Future Internet Assembly

‘Smart Cities and the Internet of Things’

Aalborg, Denmark

10 – 11 May 2012

http://www.fi-aalborg.eu

http://www.future-internet.eu
Introduction

Smart people, smarter cities … it’s the Future Internet

In the large assembly hall behind the glowing ‘Hands-on FIRE’ demos, delegates received a warm welcome to the Aalborg Future Internet Assembly from, among others, Morten Østergaard, Danish Minister for Science, Innovation and Higher Education and Finn Kjaersdam, President of Aalborg University who outlined their vision of ‘Smart Cities and the Internet of Things’ (IoT).

“Smart systems create whole new fundamental infrastructure for our society with the internet at the centre – and there is unlimited potential,” said Minister Østergaard. But smart systems need smart people “who are fluent in digital language”.

Smart cities combine the latest technologies and data-driven trends with socially-conscious policies and actions to improve the quality of life of “smart citizens” who live in them. The Internet of Things and other Future Internet (FI) developments, including infrastructure, services, standards, “big data” and security assurances, pave the way for joined-up cities to evolve. Smart cities of the future seek sustainable and intelligent growth – the type of growth that supports the EU’s 2020 vision.

Keynote speaker Thierry Van Landegem, VP Alcatel-Lucent, explained how ICT infrastructure is like a “central nervous system” for smart cities. But “smartness”, he cautioned, is not just technology; it is also about managing resources and handling vast datasets generated by the IoT. “If you analyse this data you can learn from it,” he said, and it can be used to create “value-added” apps for end-users.

In his keynote, Reinhart Scholl, Deputy to the Director of ITU, called on the FI community to press for robust standards and actions underpinning smart city developments. But it is a complicated ecosystem, he noted, which will get more so as ICT becomes more pervasive (among transport, utilities, citizens,...) and interconnected. The ICT community will have to collaborate with other organisations in different fields with different models and cultures, he suggested. “There will be some trial and error to get the best results.”

They will also have to ensure society plays its role in co-creating smart cities of the future. Leaders need to empower people with open data and civil society models to create and innovate alongside entrepreneurs, suggested Markkula Markku of Aalto University, Finland. “We’re not outsourcing production but insourcing people to develop services and apps [in smart cities].”

Mario Campolargo, Director of DG INFSO Emerging Technologies and Infrastructures, explained where Future Internet research fits into the new Horizon 2020 programme and its more integrated role in the newly renamed ‘DG Connect’:

“[The new name and programming] show our appreciation for connecting people in a networked society; people meeting with each other to reinvent the future, like we do here at FIA,” he said at the closing ceremony in Aalborg. In whatever new form and frequency it will take, FIA will continue to be an “opportunity to cooperate, ventilate new ideas and do business (real business)”, he concluded.
FIA Aalborg... all fired up!

The FIRE starters did their job on 9 May during a series of workshops designed to ignite interest and ideas for ‘Future Internet Experimental Research’. On 10 May, it was the turn of selected projects, during ‘Hands-on FIRE’ sessions, to demonstrate their platforms, networks, models, and Future Internet solutions to the wider world. Highlights included SmartSantander’s demo of a city-scale Internet of Things (IoT) and Spitfire’s testbed giving delegates the chance to interact with a linked set of objects using its Smart Service Proxy. The FIRE scheme is helping to build on a dynamic, sustainable, large-scale European experimental facility by gradually connecting and federating existing and upcoming testbeds for Future Internet technologies.

More information

Slides and videos of presentations at FI Aalborg: http://www.fi-aalborg.eu

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

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

Thursday, 10 May 2012

Opening plenary session – Smart specialisation and regional growth

Chair: Neeli Prasad of Aalborg University’s Center for Teleinfrastruktur (CTiF)

Mrs Prasad welcomed delegates on behalf of the university and CTiF and injected a bit of IT humour for a taste of the two days to come. “We tried to order a sunny day but got our request denied, I’m afraid.”

About 500 participants were registered for the Future Internet Assembly in Aalborg, which was considered a “very good turnout”. Mrs Prasad thanked the sponsors and organisers, and applauded the Assembly for coming to what her colleague once described as the end of the world. “But I don’t agree at all with that… and I’m sure after the next two days you won’t either!” she added with a grin.
Thomas Kastrup-Larsen, Alderman of Health and Sustainable Development, City of Aalborg

- The transition to ‘smart cities’ involves a physical and mental dimension.
- Strong support for ICT and infrastructure provide endless opportunities to optimise.

Aalborg is a city transforming both “physically and mentally” from an industrial harbour into a modern city – a centre of culture and sports, architecture, music, and more. Investment in the city of some 200,000 residents is robust and Aalborg University is the fastest growing in Denmark. This is because the city takes care of its students by providing housing, services and facilities… the “physical dimension”, he explained.

Aalborg’s “mental” transition has been from a hard-working industrial city to an equally hard-working but now digital city, with new technology and strong support infrastructure for ICT, as well as green technology, e-health and telemedicine as core strengths. According to Mr Kastrup-Larsen, these provide “endless opportunities to optimise” and build the foundations for a smart city with better public transportation (online traffic info, mobile platforms, etc.). He gave the example of Aalborg’s smart “care services” which are being improved thanks to a co-creation experiment between researchers, care providers and industry.

The city is trialling an advanced telemedicine programme to help sufferers of a debilitating lung condition called chronic obstructive pulmonary disease. In the pilot, the majority of participants had less hospital admissions and needed less care. “These were good results which we will take to full-scale launch,” he said.

This example shows that Aalborg is becoming smarter as a city, he said, by creating the right conditions and connections to inspire change, to become what a recent SAS Scanorama magazine report called an “action-oriented” municipality with a strong focus on tackling climate change concerns.

He welcomed delegates to his climate-friendly, student-friendly city and looked forward to hearing how Aalborg can make the next steps to becoming a truly smart city as well.
Finn Kjærsdam, President of Aalborg University

- Greater emphasis on ICT in smart cities can help solve urgent problems.
- New ideas bubble up on the internet and trigger collaborative, problem-based learning.

“Firstly, as a professor of urban planning, I take pleasure at seeing greater emphasis on ICT in smart cities to solve urgent problems,” launched Mr Kjærsdam. There is no doubt that the internet is the backbone of global developments we are witnessing in the economy, technology, government and nearly everything concerned with daily life.

International meetings like FIA are a valuable addition to this global landscape, and it is Aalborg University’s honour to be hosting a conference which is so critical to the future, he noted.

“But why in Aalborg and why Denmark?” Apart from the timing of the current EU Presidency, Denmark is fast becoming a benchmark for a knowledge society, he suggested, and Aalborg is a demonstrated leader in information technology.

“I don’t pretend to know more about this than you, but I do know about problem-based learning,” he said, “where teams (from day one) try to solve unsolved problems of public good.” This changes a student’s approach to education; he or she is freed up to think about challenges and come up with real-world solutions.

Aalborg University combines traditional and new approaches to education, he explained, which means professors have had to adapt to new learner-centred approaches as well. New ideas and theories bubble up on the internet, and students are primed to ask a lot of questions which, in turn, stimulates professors who in many ways “moderate rather than teach in the traditional sense”. Together, students and professors solve problems to achieve progress.

He hoped delegates at FIA Aalborg would have equally fruitful discussions leading to positive outcomes for our future smart cities.
A vision of smart, energy-conscious cities must be backed up by action-driven strategy.

CTiF pursues cross-disciplinary research with a global focus and affiliates in the USA, Japan and elsewhere.

“I think most of you travelled by SAS to get here and may have read the Scanorama in-flight magazine,” he said. In it, he highlighted an article entitled ‘Aalborg in the lead as climate municipality’, as a very good example of how action-oriented policy and close collaboration with industry and Aalborg University are helping to make this northern city a model of energy efficiency. “If you didn’t read it, I recommend you do as you fly out!”

For those not flying on SAS, here is a quick précis of the article: Aalborg citizens emit nearly 25% less CO2 than the Danish average, according to the article. Today, around 30% of the municipality’s energy supply comes from sustainable sources. The goal is to get that up to 60% by 2030 and for the city to be supplied totally by renewables from 2050 onwards.

A vision of a smart city like this must be backed up by action-driven strategy, major infrastructure investment and joined-up policy-making, working closely with relevant networks, ‘green’ organisations and young people, the article suggests.

“Everybody must help reduce energy consumption by 40-50% over the coming 40 years. When children learn to cut back… they’ll influence their parents,” Thomas Kastrup-Larsen is quoted as saying. An important part of Aalborg’s climate strategy is to achieve green growth, he concluded.

Mr Prasad thanked the previous speakers, especially the mayor, for their kind words about Aalborg University and its ambitious technology programmes, in particular its work on health and telemedicine. He spoke about CTiF, its global activities and cross-disciplinary approach, as well as its affiliates in the US, Japan and more. He encouraged delegates to read CTiF’s annual report for more information.
Mario Campolargo, Director of DG INFSO Emerging Technologies and Infrastructures

- We have to reinvent cities as smart cities that handle traffic, energy, health, water, security, education… in smarter ways.
- A holistic, systems approach enables smart citizens to contribute to a smarter society.

A Future Internet conference focusing on smart cities is a timely and worthy subject, according to Mr Campolargo. Smart cities are living organisms and are thus drawn towards finding solutions and new ideas; much like the Future Internet itself. “We have to reinvent cities as smart cities and the Future Internet also needs to reinvent itself – sustainability and flexibility being very important to its survival.”

He showed statistics of the world's population living in urban centres throughout history. For example in 1950, 29.1% of all people lived in cities. In 2010, this figure had jumped to 50.6% and by 2040, it is predicted to go as high as 64.7%.

“Cities spur innovation and complex urbanisation yearns for sustainability,” he stressed. “But what is a smart city?” He introduced a few key elements, which could be done in a smarter way in the future like administration, traffic, energy, health, water, security, education, culture, tourism, shopping, and entertainment. The common element is that they need underlying digital support for which the Future Internet is important, “but not the only thing”, he cautioned.

Other important factors for success are to leverage “megatrends” like getting greener and more sustainable, being more intelligent by analysing large quantities of data in an efficient manner and, by making systems and processes more dynamic.

The basic building blocks to realise the smart cities of tomorrow will be the skilled citizens supported by infrastructure (high capacity networks, Internet of Things etc.), cloud computing, social networks and further opening of public-sector information and services.

Mr Campolargo mentioned the FIRE programme and talked about the importance of innovation and experimentation – so-called “copying with evolution”, or building on solid foundations but allowing for change over time – which also engages entrepreneurs and citizens in this process. The Commission is keen to “root innovation locally” to achieve best results, he said. Examples of Future Internet Public-Private Partnership projects doing this, he said, include SafeCity, Finest and Outsmart.

He then outlined the policy dimension to smart cities, in particular energy and transport, and announced a large initiative would soon kick off in this regard. Smart cities, he confirmed, are a major theme in the context of Europe 2020. “But what’s next for Future Internet and city management?” We need a “holistic and systems approach,” he said, which cuts across sectors (energy, transport, buildings, waste, water, etc.) and goes “beyond GDP” to give smart citizens the chance of a better life and to contribute to a smarter society. But first we need to learn to engage citizens more in the process.
Morten Østergaard, Danish Minister for Science, Innovation and Higher Education

- Smart systems and the FI need smart people who are fluent in “digital language” to reach their full potential.
- We need to hear from all voices in society when evaluating pervasive changes ushered in by the FI.

“First, I should stress that Aalborg is not the end of world, rather I’d like to think the centre of Europe,” retorted the minister with a smile to Mrs Prasad’s welcome message.

“Now, I’d like to talk about cows and car parks.”

Put a sensor in the ear of a cow and it monitors the animal’s health, transmitting information wirelessly to the farmer if it falls sick, even notifying the vet straight away if treatment is needed. Ferromagnetic sensors, meanwhile, constantly monitor car park capacity, sending data that can be mapped online to help drivers find parking in busy city centres using their satnavs. In time, others sensors will also measure natural light and adjust street lighting automatically.

“It might sound like science fiction but it’s not,” said the minister. These are real examples from the Netherlands and Spain of how smart cities and the IoT promote mobility, save time and energy and ease traffic jams. “They demonstrate that the digital and real worlds are converging.”

“Use of smart systems and IoT create a world of opportunities,” he said. For example, if the US power grid were more efficient by just 5%, according to The Economist it would cut equivalent greenhouse gas emissions of 53 million cars. “Smart systems create whole new fundamental infrastructure for our society with the internet at the centre – and there is unlimited potential.”

But smart systems like this need smart people who are fluent in digital language to reach their full potential, Mr Østergaard added. He then spoke about the importance of investment in Future Internet research in FP7 and Horizon 2020, and its leadership role in industrial technologies. Investment in ICT has a guaranteed return, he said, and it already directly accounts for 5% of European GDP, or €660 billion, and contributes to overall productivity growth to the tune of around 20%.

“New developments within smart systems and the IoT will see these figures skyrocket,” he predicted, which is good news as Europe faces slower growth overall, with 17.4 million people out of work. “The path that will lead us out of this crisis is, by and large, a digital one… that requires a Digital Single Market to ensure the necessary ICT infrastructure.” He noted the Danish EU Presidency’s progress in this regard and underlined the value of agreements on roaming and e-trade towards this.
The minister touched on the “dark side” of FI and smart systems, and called on the EU to be role models in handling the convergence of the digital and real worlds to avoid “Orwellian scenarios filled with monitoring” while protecting citizens against cyber threats.

This raises the question: Is smart always better? A question not just limited to the IT sector, suggested Mr Østergaard: “We need to hear all voices in society when evaluating this important topic.” The internet is, indeed, pervasive so while change is important it needs to be conscious. “I hope the conference will be productive and constructive in achieving this,” he concluded.

**Keynote: Thierry Van Landegem, Vice President, Alcatel-Lucent**

‘**ICT infrastructure as key enabler of smart cities’**

- “Smartness” is not just technology; it is also about managing resources and handling vast datasets generated by the IoT.
- We need to better communicate the social and economic value of smart cities and treat it as a “grand challenge” with a consistent, end-to-end view.

Urban populations will grow by an estimated 2.3 billion over the next 40 years. Today, cities consume 75% of the world’s energy and produce 80% of its greenhouse gas emissions. By 2050, the number of people over 60 will triple. Global trends like these are ominous, cautioned Mr Van Landegem: “We had better make cities smart or else we are doomed!”

Smart cities, he said, must be driven by innovation and smart solutions for education, mobility, the economy, government, the environment, and directed to find ways for people to enrich urban living conditions (i.e. efficient transport, zero waste, smart grids, security and safety, etc.). ICT is like the “central nervous system of smart cities”, he said, providing platforms, services and applications, and the means to bring all stakeholders, including citizens, together to make the necessary changes benefiting all of society, “not just the happy few”.

He said better communication is needed so that people understand what smart cities are, thus focusing less on the technology or economic benefits, and more on the social benefits. Research reveals that end-users (citizens) can provide unique views on how to enrich urban living, from ideas on green homes and how to build “trusted relationships” between public-private entities to the importance of “social energy” and “city identity”. He gave examples of EU actions and projects in this regard, such as the Future Internet Public-Private Partnership, Smart Santander, Outsmart, and Finseny.

A number of smart city examples were shown, including the Chattanooga (USA) ‘1Gig broadband to every premises’ initiative and Aalborg students who integrated Alcatel-Lucent’s small cube (lightRadio™) antennas into street lamps to turn them into intelligent nodes in the Internet of Things.

“Successful smart cities have effective trans-sector leadership that reaches out to citizens.”

Thierry Van Landegem
“Smartness”, noted Mr Van Landegem, is not just technology; it is also about managing resources and handling vast datasets generated by the IoT. “If you analyse this data you can learn from it,” he said, and it can be used to create “value-added” apps for end-users.

He introduced a number of energy efficiency initiatives, including the GreenTouch Consortium’s roadmap and architectures, and explained how technology can contribute by better managing resources, which complements smart city developments.

“Smart cities are an opportunity for Europe,” he said. While the Commission is doing a lot, he suggested we need to better communicate the social and economic value of smart cities and treat it as a “grand challenge” with a consistent, end-to-end view. “Our citizens want it!”

**Keynote: Reinhard Scholl, Deputy to the Director, ITU**

‘Smart cities and the Internet of Things through smart standards collaboration

- “Big data” and the IoT are showing how citizens/entrepreneurs/innovators can develop better services and apps for smart cities.
- Broadband is becoming a commodity like roads and water – people simply expect to have it.

Today in China, over half of the population lives in cities. By 2020, more than half of the world’s population will live in cities. Mr Scholl described the ‘Science of cities’ and how vast data can reveal patterns and laws which can help planners gain economic benefits as cities grow. For example, if a city doubles in size you don’t need double the water pipes, electrical cables, and other infrastructure. He cited a September 2011 *Scientific American* feature on smart cities.

Trends like “big data” and the IoT, including “people as sensors”, are showing how citizens/entrepreneurs/innovators can develop new services and apps for the benefit of smart cities. He offered several e-government examples of best practice, including New York City’s Open Data Initiative, Amsterdam’s Smart City programme, Catalonia’s Open Data Gencat and the Commission’s Open Cities challenge.

App contests, such as the NYC Big Apps 3.0, are also a useful way to exploit open data relatively cheaply to improve city life, he suggested. One group came up with a portal which tracked, analysed and charted the 50,000 calls made daily to the municipality hotline. The data revealed interesting trends. The biggest nuisances recorded were noise, street lighting, lost property and water maintenance.
Other best practices from the USA include MIT’s ‘Track Trash’ experiment which used sensors to monitor where rubbish ends up. “One printer cartridge travelled more than 6000 kilometres!” Delegates learned about Oakland’s data-driven, crime-spotting service that is helping the city improve security, and how “hyper-local” news sites in more than 60 cities US-wide are helping communities bond.

The Future Internet and broadband rollout are also helping to bridge the digital divide which supports smart city developments. Here, he said, ITU’s work is very relevant. “Broadband is becoming a commodity like roads and water,” he said. “People simply expect to have it – and the standards for this rollout (e.g. ADSL and mpeg) are coming from ITU,” he explained. “And we’ve done lots of work lately on ICT and climate change... standardising methods to measure the impacts of ICT on climate change. He anticipates a new standard for cities next year.

Mr Scholl called on the Future Internet community to push for robust standards underpinning smart city developments, but he acknowledged it won’t be easy. Today, there are around 500 forums on ICT, forming “a complicated ecosystem” which will get more so as ICT becomes more pervasive (in transport, utilities, water, energy...) and interconnected. The ICT community will have to collaborate with other organisations in different fields with different models and cultures. “There will be some trial and error to get the best results.”
Roundtable

Thomas Kastrup-Larsen, Alderman, Health and Sustainable Development, City of Aalborg, Denmark
Asta Fog Larsen, Citizen of Aalborg, Denmark
Jose M. Hernandez-Muñoz, Telefónica, Spain
Rolf Hapel, Director Citizen Services and Libraries, Aarhus, Denmark
Iñigo de la Serna, Mayor of Santander, Spain
Markkula Markku, Advisor to Aalto Presidents, Aalto University, Finland

Chair: Reinhard Scholl, Deputy to the Director, ITU

Question: Do you have evidence of urbanisation trends like those mentioned in the opening session today in your cities?

Yes, said Mr de la Serna, Santander is definitely a growing city. He agreed that a common characteristic of any smart city is trying to maintain and improve the quality of life for the growing number of people attracted to the city. “Active citizen participation is key to smart cities and important to Santander,” he said. Other panelists noted similar trends and echoed the views of Mr de la Serna.

Do you offer similar services to meet demands in smart cities?

All of the cities represented in the panel were offering some “smart” services. Mr Kastrup-Larsen said Aalborg’s experience in providing ICT-driven services is to get the organisational aspects right. If it is an e-health project, hospital staff and patients need to be on-board. “You need careful implementation or you won’t succeed,” he warned.

Today’s doctors know their medicine but may not be sufficiently ICT savvy. True?

Mr Hapel totally agreed. But he felt this statement does not apply only to doctors. It is a challenge to get non-ICT savvy people on-board. In Arhus, he said, when you apply for the pension, it is still an analogue process. The city improved this process significantly not with new technology but by getting partners on-board and engaging in competence-building exercises through town libraries, elderly groups, and “social activation”.

Mr Markku said technology, indeed, must be practical and hands-on to see daily improvement in life and activities. “All professionals, regardless of the sector, are using digital technology, so we need to focus research and policy Europe-wide to bridge the virtual and real worlds,” he suggested, and “to focus on human behaviour and changing attitudes.”

What do you want in terms of e-health?

Mrs Fog Larsen said citizens need better health options in understandable language that is relevant to the circumstances. She suggested more people from humanities get involved in the development of electronic applications. “For us to go paperless we need help to find easier
ways to communicate with governments, authorities, etc. because there are too many errors in
the network,” she posited.

From the Telco perspective, Mr Hernandez-Muñoz entered the debate, suggesting Mrs Larsen
was not talking about information networks, but human ones. He agreed with her that there are
complex systems which affect people’s daily lives. “It’s difficult to avoid errors in such human-
computer interaction,” he added.

Mr de la Serna spoke about the 3000 sensors deployed on Santander’s streets to measure and
apply different services, including e-health applications. He said citizens got behind the initiative
wholeheartedly, even a so-called ‘participatory sensing service’ which, in his words, “feels the
pace of the city” and keeps authorities informed about traffic, road conditions, etc.

Audience question: Mr Hapel mentioned his successful pensions app that achieved 74% take-
up, but that leaves 26%. How will smart cities handle this ‘residual digital divide’?

Mr Hapel admitted this is a big challenge; some 10-25% of the population will never be
reached, so there must be support in place for them. Perhaps libraries could be reinvented as
“spaces for helpful interaction”.

Mr Markku came in on this point. “In Espoo, we advanced the role of libraries to help in ICT
take-up,” he said. The Finnish city even moved libraries to shopping centres – a place where
people regularly go – and they extended opening hours and made them more attractive to
young people. “Being in libraries is more exciting now!”

Chair: “I haven’t been in a library in 20 years!”

Mr Kastrup-Larsen weighed in as well. “Some say this problem won’t exist in 10-20 years’
time,” he said, because the so-called ‘digital residual’ will all be dead by then. “But I disagree
with that; we will still have people who can’t read and write very well, and they will need help.”
Smart cities need to provide additional programmes as part of “business as usual” so all citizens
have the same rights, he suggested.

Audience question: What can be done about net neutrality issues and other disruptive forces
coming from wider internet developments?

Mr Hapel said we may need to change totally, pursue “open governance ideology” and engage
civil society and industry in different and new ways, using different business models like open
data and open source. The EU is facing severe economic pressure right now and Mr Hapel
suggested more open ways of working can also help in reducing costs.

Mr de la Serna mentioned a Spanish network of 23 smart cities who share their project data
and findings with other cities. “It’s a conscious effort to make the data upwardly available,” he
said. Mr Hernandez-Muñoz said sharing experience was as important as sharing data and that
even in the same country citizens have different concerns and needs: “It’s not possible to have
a single business model for all scenarios.”

But Mr Markku cautioned against viewing citizens as passive “recipients of public services”.
Leaders need to empower people with open data and civil society models to create and
innovate alongside entrepreneurs, he suggested. “We’re not outsourcing production but insourcing people to develop services and apps [in smart cities].”
Friday, 11 May 2012

Closing session

Federico Álvarez, UPM

Mr Álvarez introduced the 2012 edition of the Future Internet Assembly book entitled *From Promises to Reality*, published by Springer and available online (springerlink.com) via an open access platform. He explained the cross-domain basis of the book and how the 40 submitted papers were whittled down to 20 and classified into four main chapters/domains.

- **Foundations**, including architectural questions, mobile internet, cloud computing, socio-economic questions, etc.
- **Technical areas**, including networks, services, IoT, content, etc.
- **Application areas** where the FI can boost innovation, such as smart cities, energy, health, enterprises, environment, transport, etc.
- **Infrastructure**, including experimentation and results in real infrastructures in the FI domain.

Each year, an editorial panel chooses several outstanding papers; authors of three of these were on hand in Aalborg to receive their prize and present their research: Anne-Marie Oostveen, Oxford Internet Institute (Oxford University); Ioannis Chatzigiannakis, Computer Technology Institute and Press (Diophantus); Dimitri Papadimitriou, Alcatel-Lucent.

Mr Álvarez thanked the editors, authors, reviewers and contributors – all listed in the book – and explained the growing impact that each successive edition is having on the Future Internet community.

Anne-Marie Oostveen, Oxford Internet Institute, University of Oxford

*Cross-disciplinary lessons for the Future Internet*

As part of the Seserve FP7 Coordination project, the goal in simple terms was to get people who “study the internet to talk to people who build it” to elucidate on societal concerns emerging as a consequence of Future Internet R&D.

Seserve hosted workshops to bring techies together with sociologists, policy-makers, economists etc. and their discussions led to the paper published in the FIA 2012 book.

Earlier studies identified 16 societal concerns (see paper) regarding the FI which raise technical, commercial and regulatory challenges, she said. A survey of FP7 projects revealed that six were high priority concerns:

- Privacy and data protection
- Online identity
- Security of communications
A series of “cross-cutting resolutions to these socio-economic challenges” were elaborated. These include focusing on transparency issues – for example, internet providers could be asked to publicly release monthly statistics on attacks, giving end-users a better idea of how their data is being (mis)used. More user-centricity and control was also called for, which alongside better user input/feedback and greater focus on user interests, could help promote innovation as well.

The study also revealed a need for greater exchange, dialogue and collaboration between academia and industry as well as between technology and non-technology actors, thus providing so-called “multi-disciplinary bridging”. The internet also needs to strike a balance between extremes in debate and design.

“We must avoid dichotomised thinking.” Ms Oostveen suggested, which only inflames concerns about insufficient data, identity and privacy controls, or conversely, too much control leading to “big brother” scenarios.

Digital literacy continues to be a concern for the Future Internet, according to the study, which calls for more sophisticated tools empowering users to manage their privacy and identity. And perhaps a related hurdle is the lack of a common vocabulary for FI terms and concepts, or overuse of technical jargon which alienates average users who then fail to understand the benefits of FI developments.

The study also highlights the importance of digital rights and digital choice. According to Ms Oostveen, the sector needs to clarify issues, such as privacy in the IoT and online communities, what level of anonymity should be granted and to whom, how to deal with the “right to be forgotten” and what level of off-line alternatives should be provided for those who reserve the right not to use digital technology.

Issues raised in the study point towards the need for a global regulatory framework, especially for security, online communities and the cloud. The EU has a role to play in this, the paper concluded: “The European Commission needs to find a way to update the Digital Agenda in response to the needs of a broad spectrum of people and communities rather than focusing only on big companies or governments.”

Ioannis Chatzigiannakis, Computer Technology Institute (CTI) and Press, ‘Diophantus’

Using Future Internet infrastructure and smartphones for mobility trace acquisition and social interactions monitoring

Taking the work carried out in the Spitfire project as a starting point, Mr Chatzigiannakis and his co-authors felt that the IoT is under-utilised as a tool for capturing and understanding real-world social interaction and mobility paradigms. Their paper elaborates on a system for producing
traces for a new generation of human-centric applications, using technologies such as Bluetooth and smartphone technology.

“Our system provides online, almost real-time, feedback and statistics and its implementation allows for rapid and robust deployment, utilising mainstream technologies and components,” noted the authors.

Focusing more on human activities, instead of only monitoring environmental parameters, they explained, should provide further insight into the Future Internet and is central to understanding human action and interaction not only in outdoors settings, but also indoors. A central feature of future smart cities will be the ability to capture and analyse human behaviour in all settings, in order to manage information better and continue to improve ICT services and apps.

“We can do customer segmentation and profiles with the data,” said Mr Chatzigiannakis, “and we can move more towards personalised services which are better adapted to the context.”

He showed their team’s approach to monitoring big groups of users moving around large buildings. Based on a set of criteria, they conducted experiments in two scenarios: at the FET11 congress and within their own CTI building. With mobile and fixed tracking stations covering several floors, they collected nearly real-time data of people moving and interacting (networking) in these two settings over a period of 27 hours. The paper includes charts which demonstrate the patterns of this interaction.

“We believe that recent progress in human mobility modelling and the rise of applications with social networking characteristics should be encompassed in current IoT experimentation activities,” the authors concluded.

Dimitri Papadimitriou, Alcatel-Lucent: Design principles for the Future Internet architecture

“Many ICT systems do not consider design principles and derive their model directly from requirements,” noted the researchers behind this Future Internet 2012 paper. That is a problem, according to Mr Papadimitriou. Their paper, elaborated as part of the EU-supported FIArch group, identifies some of the design principles that the authors expect to be governing the future architecture of the internet. Of course, they were highly aware of the potential historical minefield they were walking into.

We first have to understand where we stand in today’s internet to know how the FI can meet new needs and demands, suggested Mr Papadimitriou. He reeled off a list of the hurdles facing FI designers today, including shortages of capital investment and the limits of the current internet protocols and overlays which require a “deep rethinking of internet principles”, he said.

“Principles that seemed inviolable a few years ago are deprecated today. Principles that seem sacred today will be deprecated tomorrow.”

B. Carpenter, ‘Architectural principles of the internet’
"So why change?" If we don’t, the Future Internet will be an overburdened version of the current internet. Some principles need to be preserved, such as the ‘heterogeneity support principle’ (the internet must be able to work with many different networks, terminals, hosts, etc.), the ‘scalability and amplification principle’ (the internet can’t be held up every time a new device, design or idea comes along), ‘robustness principle’ (the internet will need to be reliable as more critical applications like transport, health or energy run on it), and the ‘loose coupling principle’ and ‘locality principle’, which are covered in detail in the paper.

He also showed delegates a list of principles which should be adapted or at least existing descriptions should be modified, he said. Top of the list is the ‘simplicity principle’ because “complex systems are generally less reliable and flexible”. Mr Papadimitriou advocated engineers stick to the KISS principle of “keep it simple stupid” to get it right. Others that need revisiting include the ‘minimum intervention principle’ (based on preserving data integrity), the ‘modularity principle’ (a decades-old approach to ‘stacking’ communication layers as modules which works when it works but is unsustainable going forward in the FI), and elements of the ‘robustness principle’.

Other design principles should be augmented, he said, and they include the ‘polymorphism principle’ (which applies to data or functions and is an extension to the modularisation principle), the ‘unambiguous name and addressing principle’ (which speaks for itself!), and a call to extend the ‘end-to-end (E2E) principle’.

There is strong talk among the internet design community about the need for revising the E2E principle, but it has serious consequences on the scalability, survivability and robustness of the internet at large, he said.

Mr Papadimitriou then presented “seeds for new design principles” going from “inter-network to multi-dimensional” systems covering communications, computation, data storage – requiring design principles beyond pure networking functionality. While architects of the FI recognise the importance of design principles, and the inevitable emergence of new principles, he conceded that “we’ll see lots of seeds but very few trees in the future”.

*Nozomu Nishinaga, NICT (Japan)*
*Opportunities for finding Japanese partners for the joint EU-Japan call on security, wireless, optical, IoT/clouds, experimental testbeds, low energy nets*

Mr Nishinaga explained that NICT’s mission was similar to that of FIA’s and he made an “unofficial announcement” about a joint call for proposals. “It’s high time to promote cooperation between Japan and EU in this area of Future Internet,” he said.

The call for FI projects is expected to be launched in autumn and remain open for just two months. It will be funded by the EU, MIC and NICT and thus a joint evaluation committee is envisaged. The likely start date for projects will be 2012 and they will run for 36 months.

Themes agreed under the joint MIC and EU part of the call will be: optical communications, wireless communications, and cyber-security for improved resilience against cyber threats.
Themes for the EU and NICT part of the call will be: extending the cloud paradigm to IoT (connected objects and sensor clouds within the service perspective), global scale experiments over federated test beds (control, tools and applications), and green and content-centric networks.

He advertised several relevant events for delegates to consider attending: Networking @ FI and Mobile Summit (date TBC, Berlin); and Networking @ FP7 InfoDay (Sept 2012, in Japan).

**Nick Wainwright (HP), Effects+**

*FIA Roadmap for Horizon 2020: What is ahead?*

“Why is the FIA Roadmap so important?” According to Mr Wainwright, it is certainly important to the smart city community which is very demanding and difficult to satisfy. The FI will need to work everywhere, at all times, under all conditions, and with infinite bandwidth and zero latency, he suggested. “But that’s quite a challenge!”

In the lead up to Horizon 2020, he said they will organise a workshop on 25 June in Brussels to discuss how to update the Roadmap accordingly. He called for one-page proposals on what should be included in the update, to be sent to fiaroadmap@future-internet.eu.
‘Earth’ to Aalborg… the Future Internet Awards

The winner of this year’s Future Internet Awards was project Earth – ‘Energy aware radio and network technologies’ – which is working to make wireless infrastructure 50% more efficient. Four members of the consortium accepted the trophy on behalf of the 15-member consortium. They thanked the European Union for funding programmes which make such a fruitful cooperation possible. “It’s a great project, a great name and, even more, it will save energy,” commented the European Commission’s Mario Campolargo as he handed over the prize.

Mario Campolargo, Director of DG INFSO Emerging Technologies and Infrastructures

Closing remarks

Reinvention is an important and normal human behaviour and the same goes for the Future Internet, especially regarding advances in smart cities and as we approach Horizon 2020, suggested Mr Campolargo.

Smart cities have a clear societal dimension, and we need to look beyond normal research activities and innovation perspectives to create an environment which is conducive to FI trends such as cloud computing, he noted. And just as people and places reinvent themselves, so too must the European Commission.

He announced that DG INFSO is being renamed DG Connect, which he felt was apt in the context of smart cities like Aalborg that are focused on improving connections and networks between technology but also people.

He spoke of a new face on the FIA as well, with new session leaders and a broadening constituency in the Assembly. In Horizon 2020 and for the Commission in general, the nexus between policy and society is increasingly important. He said the EU must take advantage of FIA’s momentum – “having so many people together with common goals” – and to capitalise on better cooperation to “do business, real business”.

With greater emphasis on innovation, evidence-based policy, information sharing, policy and research integration, Horizon 2020 is not just another programme, Mr Campolargo explained. “We tried to articulate Horizon 2020 from a different perspective, but it’s your interpretation of it that will make it work,” he told the Assembly.

He challenged delegates to find new opportunities to exploit the Horizon 2020 framework which, he said, “galvanises” elements of the Seventh Framework Programme (FP7) and Competitiveness and Innovation Programme (CIP) and focuses above all on “simplification and innovation”.

He then showed, somewhat ironically, a complex chart of how Horizon 2020 will translate research to meet the EU’s socio-economic and scientific challenges, such as in health, energy, transport, etc. He explained how ICT has become embedded in the fabric of all programmes and themes, and that the Future Internet is a “catalytic power” which can embrace new entities
and support the interplay between fields. “No more narrow thinking – we’ll need to tackle new areas,” Mr Campolargo stressed.

The Digital Agenda supports this evolution and new perspectives will help the Union create a Single Digital Market. Progress towards the new Cloud Strategy, due out this year, is a case in point, he suggested. We need to make Europe not just “cloud friendly” but also “cloud active” with global governance a priority, which means investing in actions beyond research.
FUTURE INTERNET CONFERENCE
Thursday, 10 May 2012

Session 1.1 – Societal view on smart cities

- **Citizens are at the centre of smart(er) cities; citizen-centric platforms enabled by the internet enhance citizen participation and engagement to boost wellbeing, social innovation and economic development.**

Cities embody a wide variety of challenges and problems which need the engagement and participation of citizens to resolve. Among these challenges are urban development and regeneration of neighbourhoods as well as the provision of advanced infrastructure to deliver services in areas such as energy management, transport and mobility, and security. Smart cities engage citizens in addressing such challenges. Citizen-centric platforms, enabled by the internet, are a promising means to realise this goal. Such citizen-centric platforms enable citizens to shape the future of their city.

Want to know more?

Session 1.2 – Open platforms for innovation

- **Greater awareness of EU and US Future Internet approaches: FIRE/GENI and FI-PPP/IGNITE; complementary perspectives, technical challenges and business models.**

The Future Internet is currently addressed by several large R&D programmes in different regions and related countries. This session focused on the EU (Future Internet Public-Private Partnership and FIRE) and US (IGNITE and GENI) perspectives, analysing the differences and complementarities in the approaches, business, challenges and involved stakeholders. The session attracted some 70 participants, providing the opportunity of a well-balanced mix of presentations, discussions and Q&As. It helped to foster greater mutual understanding between the EU and US approaches and identify potential synergies and convergence points. It is anticipated that the discussion will be furthered in the context of the forthcoming TRIDENTCOM conference (11-13 June 2012 – Thessaloniki), GENI Engineering Conference or GEC (9-11 July 2012 – Boston) and Dublin FIA (February 2013 – Dublin).

Want to know more?
http://www.fi-aalborg.eu/index.php/program/session-1-2-open-platforms-for-innovation
Session 1.3 – Novel networking and relationship with applications

- User experience, quality of service, the gap between research efforts and commercial deployments, economic and monetisation issues, and innovative technical developments all play their part in future networking/application relationships.

Application/network interconnection is motivated by the observation that network information flows are about to become as important as data information flows. From a business point of view, application/network interconnection based on innovative network designs is expected to result in a win-win situation for all stakeholders. Universal media access with sufficient Quality of Experience (QoE) is expected to be a key incentive in this direction.

Want to know more?

Session 1.4 – Impact of HTML5

- While HTML5 has been rapidly evolving, its implementation is far from uniform; hence there is a greater need for implementing organisations such as operators and device makers to work towards greater standardisation.

Interest in HTML5 picked up when Apple questioned the need for Flash on its devices. Since then, HTML5 as a set of technologies have found strong voice in the industry as the platform for targeting not only mobile device but all kinds of connected endpoints in the Future Internet. While standardisation bodies have been working on defining standards for all the key technology components for the web to work, there are several challenges for the developer looking to target multiple smartphone platforms. It is not just several smartphone operating systems but also the fragmentation within an operating system family itself, e.g. Android. The session identified the evolution of HTML5, discussed some roadblocks and also highlighted potential opportunities that existed, owing to the level of device fragmentation.

Want to know more?
Session 2.1 – Smart city applications and services

- A city is a complex innovation ecosystem depending on various actors and interactions which impact on organisational, entrepreneurial, technical and social aspects of smart cities.

A city is a complex innovation ecosystem (not only a service provider), where complex value chains have to be organised, and sustainability and new business models require special focus. In the ‘smart city’ context there is a lack of tools to support start-ups and developers and to help SMEs join complex value chains. Integration (e.g. data sources) and interoperability are identified as key technical challenges. Citizens play an important role as provider, user/consumer, beneficiary and developer of smart city applications and services.

Want to know more?

Session 2.2 – Internet of Things and Future Internet architecture

- FI architecture needs to take into account IoT as a first object component; and security, privacy, trust and user confidence are critical in an IoT ecosystem.

This session analysed the importance of security, privacy and trust on the Internet of Things ecosystem, and how this also impacts Future Internet architecture design, in order to take into account digital objects as first-class objects in the design. Using identity as the ‘identifier’ for smart objects is considered to be a key principle that could facilitate further integration of trust into IoT interactions and will help secure deployment of IoT architectures.

Want to know more?
Session 2.3 – Interoperability between clouds at several layers

- Technical, regulatory, market and even psycho-social factors are hindering cloud adoption in Europe – standardisation bodies and the research communities are the main actors in solving the interoperability issues, in particular.

Lack of interoperability between clouds hinders the establishment of a fair market for European service providers. Several technical and policy solutions are currently under consideration by different activity sectors, but they are not sufficiently mature and world-wide adoption is not happening yet. Coordinated actions of all stakeholders, from developers to policy-makers, are called for to overcome these challenges.

Want to know more?

Session 2.4 – Standardisation

- Pre-standardisation is an exploitation path for research; and there is a demonstrated need for greater ‘synchronisation’ between research projects to contribute to standardisation.

The session was organised in the context of the FIA standardisation working group. After a review of the landscape and methodology for pre-standardisation, 15 projects presented their standardisation activities. According to the discussions, research projects clearly need a higher level of coordination to get the most out of brokering events and a system needs to be introduced to organise the projects attending them, to avoid unexpected overlapping. Projects with complementary interests or goals have already been identified in the machine-to-machine (M2M) service layer field and in the research being carried out on semantics for the Internet of Things.

Want to know more?
http://www.fi-aalborg.eu/index.php/program/session-2-4-standardisation
Session 3.1 – Smart cities and big data

- If used effectively, ‘big data’ can improve the lives of citizens in smart cities; to achieve this, more data needs to be opened up, but privacy issues will need to be better addressed.

Big data can be used to provide the next generation of citizen information services in smart cities. Citizens need to be empowered to use the data through simplified access, improved annotation and new, proven presentation techniques. However, not enough data is open. This could be addressed through new incentive schemes. Privacy and policy issues related to open data also need to be addressed.

Want to know more?

Session 3.2 – IoT applications and business models

- The Internet of Things (IoT) together with Future Internet open platforms and standards stimulate innovative applications.

Together with open, inter-connected platforms, the Internet of Things – machines, sensors, objects, etc. – can stimulate the development of a broad range of innovative applications, concluded delegates in this session. A closer look at how enterprises have responded to the Future Internet provides valuable ‘business’ lessons. It is evident that business systems and industrial activities are becoming more service-oriented, and business modelling and benchmarks are useful to help monitor IoT deployment. Important issues, such as governance, security and privacy, should be collectively addressed to ensure successful deployment.

Want to know more?
Session 3.3 – Smart city infrastructure

- *Infrastructure for a smart city is a physical layer and a service platform; while support for real-life services is different from research experimentation, both can yield a net benefit for smart cities.*

Smart city infrastructure comprises a “physical layer” for connectivity and a “platform” offering services to citizens. City representatives prepared to seize the opportunity for greater research experimentation – which may not always be compatible with real-life services or business models and may be difficult to define – will still see a significant return on investment in terms of visibility (look at Santander) and increased know-how and innovation which can lead to spin-off benefits such as energy savings.

Want to know more?

http://www.fi-aalborg.eu/index.php/program/session-3-3-smart-city-infrastructure

Session 3.4 – Games, networks and clouds: What are their requirements?

- *Cloud-gaming could become an interesting approach to bring the telecom and gaming industry closer together, providing the right market, legal and technical environment is in place.*

The session provided an opportunity to explore the different positions concerning the requirements of online and mobile games; from a developer perspective and from an operator perspective. Issues raised included the need for greater harmonisation and integration of different frameworks in the online gaming sector (mobile and cloud), supported by standardisation efforts. New criteria for cloud optimisations, such as power consumption, bandwidth costs, and latency, are being introduced thanks to developments in mobile clouds. To gain traction, the need for faster, more reliable gaming-response times in hosted virtual networks was highlighted.

Want to know more?

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

On your bikes, the next FIA will be in Dublin, Ireland – **February 2013**!