting procedures in place to ensure compliance, and to be able to demonstrate compliance. They are responsible from the beginning to ensure that things go right, not just when they go wrong. This will put privacy into practice, not just a theory, and data managers must have policies that will be put into practice in any processes. Data controllers should be able to demonstrate that they are implementing these practices, through documentation and assurance services. This will help them minimise mishaps, negligence, and help authorities implement the rules.

In conclusion, these are the necessary steps to ensure that we implement the processes to bring ICT in line with fundamental values and rights.

Perspective from the European ISP: Innocenzo Genna, ICT Independent expert, AIPP Director, EuroISPA Council Officer (European Internet Services Providers Associations)

Innocenzo Genna described the relevant data protection frameworks. The main directive, 95/46, is under review and there is a consultation in process now. There is also interaction with Directive 2000/31 on electronic business.

The ISP/Telco industry produced a joint position paper from a coalition of industry organisations including Cable Europe, ECTS, GSM Europe, EuroISPA, ETNO, which identifies areas where there needs to be more debate on these topics.

There are two main categories of ISPs: access providers (providing data transportation), and hosting providers (hosting data and managing platforms). This distinction may be clear to us but to non-technical people it can be confusing and sometimes how this distinction is addressed varies by jurisdiction. To clarify:

- Access providers are not liable for the data they carry (mere conduit principle);
- Hosting providers are not liable, unless they have actual knowledge of illicit content or activity, at which point they have a 'removal obligation'.

Genna illustrated this with four case studies:

Case 1 – Spam: In many countries this is prohibited by law. ISPs can put anti-spam filters, which may require intrusive inspection of communications. There is a large difference between spam filtering and other kinds of filtering because the ISP can obtain the users' consent, it addresses only one service, email, which is only a small fraction of the content, and email is managed by hosting ISPs, not by the access ISPs. Spam is a good example of filtering, but we should note that it is not extensible to other services, something which non-technical people may not be clear about.

Case 2 – Hosting: The Vivi Down case in Italy. Google was found responsible for a video posted that breached privacy rules. Google removed the video, but Google was not sufficiently accurate in informing the user about the privacy risk. Genna regards this decision as "a bit weak" on the privacy side. Google did, however, make an agreement to prevent future incidents in the future. This is a good example of self-regulation.

Case 3 – IPR infringements: Access providers are required to cooperate and fight piracy, but these activities may conflict with privacy rules, e.g. monitoring usage which may have been done in breach of privacy laws. This may use deep packet inspection by ISPs, which may be in breach of their legal obligations, and require disclosure of personal details linked to IP addresses, something which can and should be done through the courts. Lastly, ISPs are required to retain data for IPR enforcement, but this is not covered by data retention regulations as ISPs can only retain data for the purpose of running their business. An example is the Sabam-Scarlet case in Belgium, where an ISP has been required to implement some filtering, which may be unlawful, and technically not possible to implement all filtering required.

Case 4 – Networks: Network management and traffic management measures are standard features when providing security or addressing congestion issues, but are controversial when used to discriminate between other companies/services. In order to block content, you have to 'open the packet' which may be a problem with regard to privacy rules. Proper evaluation requires a case-by-case analysis. Courts and regulators have not been analysing this problem with sufficient detail to make the right decisions as to which activities are lawful and which are not.

Perspective from an industry – social networking: Gabriel Yoran, Founder, Head of Social Network, aka-aki networks GmbH

Gabriel Yoran is the founder of two companies, previously Steganos, a company providing privacy and data security software, and now aka-aki networks GmbH, a location-based social network company founded in 2007 and based in Berlin, Germany.

The aka-aki service is simple – when two members meet, their phones ring and show mutual interest. aka-aki has 700 000 members in Germany and France. When this product was started, the company was not aware of the policy of ‘privacy by design’, but this is, in fact, what they set out to develop anyway. Users can change privacy controls, but this is kept very simple. This is a consumer offering and it has to be simple, they don’t do ‘grouping users’, etc. Users have to know which data is gathered and what is done with it. But offering too many ways to control and configure this information tends to scare users away; you can’t leave all the decisions to the users; you have to make some decisions up front.

The most exciting features on location-based services rely on location data analysis. Today, they match people by their interests. If they wanted to match people by preferred locations, they would have to keep location data. To provide a valuable service, they would have to keep this data for over a year, and if they want to have third-party applications provide additional services, then this data will have to be shared with them.

Current regulations limit creativity. In their experience, data protection authorities don’t want people to share their location, but the users do want to share location. Privacy is about being transparent about what you do with your data, but not about protecting users from themselves. Yoran noted that the current spirit of regulators is not around innovation, and what users actually want, but more of a “don’t do it” attitude.

The issues are here today and the data protection goals interfere with the business, he believes. They conflict sometimes. For example, data protection requires that data is deleted, but police and law enforcers want data on a particular user to be kept and made available to them.

aka-aki is advertising-funded, and they would like to know the location of the user to provide better advertisements. The compromise in Germany is to provide only limited location data, namely a zip-code. However, their advertising provider is an American company where they seem to do what ever they want with this data and it is not restricted in this way. aka-aki also can’t hand over device identifiers to identify individual users, something that would provide a better service to users, and which American companies can do.

Google has the ability to do this with Latitude. As a result of the different regulations and practices, many web-2.0 companies relocate to other countries. Yoran wants to ensure that the dialogue with regulators is continued but they must take into account what users want.

Why are these US services more successful? They let the users decide who to trust. They seem to trust Google, and millions have decided to do this. This change is inevitable. Geo-location will not go away; it must be made easier for innovative companies to experiment with new offers. Yoran gave caller-ID as an example of how user behaviour is changing, and reminded us how

people were concerned that their phone number would show up when making a call, and that now caller-ID is expected so that the receiver can filter calls, putting the receiver in control, not the caller. The key concluding message here was that user behaviour is changing!

Panelist	Title	Organisation
Peter Ljungstrand	Panel session moderator	Interactive Institute (Moderator)
Thomas Ruddy	Expert on topic 1: User/Citizen issues related to privacy	EMPA Swiss Federal Research
Magnus Erikson	Expert on topic 1: User/Citizen issues related to privacy	Interactive Institute
Nicola Jentzsch	Expert on topic 2: Economics of privacy	German Institute for Economic Research (DIW)
Nick Papanikolaou	Expert on topic 2: Economics of privacy	HP Labs Bristol

Panelist summaries

Each of the panelists was given an opportunity to make an intervention based on the keynote talks and their expertise in the area.

Thomas Ruddy enquired how accountability would be made to work in practice – a code of conduct, or standards, for instance. In Germany, there is a state-run information commissioner, which has a certification policy for dealing with privacy issues more transparently. It is not clear where the ISPs stand on this, according to Ruddy. Although the likes of aka-aki have a very clear position on customers and privacy, and the conflicts that they as a modern online organisation face. As we move to a mobile world, there are very real privacy risks, and this really is a ‘paradigm shift’, according to the expert.

Magnus Erikson pointed out that one of the major reasons why privacy has become a concern is that it has become “detached from the senses and the body” of persons. Now it’s unclear what data is private and what it can be used for. Even those who aggregate it don’t really know what it can be used for. Data is generated that is beyond what is understood or known by the individual. Even if data sets can be anonymised, there are still risks that they can be used in negative ways.

Nicola Jentzsch addressed the desire of organisations to collect data for profit motives, and raised the example of Google-street-view cars collecting wifi data, noting that there is a patent pending by Google on how to identify people from wifi networks and to locate them geographically. In general, she said companies gathered personal data to predict willingness to pay and, of course, to better meet the needs of customers, but this puts them in a position of power with respect to the customer. Jentzsch drew parallels between the credit reporting industry, which collects credit information on individuals that lets them better predict risk, and data collection on the internet that lets companies predict how consumers are making decisions. She stressed that it was important to understand how consumers make decisions and asked whether there are plans in the European Commission to make available funding for research

projects on the behavioural economics of privacy. Finally, Jentzsch does not agree that the innovators are stifled by regulation, calling on companies to find ways to innovate within the regulations. She also disagrees with the industry argument that consumers should always get what they want. She drew parallels to the sub-prime loan market in the US, where consumers wanted house loans, which they could not afford and turned out to be bad loans.

More about privacy

Nick Papanikolaou pointed out that it is likely users will start caring more about privacy than before. This is the flipside of the often-heard view that 'privacy is dead'. Actually, users are becoming more and more informed about the consequences of sharing data and users will care more about privacy and will expect not just to consent, but to be able to 'revoke' and reverse consent. Consent is not static, he suggested, it is dynamic. You consent to something, and then you should be able to change your mind and make sure your wish will be respected (and your privacy enforced). You should be able to delete personal data that concerns you, anonymise it, and amend it. But anonymisation is very difficult in practice. This was demonstrated in the recent examples of the Netflix prize database, which was released publicly for research purposes and was successfully de-anonymised, and the 'Facebook places' feature which is very controversial as it's enabled by default and allows Facebook users to track each other's physical location. Now that we have the technical capability to provide revocation, deletion, and some form of anonymisation, users will expect to be able to delete, hide, and revoke their data. So the issue is not just about giving users the ability to grant consent for their personal data to be processed, but about providing the ability to reverse, change, revoke that data as and when required. We must put users in control, he concluded.

Panellists respond

Each of the panelists/keynotes was then given an opportunity to respond to the interventions of the panelists.

Yoran responded to the "innovating within" the regulations statement. In the case of aka-aki, he said, they have done everything that is allowed in Germany, but they are competing with the US and other countries that don't have as many restrictions. Most of their users ask for their service to be more precise about location sharing, and they can get this from US companies.

Jentzsch replied that all international companies have to comply with national/local regulations and she wondered about competition with US companies while being based in Germany and being subject to national laws. Yoran asserted that some larger well-known companies already do not, in fact, comply with the German regulation/European minimum standards!

Hustinx observed that the EU's data protection framework needs greater uniformity and consistency – taking into consideration the global context (i.e. the OECD). He mentioned some similarities in thinking between the Federal Trade Commission in the US and the European position on privacy matters. Hustinx concurred that, where consent is given, we also need to be able to roll back unless it's contractual. On location data, he added, the guiding principle is that the client decides. Finally, on the fundamental question of privacy versus Economics, he noted

some tensions. Behavioural economics is practiced on the internet (this was covered by a recent OECD workshop in Jerusalem, October 2010). Markets operate under rules, and privacy is an issue where some rules need to be imposed as there are some market failures. We have to think about how we enforce the principles, he suggested. We will have to move privacy from theory to measurable practice. Responsibilities must be taken seriously and, if not, there will be strong sanctions, which will give a strong incentive to comply. Certification, which begins by articulating what responsibility means, who is responsible, and the consequences of non-compliance, is one instrument. Accountability, which ensures that whoever is responsible can demonstrate their competence, is another. This works for other areas – for example, the environment – and it can work for privacy, too.

Hustinx said that the EU has decided to distinguish between privacy and data protection. The latter applies whenever data applies to, or has an impact on, someone. This is the starting point where we will move towards a more consistent approach across Europe, to scale markets and build trust. We will see more transatlantic convergence over the next five years, predicted. In the meantime, we will see more focus on compliance with the regulations that we have. The market for location data is a cutting-edge area where the discussion around privacy is developing and there is space to innovate within the law.

Genna addressed the question of ISPs' motivation. There is a problem of applicable law and there is uncertainty as to which law may be applicable or not, as illustrated by the Google Italy case, where the court couldn't accept that the matter was outside its jurisdiction. However, the positive outcome was that Google set up new guidelines and practices. Genna also addressed this point with regard to 'filtering'. On a platform (i.e. an application services such as email) this can work as there is a presumption of consent – which should of course be done in the proper way. But when we talk about filtering on networks (not servers), it is much more difficult as you can't presume the consent of the users, and technically it's more difficult to do this in the network. We must have some consistency in the law across all categories, and the ISPs must comply with consistent regulation, and not depending on the particular business that they are in.

Hustinx, in response to point about ISPs, stated that issues around implied consent emerge and we need to be realistic. We need to be clear what the rules are and stick to them.

Jentzsch said that we need more "honesty" in asking consumers for consent. For example, when companies are going to sell information to many other companies, they should say so. This is not the same as asking for consent to use information "to suggest new products to you". She also raised the example of "security data breach notifications" and said that she was not aware of any field data on this. Hustinx added that there is some evidence that security breach notification works if it is targeted well, and then we do not get "notification fatigue" (he refers to some work in the UK on this).

Ruddy returned to the question on what the EU would expect from transatlantic convergence, observing that Americans have more confidence in the private sector whereas Europeans have more confidence in government. US citizens get services were they have to 'opt out' and in EU citizens get services when they 'opt in'. Do we expect convergence to go further in the field of

privacy? Hustinx came in on this saying that there is a long way to go; there is going to be “sufficient convergence to make this work but it’s not there yet”.

Session conclusions

Privacy and citizenship are intrinsically linked since these subjects are highly relevant as people are increasingly relying on ICTs where security, privacy and trust are key enablers. Tremendous amounts of data are being processed in today’s service-based economies and there is an unprecedented hunger for data (or “data deluge”). Privacy issues are set to become ever-more relevant.

When dealing with privacy and citizenship, we need to draw a careful balance to ensure that real security does not exist without privacy built in; and real privacy won’t exist without security built in.

With regard to privacy versus innovation, we need to strike a balance but not at the expense of fundamental rights of citizens.

There are a number of challenges to build privacy policy as we move forward into the Future Internet:

- Individuals must know what happens to their data;
- Individuals must gain control over the processing of their data;
- There is a need for greater transparency on data processing;
- There is an urgent need to clarify what “informed consent” means and when and how it should be obtained. In addition, clarification on what “implied consent” means, which may be inferred by a user’s action or inaction, should be addressed urgently. The way in which consent is given should be unambiguous and there should be no doubt about whether the individual has consented. The legal regime should ensure that consent is full and we need to find new ways to inform people “up front”. For example, there are some cases where expressed consent should be required.
- Putting users in control of their data is only part of the challenge. The principles of data protection and the safeguarding of data are very important. The collected data must be kept secure and only used in ways which are compatible with the users’ wishes.
- Need for more proactive approaches to data privacy and integration at a practical level.

Building the right data protection framework goes hand in hand with technological developments. When dealing with privacy and citizenship, a clear view of what data is applicable is required, including all information on individuals and on objects that could have an impact on the individual. This has consequences, in particular, on new technologies.

This brings us to the principle of “privacy by design” – better systems design to minimise the need for data. An example of this would be within social networks, keeping an individual’s profile information private as the default.

If implanted from the outset, privacy by design would ensure the following attributes:

- Compliance – it would be instrumental in limiting the collection of data;
- User empowerment – giving users more control over who uses their data and for what;
- Best practices – a reference of the best approaches to data protection.

There are a number of instruments available dealing specifically with privacy and citizenship. For example, Article 29 deals with accountability and adherence to better data governance. Rights and obligations have been defined for all those that data protection relates to and these are now laid down in Article 8 of the Data Protection Directive and forms part of the Lisbon Treaty. There are a number of defined rights: the right to know, the right to access, whenever data relates to the person or has an impact on the person, the right to object, and the right to consent.

Regarding consent, many think this is the heart of the matter as it is one of five or six of the legal grounds. However, it was suggested that consent is currently rooted on very loose grounds and doesn't mean very much. A point was made in the panel discussions that we should not get too hung up about consent, apart from ensuring that it is true and real consent, not a false, implied or misinterpreted which is common today when users blindly hit the 'accept' button. More clarity on this issue is urgent.

Maximum empowerment of users is crucial to the privacy and citizenship debate. A significant amount of technological support is needed for this. And 2011 will be an important year to review the wide public consultations undertaken to date, with detailed conclusions drawn in 2012-2013 before being brought before the Parliament in 2013-2014. The end goal is to work on an effective protection framework from today and implementation from 2015 onwards. FIA research communities can all play an important part in this.

More information

RISEPTIS report: www.think-trust.eu/riseptis.html

Trust in Digital Life: www.trustindigitallife.eu

Conference on Trust in the Information Society: <https://trustworthyict.inteco.es>

Think-Trust www.think-trust.eu

INCO-TRUST: www.inco-trust.eu

PrimeLife: www.primelife.eu

PICOS: www.picos-project.eu

FIDIS: www.fidis.net

TAS3: www.tas3.eu

TA2: www.ta2-project.eu

SWIFT: www.ist-swift.org

ICT 2010: http://ec.europa.eu/information_society/events/ict/2010/index_en.htm

Session slides available: <http://fi-ghent.fi-week.eu/slides>

Trust and Security FIA wiki: http://security.future-internet.eu/index.php/FIA_Ghent

FIA session V – Architecture group

Chair: Isidro Laso Ballesteros (EC–DG INFSO), Theodore Zahariadis (Synelixis)

Session objectives

The objective of this session was to present the activities of the FI Architecture (FIArch) group, collecting feedback and comments from the FIA community and calling on experts to present their point of view on activities geared towards a ‘Future Internet architecture’.

The FIArch Experts Reference Group is composed of representatives of the most relevant FP7 research projects and renowned experts involved in Future Internet architecture. The work of the group is coordinated by the FP7 CSA projects in the area of Future Internet and supported by several units at the European Commission (D1: future networks, D2: networked media systems, D3: software & service architectures & infrastructures, D4: networked enterprise & radio frequency identification (RFID), and F5: trust and security). The aim of the FIArch group is to focus on a few key architectural issues and contribute to an EC research roadmap for Future Internet architecture. As a first concrete step, the FIArch group has been working on the identification and categorisation of the ‘Fundamental limitations of [the] current internet’ that could eventually hinder Future Internet applications.

In this FIA session, the current progress was presented and feedback from the FIA research community was received.

Presenter	Title	Organisation
Paulo de Sousa	Introduction and context	EC–DG INFSO
Dimitri Papadimitriou	Rationale and methodology	Alcatel-Lucent
Theodore Zahariadis	Fundamental limitations of [the] current internet	Synelixis
Isidro Laso Ballesteros	Internet architecture and innovation	EC–DG INFSO
<i>Moderator:</i> F Alvarez R Nejabati W Colitti W Burakowski Ioan Toma <i>Panel:</i> D Papadimitriou S Haller H Tschofenig J Clarke L Nixon P Moore	Open forum (5 minutes each) Panel discussion	UPM University of Essex Vrije Universiteit Brussel Warsaw University STI Alcatel-Lucent SAP NSN TSSG STI International Atos Origin
Isidro Laso Ballesteros	Next steps and wrap-up	EC–DG INFSO

Presentations on the FIA Ghent website: <http://fi-ghent.fi-week.eu/slides>

Session summary

Rationale and methodology: Dimitri Papadimitriou

<http://fi-ghent.fi-week.eu/files/2010/12/1435-Dimitri-Papadimitrio.pdf>

The global Future Internet is a complicated structure that cannot be created by a linear process of engineering and technological design. In order to identify fundamental internet limitations, the FIArch group is following a four-step methodology. Step 1 is to identify the motivations and the design objectives of the FI architecture, Step 2 is to define common architectural principles, step 3 is to specify the architectural components, and finally, Step 4 is to put all components into a common model. The goal is to identify what an architectural 'limitation' is and characterise it with quantitative and qualitative arguments.

To the best of its knowledge FIArch defines a 'fundamental limitation' as a functional, structural, or performance restriction or constraint that cannot be resolved with current or clearly foreseen paradigms. Whereas a 'challenging limitation' is a functional, structural, or performance restriction or constraint that could be resolved by replacing and/or adding/removing a component of the architecture that would, in turn, change the global properties of the internet architecture. Moreover, the following terms are used: 'data' in this sense refers to any organised group of bits (or data packets), data traffic, information, content (audio, video, multimedia), etc., and 'service' refers to any action performed on data or other services and the related application programming interface (API).

Currently, FIArch has made progress in Steps 1 and 2, and the next challenge is Step 3, which will identify the architectural components (i.e. procedures, data structures, state machines, etc.) together with the characterisation of their interactions (i.e. messages, events, etc.) and their distribution.

Fundamental limitations of current internet: Theodore Zahariadis

<http://fi-ghent.fi-week.eu/files/2010/12/1445-Zahariadis-FIArch-Ghent-20101215.pdf>

Since its creation, the internet has been driven by a small set of fundamental design principles rather than a formal architecture that is created on a whiteboard by a standardisation or research group. Moreover, the necessity for backwards compatibility and the trade-off between internet redesign and proposed extensions, enhancements and re-engineering of today's internet protocols are heavily debated. FIArch has tried to identify and analyse the presumed problems and limitations of the internet starting from the basic networking layers upwards.

The emergence of new needs at both functional and performance levels, the cost and complexity of internet growth, the existing and foreseen functional and performance limitations of the internet's architectural principles and design model put the following base functionalities under pressure:

- **Processing/handling of 'data'** – refers to forwarders (e.g. routers, switches, etc.), computers (e.g. terminals, servers, etc.), CPUs, etc. and handlers (software programs/routines) that generate and treat data.

- **Storage of 'data'** – refers to memory, buffers, caches, disks, etc. and associated logical data structures.
- **Transmission of 'data'** – refers to physical and logical transferring and exchange of data.
- **Control of processing, storage, transmission of systems and functions** – refers to the action of observation (input), analysis, and decision (output) whose execution affects the running conditions of these systems and functions.

The fundamental limitations in each one of these categories were presented. Moreover the high-level and low-level design objectives were highlighted. The conclusion was that extensions, enhancements and re-engineering of today's internet protocols may solve several challenging limitations. Yet, addressing the fundamental limitations of the internet architecture is a multi-dimensional problem. Improvements in each dimension combined with a holistic approach of the problem space are needed.

Internet architecture and innovation: Isidro Laso Ballesteros

http://fi-ghent.fi-week.eu/files/2010/12/1515-ISIDRO_IA-and-Innovation.pdf

This presentation was based on a paper prepared by an industrially driven task force from the FIArch group. It contained information about different, and sometimes contradictory, viewpoints affecting the evolution of internet architecture. The key message of the presentation is that internet architecture is a new policy tool (no longer only a matter for techies) and that it could be used by policy-makers to shape the future EU economy by favoring some industry sectors while perhaps hindering others. The presentation reviewed a number of application areas (telephone, e-commerce, social networks, community-driven content, collaboration environments, web-based business services, cloud-based enterprise computing, on-line banking, etc.) and highlighted how innovation is hindered by the current internet architecture.

The presentation concluded that decision-makers need to know the importance of internet architecture for all economic industries. The evolution of the internet affects all economic actors, benefiting some industrial players while perhaps holding back others. Thus, any steps taken towards modifying the internet, whether in terms of technology and architecture or governance, can be seen as a policy tool for modifying the economic situation in Europe. We must be aware of the tradeoffs that any changes in the internet may bring. An increase in security on the net could, for example, foster innovation in health or policing or citizen services. But, unfortunately, this increase in security could stifle innovation in some other areas such as social networking, peer-to-peer or content-aware networks.

Some of the issues to be taken into account for Future Internet design include:

- Measure and comprehend before considering modification of successful principles
- Quality of service issues for critical applications
- Relaxed layering and security
- A framework for intermediary common services
- Transport layer innovation

- Application component eco-system for continued application innovation
- Long-term disruptive approaches

Policy-makers should consider these and other internet architectural design decisions and considerations as another possible policy tool that can have far-reaching positive effects in the European economic space and that allow innovation to drive more and better jobs for Europeans http://ec.europa.eu/information_society/activities/foi/library/docs/p3-aiai-2010.pdf

Panel presentations and discussions

The panel was moderated by Dr Federico Alvarez and interested members of the audience presented their point of view. Among the contributions were:

- R Nejabati (University of Essex)
http://fi-ghent.fi-week.eu/files/2010/12/1535-2-Reza-Nejabati_sfv2.pdf
- W Colitti (Vrije Universiteit Brussel)
http://fi-ghent.fi-week.eu/files/2010/12/1535-3-presentation_fia_colitti.pdf
- W Burakowski (Warsaw University)
<http://fi-ghent.fi-week.eu/files/2010/12/1535-4-System-IIP-FIA-Ghent-ver1.pdf>
- Ioan Toma (STI)
<http://fi-ghent.fi-week.eu/files/2010/12/1535-5-SOA4All-FIArch-Ghent2010.pdf>

Session conclusions

Some conclusions based on the discussions are that Future Internet architecture should be designed very carefully in order to ensure global acceptance. Flexibility should not be sacrificed in the pursuit of performance, while security will play a very important role. This means that the model for the 'reference architecture' should not sacrifice internet openness and its ability to evolve.

More information

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

FI limitations:

http://ec.europa.eu/information_society/activities/foi/docs/current_internet_limitations_v9.pdf

Internet architecture for innovation:

http://ec.europa.eu/information_society/activities/foi/library/docs/p3-aiai-2010.pdf

Three communities get together

The '**Living Labs and Smart Cities: open innovation for the Future Internet**' conference was launched to reflect on 'smart cities' as centres for user-driven open innovation, using Future Internet technology to enable a truly knowledge-based society. This one-day sub-conference took place on 14 December, ahead of the FIA, to bring the Smart Cities and Living Lab communities together with FI stakeholders. The goal was to see how living lab-methodologies could help to identify novel concepts, and how user co-creation can enhance the innovation process, resulting in new public services in domains such as health, mobility, environmental monitoring, or energy management.

FIA session VI – Smart Cities

Rapporteur: Roberto Santoro, ESoCE Net, Fireball project

Session objectives

The 'Smart Cities and Future Internet experimentation' session was organised following similar successful sessions in Stockholm and Valencia. As a result of these sessions, there was growing consensus that Smart Cities can serve as an excellent catalyst for Future Internet research, as they form very dense social ecosystems that rely heavily on internet technology and, in turn, internet technology and applications heavily influence social interactions.

Smart Cities is a cross-cutting topic combining a variety of different application domains and required Future Internet technologies in compact urban environments.

The Fireball project was presented as one of several actions emerging in this area which harnesses the synergy between the Future Internet, Smart Cities and the Living Lab communities.

The session was divided in two parts and sought to: (1) explore the role of experimental facilities for Smart Cities and resulting challenges to meet the needs of multiple stakeholders; and (2) to establish how effective cross-community collaboration can be achieved to better exploit available experimental facilities provided by the different communities and stakeholders.

Each of these parts started with two 20-minute keynote presentations, followed by a 20-minute panel moderated discussion with the session participants.

Presenter	Title	Organisation
Alex Gluhak	Session moderator Experimentation and innovation facilities for Smart Cities – opportunities and needs	University of Surrey
Michael Börjeson Margarete C Donovan-Kuhlich	Keynotes	CDT IBM
Timo Lahnalampi José M Hernández-Muñoz Alvaro Oliveira Esteve Almirall Martin Bryskov	Panellists	DIMES, Firestation Telefónica, SmartSantander Alfamicro, Fireball / Periphéria Esade, Open Cities / Fireball Aarhus University
Michael Nilsson	Session moderator Collaboration requirements and opportunities in the Future Internet, Living Labs and Smart City communities	Luleå University of Technology
Hans Schaffers Pieter Demester	Keynotes	ESoCE Net, Fireball IBBT
Nicos Komninos Heikki Huomo Georgios Tselentis Nick Wainwright Kimmo Ojuva	Panellists	URENIO, Fireball Centre of Internet Excellence DG INFSO–EC HP Labs DIMES, PII

The objective of this first part of the session was to gain an understanding of the gap between, on the one hand, facilities and methodologies available for experimentation in FIRE and Living Lab communities, and on the other hand, the experimentation requirements of Future Internet technology as well as the priorities and real needs arising in today's cities. The session explored the difficulties faced by providers of experimental facilities when catering for multiple stakeholders such as FIRE researchers, service providers and end-users – i.e. cities and their citizens. The session started by creating the necessary awareness among the participants to explore how existing facilities and methodologies for experimentation and innovation can be adapted and integrated to better suit the needs of the respective communities.

This session focused on how to orchestrate sustainable collaboration across the different communities involved in creating Smart Cities and internet innovation ecosystems, in particular city development organisations, research organisations and companies involved in the Future Internet, and initiatives for Living Lab innovation. The session acted as an opportunity for synergy and collaboration across the Future Internet, Smart Cities and Living Lab communities, and as a study on the collaborative models that can be realised within the innovation ecosystem of cities, in order to benefit from available facilities and know-how.

Session summaries

Around 80 participants attended Smart Cities and Future Internet session VI from the three communities, from academia, and from the scientific and Living Lab environments.

The first phase of the session was dedicated to understanding how the existing technologies can be applied and integrated in the development of Smart Cities.

Mikael Borjeson described the concept behind Smart Cities and the environment (such as the infrastructure, the services, the technologies and the information) necessary to develop and integrate the kind of environment characterised by specific ICT solutions aimed at addressing citizens' problems and needs (i.e. parking, services and infrastructure).

Margarete C Donovan-Kuhlisch illustrated the importance of the application layer for Smart Cities – instrumented and interconnected with intelligence processes and application services for citizens built around a wide network of information. The solution proposed was an 'application as a service' model based on cloud computing. Donovan-Kuhlisch also reported the example of the EPIC programme where the implementation of this model, available in the cloud, can be potentially reused from city to city.

Timo Lahnalampi illustrated the concept of sustainability in Smart Cities for the improvement of people's life and the importance of leveraging the inspirational role of Living Labs.

José M Hernández-Muñoz presented the SmartSantander pilot and underlined how complex it is to deploy a large-scale sensor-based (internet of things) test-bed case like this. The problems emerging out of Smart Cities are not necessarily technical (i.e. regulations) because they are critically related to citizens' needs and day-to-day life. The speaker explained the importance of identifying the real requirements at every step of the development process (not only at the end) and how this aspect is strongly related to a Living Lab approach.

Alvaro Oliveira illustrated the Living Lab contribution and involvement in the Smart Cities development, starting from the network of Smart Cities (created within ENoLL) and the global Living Lab movement which is growing at good pace and has been successfully exported to other countries (i.e. China, Brazil).

Esteve Almirall presented the idea of an innovation city (Smart City) as more than the technology that underpins it. The question of who manages or governs the platform for services and the level and forms of community engagement involved are also important. Furthermore, the technology and processes needed to build Smart Cities also have to be addressed, particularly in relation to existing platforms and services (i.e. Googlemaps) and legacy systems.

Martin Bryskov illustrated the cultural aspects of technology and the possible risks of integrating and interfacing cities along cultural lines which may lead to less autonomy, or 'dependencies', in the systems and potentially incompatible solutions (different from city to city).

The session was followed by an open debate in which several interesting questions were posed along the lines of:

- How do we overcome the challenges already raised and others still emerging?
- How do we involve local government in Smart Cities cooperation?

Panellists noted the importance of pilot projects as an early example of collaboration which can help to overcome and address any emerging problems in the cooperation between Future Internet and Living Labs for Smart Cities.

The case of Smart Santander was again described as a good example of citizens and local government involvement (starting in the early phases of the project).

The second session was opened by Hans Schaffers who summed up the various elements of the cooperation between Smart Cities and Future Internet. He underlined the relations between human and social capital, tradition and ICT solutions, management and city resources, ICT and collaborative processes, as well as the role of Living Labs in the innovation system.

Pieter Demester illustrated how Living Labs work in the innovation process, from the idea stage through to the marketplace. His presentation was useful to understand the contribution that Living Labs can give to the technology experimentation process in test-beds. In particular the inclusion of final users was described through an actual pilot conducted in the homecare domain.

Kimmo Ojuva presented Finland/Japan as an example of the benefits of an open innovation environment where technology and competencies are effectively turned into customer-driven services and then as early success stories.

Nicos Komninos examined cities from different angles, looking at the functions that they serve and the inherent complexity of integrating all this into Smart Cities.

Nick Wainwright illustrated the importance of complementary aspects of Smart Cities, Future Internet and Living Lab cooperation, underlining also the significance of including all the stakeholders and in applying open standards (with a proper business model but with sufficient network externalities and reaching a specific critical mass).

Session conclusions

This session aimed to bring interested members from the Future Internet and Smart Cities communities with those from the Living Labs domain, to underline common ground and methodologies, and any possible synergies.

Smart Cities were recognised as emerging realities and an important test-bed environment characterised by dedicated services, important infrastructure, and the provision of sustainable,

'smart' and open solutions which improve the quality of life of citizens living in urban environments.

The Future Internet was recognised as the technology provider capable of making Smart Cities a reality, connecting people, sensors and services, and enabling the exchange of information in an "open data" environment.

Living Labs, it was concluded, provide the missing elements, or the people factor. They involve society in the innovation process shaping and transforming regular cities into Smart Cities. Living Labs make change and innovation less scary, and help to leverage and further support the human and social capital needed for such transformations to be successful and accepted.

Governance issues, common values, real services, an open innovation ecosystem, and the involvement of both private and public stakeholders were all considered important to improving cooperation between Smart Cities and the Future Internet and Living Labs communities and boosting innovation for the benefit of the citizens.



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FIA session VII – Information as economic good

Rapporteur: Michael Boniface, University of Southampton

Session objectives

The Future Internet must be open to all and allow all stakeholders to derive benefit. At the micro-level, economic productivity and the sustainability of the digital industries (e.g. services and content) is a major concern. Today, the digital market is focused on the provision of services as a business model from the provider's perspective rather than economic production processes in the traditional sense, i.e. based on revenue. This model of economic exchange is suited to the material economy but does not fit the knowledge economy, which often includes non-monetary exchanges. Much of the search for new business models in the digital landscape has tried to simulate the analogue manufacturing or mass media situation online by imposing artificial scarcity. A re-thinking of Future Internet business models is necessary to break out of the manufacturing and distribution paradigm.

This session aims to stimulate discussion about what lies beyond current approaches, not only because technology makes such artificial scarcity easy to circumvent, but also because it fails to understand the nature of information, attention, selection and why cultural experiences become meaningful. A business paradigm based on control and distribution of information counteracts its own purpose by not allowing users to freely form social contexts by using information as social objects that build communities.

When the social web and mobile technologies are merging the virtual and the physical world need to adopt post-digital thinking for Future Internet business models where a whole ecosystem of cultural circulation is taken into account. This would shift the discussion from business models, defined in a narrow sense as monetising information, to business strategies and a number of interesting socio-economic issues about cultural circulation and policy regarding creative industries in general. Examples of successful businesses would be drawn from the music industry and the open hardware scene.

The session was organised by Michael Boniface (University of Southampton IT Innovation), Peter Ljungstrand (Interactive Institute), Magnus Eriksson (Interactive Institute), Jonathan Cave (Rand Europe), Man-Sze Li (IC-Focus), Didier Bourse (Alcatel Lucent), Burkhard Stiller (University of Zurich), Peter StollenMayer (Eurescom), Pierre-Yves Danet (Orange FT), Tuan Anh Trinh (Budapest University of Technology and Economics).

Presenters	Title	Organisation
Jonathan Cave	Economics of information on the Future Internet: the complexity of moving beyond 'content'	SESERV
Mikhail Simonov	The enabling role of the information broker: an example	??
Peter Ljungstrand, Magnus Eriksson	Beyond copyright	??
Multiple presenters*	Panel discussion with representatives from European Future Internet socio-economic initiatives in Challenge 1	See below

*FI-PPP with Jonathan Cave; SESERV with George Stamoulis; SEQUOIA with Andrea Nicolai; Paradiso2 with Roger Torrenti

Session summary

Economics of information on the FI: the complexity of moving beyond 'content'

Jonathan Cave's presentation covered the characteristics of information, value creation and the role of search in innovation processes. Cave started by contrasting traditional goods and services with information goods. The intangible nature of information means that in an information transaction the information goods are non-excludable when traded (i.e. they still exist and can be traded again). This characteristic is difficult for markets as there is no scarcity and the non-existence of equilibrium. Property rights have evolved to make information markets work by creating artificial scarcity but this depends on measures to enforce scarcity. In effect, property rights create the incentives for sharing information (i.e. providers can retain value) and copyright can be used to control the use of it.

Value from information can be derived from the process of creation, storage, distribution and scarcity. Value is created at different points of the information lifecycle – it changes over time, circumstance and point of view. Information can also be combined to create useful knowledge. Meaning to specific consumers is critical which makes value in a singular sense meaningless. Information does not even need to be true to have value to some people. Value of information is directly affected by sharing and dependent on distribution in a network. In some situations sharing information makes information more valuable (e.g. pure research to applied research) whereby in other situations (e.g. information about a company's future performance) can reduce value.

If markets work efficiently they collect all the information and the price is related in terms of the assets. It is what everyone knows about the information. If someone has valuable information and brings it to the market then a software program will automatically exploit it. The systems we are developing are complex systems with emergent behaviour. We are not controlling or designing anything but taking part in a systemic process. What is necessary are the means to understand and protect the desired behaviours but sometimes undesirable emergent behaviour occurs. For example, a flash crash occurred in New York and trading was suspended due to safety mechanisms misinterpreting price movements in another location on the globe. Information exchange in social networks is especially interesting. Values can be inferred from the way that people choose to disclose information within such online communities. However, often people do not think about the scope of sharing, in fact few people know who is watching them let alone what they are watching them for. But the question of the level of privacy each person can tolerate is personal and being tested through the large privacy experiment that is Facebook.

Search is an essential element of the internet. Markets depend on search to help consumers determine quality and price. If people cannot compare offers then the market cannot work, it will function and generate money but not reach the social goals. The companies that dominate the internet run platforms that are used to realise end-to-end benefit but these companies want appropriate gains. This is a two-sided market model because there is unrealised gain and scope for these intermediaries that connect people through content. For example, we can search for jobs in new ways and the ability to find people is profoundly changing the labour market. Service providers can now offer the ability for individuals to provide small skill packets to employers, which can only be realised through large social networks and information exchanges.

Search needs to move beyond text and beyond content to smart searchers (demand curve), repositories (supply curve) and search engines that use multi-sourcing of information. The way

we search is changing the creative processes. Traditional scholars used to be in textual communities around a piece of content (e.g. a book). Connections were made through the mind or insights of the author. Search is entirely different, today people do not read the text, people look at what we already know. With search today building on common search terms is good for reinforcing the current state of the art but poor for innovation.

Enabling role of the information broker (the energy example)

Mikhail Simonov's presentation focused on the role of information sharing and brokering in increasing the efficiency of energy grids through a reduction in the imbalance between supply and demand. Information can be used to create anticipatory knowledge. Information sharing is important to ensure we achieve a carbon neutral environment but ensuring we use energy in the right ways and in line with societal goals. By collecting energy usage patterns based on past behaviours and combining this with environmental information and predictive models better forecasts for our energy needs can be made. The challenge is the cost of real-time monitoring of energy consumption considering the sampling rates and the amount of data generated. There is currently a lack of capacity in real-time data processing to realise the benefits.

The question is, at what resolution or level of detail do we take measurements? For example, 20 million households with a sampling rate of 15 minutes will generate 1.92 Terabytes (TB) of data per second. For a 1 second sample rate this increases to 1728 TB/sec. The cost of creating this anticipatory knowledge is a critical factor in assessing its value. The new information must bring more value than the cost of creation (monitoring, distribution, processing, etc). The overall goal is to reduce the imbalance in the energy system, a key source of inefficiency and emissions.

The FI challenge is how to transform the additional costs of acquiring knowledge into increased venues for the supplier and reduced costs for consumers. This is where the information broker comes into play. By sharing monitoring information between large groups of consumers in common information spaces the predictor models can be improved and actionable insights created that can reduce inefficiencies and create a win-win for everyone. Simonov presented results from the EU-funded HPPC/SEA projects which are developing such predictor models based on generic algorithms that deliver insight into consumer demands based on real-time monitoring information.

Magnus Eriksson presented an analysis of trends and revenue models within the music industry. Following years of reduced revenues due to music piracy and pricing pressures the music industry is looking for business models that move beyond digital downloads. In this context the information is the experience or the coordinator of the experience. Culture is seen as increasingly immaterial, liberated from physical constraints (e.g. digital music) and with streaming services in the cloud nobody holds the files anymore and no commitment (e.g. purchase a product) is really required. The problem then moves to 'search' as the production process moves from a manufacturing paradigm to information production and distribution challenge. In reality, information is not the primary good as it does not recognise the parts of the cultural domain in the environment. Film is the same thing whether it's seen at the cinema or at home but the collective experience of going to the cinema is important.

Session conclusions

The industry is looking to increase revenues by creating community experiences around content where individuals have to make greater social and financial commitments. This has manifested in a move from copyright to a model where live experiences and performances by artists are increasingly important. Eriksson called this the “post-digital age” where the real and digital worlds are combined to move from networked content to networked experiences. The impact of this shift moves revenues from labels who record the content to artists who create the performances. Service providers must create incentives to disclose, share and facilitate relationships through online and physical events. This requires investment and commitment in a deeper sense from individuals. In fact this can be seen in music scenes which are built up on networks of trust. The selection of acts and events has a large impact on attendance which is important for the discovery of new acts. The challenge is the shift to focus on the local, social context and the role that information can play in specific social situations. Eriksson discussed FabLabs where people can access digital fabrication tools and share information with people at a physical location. This is similar to the medieval textual communities discussed by Jonathan Cave earlier, in that now we form communities around social objects. Eriksson finished on cultural production and cultural expression where the recorded element does have an important function for creating cultural memory over time. In this case memory (experience + recording) can invoke something beyond the experience, but before things got too “way out” this interesting presentation was brought to a close.

More information

FISE working group wiki: <http://fise.seserv.org>

Impact Study FI-PPP (FI-3P): www.fi3p.eu

Obj 1.1 Networks (SESERV): www.seserv.org

Obj 1.2 Services (SEQUOIA): www.sequoiaproject.eu

Obj 1.6 FIRE (Paradiso2): <http://paradiso-fp7.eu>

Session VIII – Search as an architectural component

Chair: Loretta Anania (EC– DG INFSO),

Theodore Zahariadis (Synelixis), John Domingue (Open University)

Session objectives

As the FIA activities evolve, it turns out that there are going to be different stratum that support the Future Internet. All these stratum have different types of resources and also virtual representations. At the network stratum, we may consider as resources the nodes themselves (e.g. routers, servers, printers, terminals, etc.) and their physical characteristics (e.g. processing power, network interfaces, routing capabilities, memory, caching capabilities, traffic, etc.). At the Service stratum, we may consider the services, the service components and their APIs and interfaces as resources. At the Content Stratum, the different types of content (e.g. text, pictures, voice, video of different types and formats, slices and sub) can be considered as resources. Finally, any piece of information or any application (including social networks and link open data links) may also be considered as a resource.

The initial objective of this session was to highlight the search and discovery issues of different resources at the different stratum. This is a very broad topic. Quite different mechanisms (even philosophy and language) are currently used to discover/mine, describe, index and retrieve resources at each stratum. Due to time restrictions, the session was focused only in the area of content searching and retrieval, which may be the most challenging ones as the content is and will grow much faster than any other resource and the search engines need in most cases to extract and combine information rather than just discover it.

Presenter	Title	Organisation
Loretta Anania	Introduction and context	EC–DG INFSO
Francesco Nucci	Search as an architectural component: searching for a new paradigm	Engineering in Pharos?
Ricardo Baeza-Yates	Next-generation search	Synelixis
Isidro Laso Ballesteros	Internet architecture and innovation	Yahoo!
Alexis Joly	Visual search as an architectural component	INRIA
Moderator: L Anania R Baeza-Yates F Nucci A Joly J Domingue	Discussion moderator	EC–DG INFSO Yahoo! Engineering in Pharos? INRIA Open University
Isidro Laso Ballesteros	Next steps and wrap-up	EC–DG INFSO
Loretta Anania	Conclusions	EC–DG INFSO

Presentations on the FIA Ghent website: <http://fi-ghent.fi-week.eu/slides>

Session summary

Search as an architectural component: searching for a new paradigm

(Francesco S Nucci – Engineering R&D Lab, Director European Projects)

'Search' is not limited to the everyday experience of individual web surfers. It has become a *must* for business intelligence applications for enterprises large and small. The size of digital archives has grown enormously in many application domains (e.g. enterprise, news agencies, TV broadcasters, advertising agencies, etc.), as have the number of interactions taking place over the net (messaging, events, etc.) and the way this communication and data exchange takes place, or its distribution. Moreover, content is increasingly multimedia based, combining text, audio, still images, animation, video and interactivity into a single form. As a result and based on various analysis, 50% of the applications will include a search facility as a primary interface for end-users.

This need for search engines poses a number of challenges, namely:

- Lack of a unified framework for multimodal content search and retrieval
- Lack of dynamic and scalable indexing techniques for searching over the network
- Lack of user-centric and context-aware search and retrieval (S&R) framework
- Lack of efficient tools for searching 'intelligent content'

Nucci outlined the increasing importance of services on the internet, and that search is among the core services, alongside and in combination with new uses for geo-information, people search and social networking. But he concluded that we are mostly using these services in isolation from each other, via independent websites and user interfaces. Some services like search, he explained, are starting to become integrated but he expects a significant increase in this in coming years.

Next-generation search

(Ricardo Baeza-Yates, VP of Yahoo! Research for EMEA & Latin America)

The rapid increase of content on the internet is worth emphasising, according to Baza-Yates. Even in 2007, published content was more than 4GB per day, while the volume of private data was significantly more than that – user-generated content was reported at around 80GB per day, while private text approached 3TB, and typed text was thought to be in the vicinity of a staggering 700TB. This has given rise to specific trends and challenges for search engines: quality vs. quantity issues, the expansion of social networks, and new forms of real-time content creation (people and physical sensors). Search engines are therefore also evolving, moving from relatively simpler text mining activities into more complex tasks such as identifying what users really want, the semantics and context of their actions. This affects not only the retrieved information but also the way it is presented to users.

Baeza-Yates concluded that we are moving from a web of pages to a web of objects. Objects are people, places, businesses, restaurant, etc. (so-called named entities), which have attributes (missing, noisy, etc). Search engines should be intelligent enough to find and retrieve content 'objects' based on the context and user needs. The key feature in search engines will be the user experience (information and presentation).

Visual search as an architectural component

(Alexis Joly, INRIA)

Visual search already supports very important applications, such as searching vast TV and film footage, copyright monitoring and detection (beyond basic digital rights management issues like content-links), as well as large-scale object retrieval. The next step in visual search will be more effective mining of visual objects, linking visual contents at the object level, visual query suggestions and visual-based events tracking. The visual objects model in the Future Internet is expected to have neither concepts nor low-level features, but support visual objects represented as independent entities.

Session conclusions

Some conclusions based on the discussions are that the term "searching" has quite different usage and meaning in each stratum (networks, content, services). Moreover, there are quite different mechanisms for 'discovering' information, so we should be very careful as the term is evolving. On the other hand, it is obvious that discovery of resources should be inherently supported by Future Internet architecture.

Another important topic affecting search engines was how to deal with privacy and data security issues as the internet moves more and more towards personalisation and user aggregation. Everyone agreed that privacy and security are very important. Yet, the trend towards personalising the search experience to provide better, richer services calls for more, not less, information to be extracted from users, and so privacy is challenged.

Finally, the issue of open source search was discussed and proposed as one of the lessons learned by the 'Engineering in Pharos' project.

Session IX – Scenarios for FI business

Rapporteur: XX

[report to come]

FIA session X – Experimentation

Rapporteur: Martin Potts, Martel

Session objectives

The session sought to present existing Future Internet facilities based on successfully executed cases and experiments. It also provided information on the open calls for experiments being offered by the new Integrated Projects (IPs).

Presenter	Title	Organisation
Anastasius Gavras	Opening, welcome	Eurescom
Jacques Magen	Successful experiments overview	Interinnov
Florian Schreiner Julie Marguerite Andreas Gladisch Ingrid Moerman Mirko Presser	Plans for open calls and offerings by: BonFIRE TEFIS OFELIA CREW SmartSantander	Fraunhofer FOKUS Thales Deutsche Telekom Ghent University / IBBT Alexandra Institute
	Open discussion	

Session summary

Anastasius Gavras of Eurescom introduced the session by announcing that it was oriented towards presenting (i) results from successful experiments that have been performed on the existing test beds and (ii) highlighting the upcoming open calls from the new Integrated Projects.

Interinnov's Jacques Magen, Interinnov explained the philosophy of using large-scale testbeds for the experimentation of innovative research results employed by FIRE, a Strategic Targeted Research Project (STREP). He advised the audience to read the following two documents for more information:

- The official FIRE brochure containing short descriptions of all the STREPs and IPs
- The new FIRE STATION brochure describing the IPs and example case studies

He then presented some examples of successful take-up of the existing (Call 2) test beds:

- **OneLab2** has been used experimentally with a distributed (over 50 sites) overlay routing system for a wide variety of network applications, ranging from routing to peer-to-peer file sharing (called Egoist).
- **FEDERICA** has been used experimentally with a multi-domain, multivendor network resource brokering system (called "Harmony").
- **WISEBED** has been used experimentally with two physically distant sensor networks that were combined into one single virtual network.

- **Panlab – PII** has been used experimentally with end-to-end self-management in a wireless internet environment, adaptive admission control and resource allocation algorithms, and enhanced Web TV services over mobile phones.

Magen then briefly introduced the facilities that will be offered by the new IP projects from Call 5: BonFIRE, CREW, OFELIA, SmartSantander and TEFIS.

BonFIRE is open for experiments that pose state-of-the-art research challenges in Cloud Computing, including Dynamic service landscape orchestration for an internet of services, QoS-oriented service engineering for federated clouds, elasticity requirement for cloud-based applications.

CREW has four wireless test beds across Europe, with advanced spectrum sensing solutions. These can be combined to allow industry and academia to evaluate wireless protocols and/or hardware in a controlled environment.

OFELIA has five test beds across Europe that create distributed OpenFlow multi-layer and multi-technology infrastructure. The experimental facility will offer access to diverse technologies, including Ethernet, optical and wireless domains. The islands are connected by multiple 1GE links to the GEANT network.

SmartSantander has a unique city-scale experimental research facility that supports typical sensor (IoT) applications and services for a smart city.

TEFIS has a web portal that provides a single access point to different testing and experimental facilities. Initially, the TEFIS platform integrates 7 complementary experimental facilities, including network and software testing facilities. An example of a typical use is a large-scale SOA application for a major travel-business e-commerce platform accessible both from websites and web services.

Finally, Magen introduced the concept of the open calls, informed participants about the Information Day which is due to take place on 9 February 2011 in Brussels, and the goals and services of the FIRE STATION project.

BonFIRE

Florian Schreiner of Fraunhofer-Fokus explained that BonFIRE operates a multi-site, controlled cloud facility, with real and emulated services. Two infrastructures are currently installed and a third should be added later (through federation with OneLab or FEDERICA). The emulated facility is provided by IBBT's Virtual Wall.

The current project DoW specifies three experiments: dynamic services, QoS-oriented service engineering for federated clouds, and elasticity in cloud-based web applications

The total value of the two open calls is €1.34 million.

New proposals should last for 12 months and improve the current infrastructure in areas such as:

- Service engineering, including service discovery, service management and lifecycle control, composition and aggregation of services, and orchestration.
- Virtualisation techniques and distributed computing.
- IT platforms, including management services (SLAs, LM, etc.), QoS monitoring and middleware technologies.
- Extended enterprises, such as service architectures beyond SOA platforms with enhanced capabilities, as well as enterprise application integration

The first open call will open in February 2011 and close on 2 March 2011.

TEFIS

Ms Julie Marguerite of Thales described how TEFIS operates an open platform for the management of experiments orchestrated across heterogeneous facilities. It allows an efficient combination of networking resources (using the Teagle portal from Panlan for resource management), LivingLab resources and feedback evaluation (using the Botnia LivingLabs tools for design and validation), as well as Cloud resources.

The first open call is expected to fund three experiments worth €150 000 each. New proposals should make use of at least two of the facilities, and be in areas not already covered by existing TEFIS activities (i.e. e-health, e-commerce and mobile content sharing).

The first open call will open at the end of February 2011 and close on 27 April 2011. TEFIS is also looking for independent evaluators.

OFELIA and OpenFlow

Deutsche Telekom's Andreas Gladisch explained that OFELIA is a test bed for experimenting with OpenFlow. Particular aspects that will extend the state-of-the-art are:

- OpenFlow extensions needed for multiple layers and multiple domains
- Multi-domain OpenFlow requires controller-controller communication

The total value of the two open calls is €830 000 (with each experiment not exceeding €200 000). Funded experiments will be widely published (for example, in IEEE Communications Magazine).

The first open call in February 2011 will invite experiments focused on a 'single island' scenario. The second call, due out in February 2012, will focus more on multiple domain scenarios (resource assignment automation of connections to other geographically-distant facilities, measurement, extensions of OpenFlow, etc.).

CREW

Ingrid Moerman of IBBT told the assembled participants that CREW offers four test beds each focused on a particular technology (heterogeneous ISM, heterogeneous licensed, cellular, and

wireless sensor). These are interconnected into an open platform for the evaluation of cognitive radio/networking solutions in a configurable and repeatable environment (into which interference can be injected). It avoids the need for every experimenter to build their own test bed. Topics that are particularly studied are advanced spectrum sensing, cognitive radio, cognitive networking, and spectrum sharing in licensed and unlicensed bands.

The first open call will be published in the second half of 2011 and the second one will be issued at the end of 2012. The calls will seek innovative experiments using the federation of test beds, as well as proposals to integrate additional cognitive radio technologies into the federation. Potential user scenarios will be described in a public deliverable due at the end of February 2011. Interested parties should subscribe to the CREW newsletter.

SmartSantander

The Alexandra Institute's Mirko Presser expressed how SmartSantander will install 20 000 sensors in the city of Santander, Spain, to enable citizen-centred services such as traffic control and parking, support for the elderly, cultural activities, smart metering, environmental monitoring, public transport, and urban waste management.

As the region of Cantabria is supporting the project financially, the services must serve the public good. However, there will also be scope for conducting research into the lower-level networking aspects, such as routing protocols, multicast, location-based services, IPv6, interactive services and data management.

The project will issue open calls in July 2011 and July 2012, for a total value of about €800 000. A developers' day will also be organised.

More information

FIRE: www.ict-fire.eu

FIA session XII – Can the cloud be trusted?

Rapporteur: Jim Clarke, Waterford Institute of Technology, Nick Papanikolaou, HP Labs

Responsible caretakers: Volkmar Lotz, Jim Clarke, Nick Wainwright, Michel Riguidel

Other session contributor/organisers: Gregory Lopez, Volker Fusenig, Elmar Husmann, Demosthenes Ikonomou

Chair: Volkmar Lotz, SAP Research

Session objectives

In this session, the main objective is the closer examination of trust in a Future Internet (FI) that is made up of numerous solutions based on new paradigms of service offerings, including those in the context of cloud computing. One of major properties expected of the FI is to provide a platform for new businesses, which can only achieve value if there is sufficient trust in the infrastructures. The 'cloud' has been variously described but broadly it is the technology and systems which enable the real-time delivery of vast data, applications and services over the internet. Due to its diverse nature, the cloud poses a number of potential trust challenges which this session addressed:

- How can trust be built in the digital space of the cloud, where services and resources are exposed instead of humans? We do have means at hand, such as service level agreements (SLAs), monitoring and logging, privacy enhancing technologies, reputation systems, security technology, process and risk models, etc., but how should they be combined and applied to manage trust effectively?
- Is trust specific to application domains and cloud models?
- What kinds of events in the cloud (like migration of data across servers or domains) have an impact on trust? What needs to be signalled to a user, taking his role as consumer or provider of services and content into account, how much detail needs to be released?
- What needs to be done to ensure that users are not overwhelmed by the amount of information and technical detail, still being able to make informed decisions?
- Does the cloud need regulation to provide trust? Do cloud providers and services need to be certified? Which principles should apply?

The challenges in the session were addressed from two complementary angles and the speakers were chosen accordingly: a business viewpoint focusing on needs and customer requirements, and a technology viewpoint focusing on technology enablers and the state of the art.

Presenter	Title	Organisation
Gregory Lopez	Business view on cloud security	Thales
Volker Fusenig	Security challenges for the Cloud	Fraunhofer Institute for Secure Information Technology
Elmar Husmann	Trustworthy clouds in the Future Internet	IBM

Session summary

Business view on cloud security

The first presentation concerned a number of cloud platforms that had been developed by Thales for use by the French government and industry. By discussing examples of real systems, the speaker was able to illustrate the core security issues that emerge in the cloud.

An e-health cloud platform for assisted living was presented; this is intended as a tool that facilitates the provision of healthcare and patient monitoring in their homes. In this example, there are very strict regulatory requirements that must be satisfied, and the success of the system is very sensitive to negative public perception.

Other examples of systems developed by Thales are specialised platforms for the French Ministry of Finance and for the French Ministry of Defense (MOD). These examples highlighted the need to ensure the privacy of citizens through secure access to personal data. The system for the French MOD is built on a private cloud, designed so that data held will not leave the country of collection at any time, even though interactions with other information systems abroad may be needed for processing. The core challenges faced by the developers of the system are managing the location of the data and providing mechanisms for secure federation and monitoring.

Broader challenges related to data security in the cloud include:

- Who can access the data?
- When can data be accessed and under what conditions?
- What is the appropriate SLA?
- Can a user stop their contract at any time (reversibility)?

Compliance with security standards and privacy laws is a central requirement. To ensure compliance, clouds must incorporate data handling and monitoring mechanisms that guarantee the location of data, that can be checked and certified on a regular basis, that provide audit trails for data disclosures. Also, it is important to deal with issues like suppression of data and administering a managed requisition process for the data.

After the examples were presented, the speaker discussed the lessons learned and argued that there are still some open problems. It had become clear that service level agreements would have to be contractual and embedded within any cloud service offering, with cloud providers competing to provide the highest quality of service and availability.

Cloud providers have to deal with multi-tenancy issues and intrusions. Different customers are likely to be using the same physical infrastructure to host their systems and it is very difficult to guarantee 100% isolation of one system from another. There is a host of threats posed by this situation, including data losses and leakages as shared memory and shared virtual machines (VMs) are used.

One of the security and privacy challenges still faced by providers of cloud offerings include finding ways of enforcing compliance with applicable law and regulations. Since cloud operations involve data centres in multiple locations, dealing with flows of data between them, while ensuring compliance, is a core problem. Of course, it is also true that regulations on privacy, data retention and data access by law enforcement agencies are not always coherent and need to be better aligned with each other, thus making enforcement and automation of compliance both practical and efficient.

Especially for government-grade applications, one will expect to get the same level of security provided by traditional solutions (and classical, closed infrastructures) from cloud platforms, but this seems very difficult to achieve at the moment. This is the most important challenge faced by cloud operators; they will need to provide ever-higher grades of security before customers will be convinced to migrate to their systems.

Security challenges for the cloud

The presentation focused on cloud networking security for 'Scalable and adaptive internet solutions' (SAIL), a project engaged in R&D of novel networking technologies to lead the way from current networks to the networks of the future including one built of a cloud computing physical infrastructure.

First, the architecture for cloud networking was discussed, along with the scenarios and use cases in which cloud networking is of benefit. For instance, the deployment of virtual desktops is an enabler for the dynamic (virtual) enterprise. In this scenario, a thin client is connected to the virtual network infrastructure, and a virtual machine is provided to the user for his computing needs. Interestingly there is the challenge of reducing latency, since the virtual machine may end up being run on a physically distant machine, and this means there is a delay to network switching/routing processes.

Now, consider the SAIL scenario in which there are virtual machines hosted at different locations, which must all be interconnected through virtual networks. Users require access to some of these VMs and some of these networks, so there is the challenge of separating/isolating them from one another for security reasons. VMs at different locations need to be migrated to a closer location to the user to reduce latency, but to reduce network load they should be migrated where network availability is high; these requirements may be conflicting at

any given time. Furthermore, there is the fundamental issue of cost, which places a requirement to run VMs on the cheapest possible infrastructure. Such are the challenges that SAIL attempts to address.

A practical scenario where the very same problems arise while running on a cloud infrastructure is that of intelligent video distribution. For a video to be distributed effectively, the cost of distribution should be low while at the same time ensuring quality of service, so that frames are not lost (which would reduce the user experience).

For cloud networking, there is the central question of where and how to perform virtualisation management. Where exactly, on a large, physically distributed network of interconnected virtual links, would a given VM be run? Which machine would host the hypervisor and what policies would it need to enforce? All of these issues were raised during the talk.

Clearly, there is a need for new policy models and policy enforcement mechanisms for cloud networking. There are different tradeoffs to consider, as well as the issue of cross-border data flow. New encryption mechanisms are likely to be needed, in particular for secure channels along particular links. Homomorphic encryption might in principle work as a means of processing encrypted data, but it is not yet widely available in a practical form. There is an element of trust that inevitably needs to be placed on cloud providers.

In summary, cloud networking is a framework that combines cloud computing and virtual networking; this requires combined control of computing and network resources. Cloud networking enables flexible usage of virtual infrastructures via the live migration of VMs between different locations, and subsequent optimisation of VM placement given constraints on latency, network load and cost. The use of cloud networking is likely to enable new business models and will in particular fuel the virtual enterprise. For this to happen, of course, there are key security challenges that need to be better understood and then resolved.

Trustworthy clouds in the Future Internet

This talk began with some shocking statistics, which of course are intended to demonstrate the significance of security measures for cloud platforms. It seems that in a particular study, 80% of enterprises consider security issues the key inhibitor to adopting cloud-based solutions for their business. The same study showed that only about 48% of enterprises were as concerned about reliability. This shows that industry would be willing to have some tolerance with regards to quality of service, but much less so with confidentiality of their systems and data.

There are of course different types of cloud – private, public and hybrid clouds. The speaker asked which type of cloud is suitable for what. The risk concerns include control, reliability, compliance, data handling and security management (by whom, when, where?). There are trust and security limitations for global cloud infrastructures, due to the openness of these platforms to all sorts of threats.

IBM projects on cloud platforms have included Reservoir and Vision; the challenges raised by these projects include the following. First, there is the question of how to federate public clouds; there is also the issue of moving data from one cloud to another. Privacy issues are very

worrisome and have yet to be addressed fully. Other practical problems included preventing data leakage from one customer to another, and restricting the damage that one cloud customer/user can inflict on others (especially when sharing the same infrastructure).

There are threats posed by cloud administrators who are capable of performing 'insider attacks'. System administrators have wide privileges in traditional systems, but the domains within which they operate are still clearly demarcated. This may not be the case in the cloud setting, due to the fact that systems are inherently distributed and difficult to pin down and restrict: data flows across administrative and physical domains.

Another difficulty with cloud platform offerings is the lack of transparency and, hence, understanding on the customer side. There is what is known as the "cloud curtain", a term which refers to the manner in which cloud providers hide the details of how a cloud service is technically delivered to customers. The consequence of this is that customers cannot gain any insight into real system status and how to deploy adequate risk mitigation mechanisms. Certified, auditable cloud services are likely to provide higher levels of trust. Another solution may be to give to customers low-level system access, so that the customers can implement their own trusted computing mechanisms; this would alleviate some of the pressure on the provider to secure the infrastructure.

The ways in which cloud solutions can be contrasted to traditional data centre services were discussed, and this material was similar to that in the other two presentations. Of course privacy was raised as a central concern here too, and it was made clear that better encryption and compliance mechanisms will need to be developed and deployed.

The speaker concluded with a presentation of the TClouds project, which deals with privacy and resilience for internet-scale trustworthy infrastructures. The most relevant activity in the project dealing with trustworthy clouds is activity 3, which deals with end-user application scenarios such as home healthcare monitoring (issues here include privacy and resilience) and capacity planning for the smart grid.

Discussion and conclusions

A number of questions were raised on the **first presentation** including:

- Can the cloud be trusted?
 - The response was "both yes and no". For internal use, the answer is yes, as data is held and managed inside corporate systems; for external and customer use, at the moment, the answer is no.
- There is a need for "uniform" and consistent security and privacy regulation, but there is also a need for national laws and regulations that have to be equally respected. How do we balance the two?
 - The speaker replied, in the context of the system designed for the French Ministry of Defense (MoD), the regulations override any EU regulations. It was

also noted that for cloud-based applications specifically for the French MoD, it was necessary for all data and servers to be physically located in France.

- If you are in Finland using services in Finland, it is possible that your IP packets will travel through Sweden. Clearly this can be a problem due to mismatches in law/regulation in these two (or any other two) countries. How does a cloud provider deal with this?
 - It was pointed out that it would become necessary to be able to guarantee end-to-end security.

A number of questions were raised regarding the **second presentation**:

- Are we to assume that the communication medium for clouds is de-facto the internet?
 - The speaker answered yes, noting that it is a shared medium.
- What dedicated hardware might be required for the Future Internet's cloud-based systems? Do we need a new processor design to cope with the real virtualisation that we are relying on in order to achieve separation, or is what is currently available sufficient? Do we need to look at the hardware processing design to be responsive to the new networking requirements?
 - A number of hardware companies in the audience responded that there is new hardware required, and some of these were already being tested in a number of R&D projects.
- Should we be concerned when moving “virtual machines” around and sending data between them, can the data end up in the wrong hands?
 - The response was yes, this was a possibility and needs to be safeguarded against.

A number of questions were raised on the **third presentation** including:

- It was confirmed that new security applications dealing with cloud computing are needed, and that projects should play a role in this development.

Standards play a role in the migration of data from one cloud provider to another – speakers felt the FI community should indeed be involved in the standardisation process.

- What is required for a “trusted cloud” – to prove beyond doubt it is trustworthy?
 - A number of different trust levels were presented:
 - High – explicit, “provable” trust in the provider
 - Medium – ability to see how the provider is handling data
 - Low – the ability to actually control and monitor data and data flows
- On the question of online compliance testing and auditing, it was felt that everyone needs to be accountable for every part of the transactions.

- The development of policy enforcement mechanisms specifically for clouds is still an active area of research, according to the speakers.
- The cloud is not transparent so how could it ever be trusted?
 - Trust will have to come out of trust models for reputation etc. Within the Future Internet, there is a need to add measurement around and inside clouds to get new variables to compute or estimate whether you can trust it fully.

More information

Session slide available at FIA Ghent website: <http://fi-ghent.fi-week.eu/slides>

Trust and Security FIA wiki: http://security.future-internet.eu/index.php/FIA_Ghent

TClouds project: www.tclouds-project.eu



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FIA demonstration session



For its 2010 edition, ServiceWave joined forces with FIA and FIRE in order to present a unique demonstration track featuring 24 selected demonstrations covering diverse Future Internet topics ranging from services to infrastructures and applications. The event took place in a friendly and informal atmosphere and provided a great opportunity for networking and fostering conversations across projects, application domains and scientific communities.

There was a 'best demo' prize awarded according to four criteria: originality, relevance, quality and presentation. The winner, announced at the conference, was: **NinSuna: Metadata-driven media delivery** by Davy Van Deursen, Wim Van Lancker, Erik Mannens and Rik Van de Walle. Congratulations to the team!