

European Games Developer Federation

Report
Future of Internet Assembly (FIA)¹
23.11. - 24.11.2009 Stockholm
Jari-Pekka Kaleva

Summary

The Future Internet Assembly is mostly focused to questions related to networked distribution technologies. In its latest Technology Paper EGDF underlined the importance of game-like applications as indicators of future on the distribution structure:

“Game developers are more and more considering self-publishing, and thus starting to distribute their own content. As the distribution of computer games is slowly shifting from boxes to online new distribution modes emerge. This is also relevant when considering the phenomenon of media convergence. In the context of the “internet of the future” network and social network based games and game-like applications should be regarded as leading indicators of future requirements on the distribution structure that is necessary to address both the needs and the rights of the creators and the end users.”²

EGDF also expresses its support to network neutrality:

“Given solid European traditions regarding creators’ rights, freedom-of-speech, personal data integrity and the like, and insistence on fundamental requirements for new business creation, such as network neutrality, Europe is uniquely positioned to take the world leadership in supporting digital content creation.”

In relation to these goals many speakers underlined in one way or the other the fact that in current infrastructure the capacity of bandwidth will be a big problem. The infrastructure has to be updated, but ISP’s are a clearly reluctant to do so, if they will not have a bigger share of profit. Many of the technologies introduced to tackle the capacity problem also include elements that might be dangerous from the perspective of network neutrality (e.g. routers identifying content going through them).

As the goals of EGDF considering the architecture of the future Internet (including service level agreements with ISP’s) are quite broad, it might be worth asking if the online game companies have their own more specific needs for the architecture, because that seems to be the main focus of the FIA at the moment. Luckily content perspective is highly valued, as it seems to widely accepted that the future Internet will be content-centric. However it should be remembered that some of the major issues considering the future Internet are not technological anymore, they are legal (e.g. how to fight against child pornography, how to do cashing for videos etc.)

Consequently it might be worth to examine the question of the architecture of the future Internet in a more detailed manner in the tech paper of EGDF. This would be important especially from the perspective of the interactivity, as now most of the actors in the assembly seem to think that users are just downloading content instead of interacting with highly lag sensitive environments like virtual worlds that require also uploading (I do not have any idea, if this observation of mine is really relevant at all from the technological perspective when it comes to Internet architecture).

In addition to technological questions FI PPP³ was introduced in the seminar. The Power point slides of the roadmap for it are attached in the end of this report. In short the upcoming milestones of the FI PPP are the following:

- 8/2009: €300M ICT WP 2011-2013
 - E.g.: Supporting Future-enhanced applications
- 12/2009: Contributions to the WP
- 4/2010: Spain presidency event in Valencia – PPP announcements and council conclusions
- 7/2010: WP Call launch, specific evolution criteria
- 1/2011: Projects will start

It is worth noting that representatives of European Future of Internet Initiative (EFII) promised that a community around FI PPP will be widened from the current sixteen companies and public workshops and commons statements considering FI PPP are coming soon.

The next steps of EFII itself will be following:

- *Online consultation (bottom-up) to identify and structure topics*
- *Caretakers meeting 22 January: identifying broad frame for Valencia*
- *FI PPP meetings with utilities, research institutes, cities ... (Dec09-Jan10)*
- *FI PPP Information Day, Brussels, first half of March 2010.*

¹ The official website: <http://www.fi-stockholm.eu/>

² The full paper is available online at: <http://www.egdf.eu/tech09.pdf>

³ More information available at: http://ec.europa.eu/information_society/activities/foi/lead/fipp/index_en.htm

- Regular FIF meetings collocated with the FIA workshops, Valencia, Gent (Dec 2010), and possibly at ICT2010 (27- 29/09/2010)*
- Calls and Work Programme 2011-12"*

Also a debate considering the priorities and rules of FP8 has clearly started and EGDF should consider writing a statement of its goals considering it.

Monday 23. November

8.30 – 10.30 Plenary opening session

Welcome messages

Prof. Gunnar Landgren, Vice Rector of KTH and Leif Zetterberg, State Secretary to the Minister for Communications

As i2010 is ending, a new ICT policy for Europe is currently under a construction. A new digital agenda for Europe will be published in the first quarter of 2010. As noted in a Visby Conference (Visby declaration⁴), green knowledge society will be a clear priority of the agenda. One of the key messages of the agenda will thus be: If EU wants to become a global competitor, the green knowledge based society, broadband and ICT skills will make the difference.

Therefore a PPP should not just be understood as a public private partnership. It should also be seen as people, planet and profit; people meaning knowledge society, the planet stressing green society and the profit underlining effective society creating jobs.

At the moment there is a strong support for increasing ICT funding in member countries, but public support for private sector does not have to be only money. Also developing market conditions, like creating a broadband network, is important.

European Perspectives on the Future Internet

Mario Campolargo, Director, EC

A digital agenda will be in the core of the post i2010 agenda and one of the most important parts of it will be a green economy. In this context the Future of Internet is a key enabler for innovation.

Currently EU has started an early discussion on new instruments supporting this agenda. As a part of it, FP7 is currently under renewal process. In addition to that the Commission has published a communication on a PPP on the Future of the Internet (FI PPP)⁵.

The FI PPP has a holistic approach to the Internet. There is a clear need to link technology and applications to each other and make different platforms generic, open and good for new business models. A special focus is placed on making applications with social interest more effective. The target domains of PPP will be: Smart Energy, Smart Health, Smart Transport and Smart Living.

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The European Council has directing more and more funding for activities under The Future of Internet. This means more and more projects. However the initiative itself will stay more or less the same for next years. On the area of initiative the upcoming roadmap looks following:

- In short future WS on utilities and WS on R&D centers will be organised
- A new wave of FI projects on FP7 Call 5

All in all there will be potentially €250M to €350M new funding available for the Future of Internet. This means that the co-ordination of R&D activities will come even more important than before (in international, European and national levels). At same time, standards, regulations and governance need more consideration.

Industry preparations for a FI PPP

David Kennedy on behalf of the "European Future Internet Initiative"⁶ (EFII)

The ICT sector is becoming a key infrastructure, as the current economical crisis show. A cross sector approach is needed on the area of ICT for sustainable development towards a future networked society

EFII is formed by sixteen companies that are lobbying for FI PPP and for a good partnership inside it. The

⁴ Available online at: http://www.se2009.eu/polopoly_fs/1.22793!menu/standard/file/conclusions%20visby.pdf

⁵ More information available online at: http://ec.europa.eu/information_society/activities/foi/library/docs/fi-communication_en.pdf

⁶ More information available online at: <http://www.fi-prague.eu/program/p/kennedy.pdf>

shared ambitions of these companies include creating growth and jobs and accelerating speed that things are done in markets.

For the FI PPP a JTI models have to be improved, but unfortunately the current legal framework of FP7 makes most of the required improvements impossible. The commission is trying to find creative ways to bypass these restrictions. However, for FP8 new sets of rules need be created, e.g. public money should be used as venture capital.

IPR rules form a big challenge for the FI PPP. Under current models, projects from the call one cannot be used easily for further projects. Therefore the rules of participation for the projects should make it clear that IPR's have to be shared. This should be clearly supported also in the contract with the Commission. Also überconsortium treaties should be created to ease up the use of IPR's.

Smart energy grids, utilities for environment, transport mobility and logistics, e-health and content are the sides that common enablers are to be built. Thus EFII recommends following:

- Large scale projects
- Flexibility in every stage
- Systematic approach to project selection
- Facilitating open sharing of project foreground (IPR issues should not slow the process down)
- Integrating sector competence with the ICT competence
- And leading by example: large scaled trials and demonstrations

When it comes to the structure of the PPP, it can be stated that millions of SMEs are needed to create new applications. Thus the community around the FI PPP has to be widened from the current sixteen companies. Therefore public workshops and commons statements for this are coming soon.

It should be remembered that the PPP might in the end cut funding for Future of Internet, as they may not be funded from other programs anymore.

Socio-economic views on the Future Internet

Chair Burkhard Stiller (Un. Zurich)

The current stakeholders of the FIA are: citizens and end users (technology difficult for people?), business and network providers (faster networks may destroy business value?), funding bodies (can European goals be reached?) and policy makers (politics may not be implementable into technology?). In order to address the diverse needs of stakeholders, interdisciplinary approach is needed to unite technological, social, scientific, political and economical approaches.

When it comes to overlay optimization, many actors are working at the moment simultaneously (ISP's, content providers etc). In the end, all-win-situation should be reached, so that traffic generated would benefit everyone (SmoothIT project is currently working with this issue).

Meanwhile self-interested players with conflicting interests and substitute or complementary functions tussle with each other. This tussling easily leads to equilibrium point that is not the global optima.

The Mechanism Design Theory underlines the engineering side of economic theory. The overlays have to be optimized (like ones in Bittorrent), but this might conflict with ISPs' incentives or information to do it is incompetent.

Therefore economic traffic management (ETM) mechanisms should be introduced, so that users can make their own optimal choices. ISP can shape users behavior by: providing user extra information (locality promotion, avoiding cross Atlantic links) or offering extra resources in overlay to "help" local users.

ETM can be combined with Network neutrality (if it is understood as neutral pricing). It can improve overall performance and it is applicable under flat rate pricing and for multiple applications.

The future of Internet is without hesitation a multidisciplinary research subject, as underlined by the Bled declaration⁷ and by the board of the European Research Area (ERA)⁸. A broader research (including even philosophy) is needed to address round challenges. E.g. research in social sciences might have helped to introduce mobile video telephony or MMS's. Similarly from the point of view of technical authentication one individual is only one subject, but from the perspective of social sciences one individual has multiple social identities. The problem is that social sciences, not oriented towards design or future are not represented in FIA at all at the moment.

⁷ Available online at: <http://www.future-internet.eu/publications/bled-declaration.html>

⁸ The board described the future of internet as "new renaissance"

Therefore it can be concluded that economics and the business models as well as the social sciences should be addressed as much as technology in the FIA. Currently they are only present in opening paragraphs and political visions, but no actual research is carried out on them. This creates a significant risk of misunderstanding some fundamental concepts of human life, like identity.

11.15 – 12.45 **Session I.1 Different architectures for different business models?**

Summary of introduction by Henrik Abramowicz:

"We are currently in a transformation mode where different business segments are merging continuously and rapidly into something new. Traditionally we have been looking at Cellular/Mobile communications, Internet, Media and Service distribution separately each having their own business drivers, model and corresponding architectures. We have a growing number of applications, devices and recourse based platforms that are multi modal and interconnected and working cross-domains.

Another high-hope of Future Internet is to enable the role of the user (individuals, SMEs, community networks) as content and services prosumer. In this new model, the same entity will be producer, mediator and consumer of services and multimedia content at the same time, and be able to seamlessly change roles based on the specific needs. Open competition is expected to be a key differentiator. In the same way one can see SMEs community networks becoming not only a content prosumer but also provide network services as well consuming such services in a cooperative networking fashion

A motivating meeting point is in the systems enabling faster mergers of the most ICT business segments, impacting the roles of the actors and stakeholders. So what will happen when these diverse business segments are increasingly being merged? Will the different business segments try to sustain their current models? Are we going from vertical oriented business models and architectures towards horizontal? What impacts do we see on an overarching architecture? Revenue and value sharing between different actors to be considered? Advertisement based?

Another issue that should not be underestimated is the cost of the infrastructure. New services and application like multiparty immersive telecommunications will generate new traffic patterns, more symmetric than today's Internet. Not only support of really broadband networking is required, but also new architectures that are service, content and context aware. However infrastructure is not for free. New business models, well beyond flat rating, are needed to enable telecom operators to invest in such technologies. Should telecom operators converge to service providers? Who will then provide the infrastructure.

The requirement of a single, scalable and configurable architecture will be one of the driving forces for the Future Internet. The variety and heterogeneity of the emerging business models, as well as the dynamic service composition and provision may lead to a situation of many Internets, with different architectural structure, requirements and functionality. Such a scenario will result in a nightmare of maintenance efforts, increased costs, incompatibilities and the like. It is thus important to try to build a single core architecture that maintains properties like configurability, extendibility, scalability and openness. Keeping the core architecture as generic as possible will offer the possibility to easily extend and adapt it to the requirements of the edge. Such a design will follow the rising trend of moving intelligence to the edge of the network.

Expected Results:

- Requirements of the future network architectures (auto-configuration, dynamic self- adapting, ...)
- Agreement and initial description of the system interfaces and architectures enabling integration of polymorphic faces of the Internet
- Initial description of the milestones and roadmap of research results

Points of agreement:

These are the starting points:

- The different ICT segments are merging, while new service creation/consumption environments (home, mobiles) are becoming more and more important.
- The user is becoming a prosumer. New business models to support user generated content and user generated services will appear.
- New services and applications will generate new symmetric traffic patterns, which can't supported by today's network infrastructure. Which business models will make investing in infrastructure profitable? Will Telecom operators transform to sole service providers?
- We are going more and more from vertical business models towards horizontal and hourglass types and consequently the architectures need to follow suit. We need to mirror the business interfaces that are defined according to business models to technical interfaces
- The management of the new architectures reflecting dynamic relationships between actors and stakeholders

• *New forms of the infrastructures enabling change*⁹

From a content perspective¹⁰ the Internet of the future will be a federation of different networks, services and content. In the long run, new media solutions shall bring also information about feeling, touch and smell in addition to audiovisual information. Therefore it is highly important that new a Internet architecture follows following principles: simplicity, supports new business models and fulfils technical requirements like sustainability and scalability.

Consequently a content centric Internet architecture means that the infrastructure has to support content (not vice versa), security and privacy are taken account, information/adaption is separated from services themselves (virtualisation) and special attention is placed on service media. Technically this means that the Internet could be improved by storing or caching the content closer to end users, by letting routers to identify/analyze what is flowing through them and to replicate content for other users, by letting the network to identify what is the best end to end path for traffic and by the making content interactively adapted.

From a technology perspective¹¹ the current internet is a network of interconnected uncoordinated networks. Meanwhile size and costs (mostly from manual work needed for managing the Internet and for securing interoperability) of it are booming exponentially. Therefore the Internet needs to be more controlled and managed. Thus the race is to define a proper architecture for achieving this goal. The main problem is that the internet is not at the moment centric, thus it has be made polymorphic (communication centric systems, information centric systems etc.).

As new technical architectures lead to new business architectures, from a socio-economic perspective¹² we have to move towards a generic business architecture that is well-understood and applicable across heterogeneous network and service domains, and that has generic flexible combination of business roles that are interchangeable, not fixed business relationships. This means that adherence on core-architecture is highly important. Thus we need a generic core architecture that is configurable, (self-)manageable, extendable, scalable, open and moving intelligence to the edge.

It should be also remembered that successful business models require trust on robustness of solutions provided and need standards for the certification of interfaces. Especially operators will need to enhance their business understanding of platforms in order to offer incentives to gain as many customers as possible on both ends of the 2-sided market by offering true value-added services and by internalising the externalities produced on different sides of the market.

If we want to make things to work together, we need standards. Therefore from a research perspective¹³ the question is, if there really is a possibility for a single core. This means that a reference architectures has to be developed as a tool kit for system architects to build system architecture and Research projects should receive attractive foundation for their research on reference architecture in order to consolidate innovations. Thus gaps in SRA and deployment of research has to be addressed.

As security is about economics, it is in the hearth of architecture decisions. Therefore from a security perspective¹⁴ it should be remembered that different applications and stakeholders have different protection needs. Security itself should not be about perfection, as perfect security cannot be achieved. Also if one wants security, one must be prepared for inconvenience, as security has its price.

14.15 – 15.45 Session II.1 Orchestration across networks, things, services and content

Summary of introduction by Alex Galis:

“In the today’s Internet there are some orchestration embedded capabilities for enabling network-of-networks to grow organically, to operate and interwork. In a Future Internet the questions are:

- What are the orchestration capabilities needed to integrate and govern the complete behaviour and operations of the system-of-systems (i.e. communication-centric systems, information-centric systems, context-centric systems, resource-centric systems, content– centric systems, service/computation-centric systems, device-centric systems, object-centric systems, things-centric systems and management-centric systems)?

- What are the capabilities needed to dynamically grow, adapt and optimize infrastructure (network, computation, storage, content) resources in response to changing context and in accordance with applicable business goals and governance policies?

⁹ <http://www.fi-stockholm.eu/web/page.aspx?pageid=58719>

¹⁰ by T. Zahariadis (Synelix), P. Daras (CERTH/ITI) and J. P. Moore (ATOS Origin)

¹¹ by Alex Galis, University College London

¹² by Simon Delaere, IBBT-SMIT

¹³ by Frederic Gittler, HP Labs

¹⁴ by Volkmar Lotz, SAP Research

- What are the capabilities needed to dynamically grow, adapt and optimize (user-generated) content (stored or live content) in response to changing user and application needs, devices and context and in accordance with applicable business goals and governance policies?
- What are the capabilities needed to dynamically grow, adapt and optimize services resources (service components and mash-ups) in response to changing user and application needs, context and in accordance with applicable business goals and governance policies?
- How efficient may be (semi-)automatic annotation and reasoning?
- How efficient and realistic is the automatic orchestration and composition of new user generated services?
- How Services and Content can be seamlessly integrated in a new environment?
- Can we define a polymorphic object that will be morphed to thing, service or content according to the user needs? Which is the role of annotation and reasoning to that?
- Which is the role of the environment (network, service, context)?
- What are the supervisory and interworking capabilities that integrate all other system behaviour insuring integrity of the FI operations?
- What are the capabilities supporting the simple and fast merging different Internet business segments into new forms?

Points of agreement:

- Orchestration Plane (OP) capabilities and reference configuration;
- Orchestration Plane (OP) architectures and interfaces
- Orchestration use of resources (networks, systems, things, service and content) and requirements for Future Internet virtualisation and dynamic composition.
- OP Integration in Future Internet architectures”

From the point of view of content services¹⁵ network is nothing without content. At the moment so called legacy applications are evolving, as new usages drive new applications and services (e.g. more mobile, user generated services and social networks changing privacy rules).

Consequently it can be said that content fuels the Internet evolution. Increasing immersion and realism lead to virtual communication capable to truly communicate emotions. At the same time exponentially increasing amount of content creates a huge pressure for developing access and search possibilities (distributed storage, recommendation engines). It is as well important to deliver content transparently and quickly (in any format, to any device, everywhere). This means that content production and management has to be made easy regardless of its place of production or storage.

If the future of Internet will be content-centric, it has to accommodate services, methods, procedures and techniques that will enable the creation and consumption of new experiences and seamless, personalized multimedia communications. All this will be made across a grid on networks constituents (e.g. personal and body area networks, home networks, mobile networks etc.).

From the point of view of research¹⁶ the main challenges to address in future are: virtualization of resources, applications and networks; tackling vertical vs. horizontal orchestration, provisioning of services and resources, supporting different business and delivery models, service orchestration for networks improving coordination and manageability, influencing service composition models and infrastructures, the influence of cloud computing on service orchestration and enabling infrastructures for it, architecture of infrastructure for the future Internet orchestrations, programmability of services, and trust and governance having a great impact on everything.

From the point of view of services¹⁷ it is highly important to take account the implications of service level agreements (SLA) for the orchestration. This means that in negotiations and during planning phase complexities introduced by variations in SLA parameters, and mapping these to contracted SLA's with consumed services, as well as statistical reasoning and optimization problems should be tackled. During run time, workload patterns and variations, combined with policy objectives, may dictate a re-composition of consumed services, thus elasticity rules, SLA adjustments for these resources and possibilities for re-negotiation are highly important.

16.30 – 18.00 Session III.2 What does Future Internet mean for enterprise?

”The central question is this: how to ensure that the full potential of the Future Internet is accessible to, relevant for, and put to use by European enterprises including SMEs?”

Interpretation of the Future Internet

¹⁵ by Jean-Dominique Meunier, NEM

¹⁶ by Dimka Karastoyanova, University of Stuttgart

¹⁷ Joe Butler, Intel Labs Europe.

From an enterprise perspective, the Internet of the future may be considered as a universal business system on which new values can be created by competing as well as collaborating enterprises, incumbent as well as new. Tomorrow's ICT may need to sustain a new kind of infrastructure as an open and level playing field, which is stable with an initial fixed set of services, in order to enable enterprises to build their (business) infrastructure at low or even no cost, and fully integrate that infrastructure into the wider paradigms of business. Individual enterprise systems of the future are likely to be leaner, more adaptive, flexible, portable and open. They need to enable value innovation at the business level. They also need to deliver value beyond economic value and drive innovation that meets a set of business objectives and sustainability concerns much broader than those of today, including societal and environmental objectives.

There is a critique that the Future Internet concept so far fails to encourage ground-breaking scientific research that is required to develop a truly new approach, both at the level of an innovative Internet infrastructure and at the level of radically different business models and approaches to value creation that make use of it. In other words, there is a significant risk that European enterprises may not reap the promised benefits of the Future Internet.

The emergence and impact of new interconnection economic paradigms

Traditional concepts of providers and customers, servers and clients, computational farms, data/content/information centers and administrative domains will dramatically change with the evolution of Future Internet. The virtualization of (computing and networking) resources as introduced by Grid and, later, Cloud Computing, the dynamic composition of services presented by the SOA paradigm and the participation of end-users in the content creation and distribution with the introduction of prosumers in the list of stakeholders, are some of the new key features that will characterize the new era.

Traditional business models and value chains will have to be re-considered and probably re-designed, since end-users will actively participate in the creation and distribution of digital goods. Furthermore, spare (computational) capacities will be offered (at a price) to the traditional (computing) resource owners, helping them to deal with unexpected peaks in demand. Business relationships will evolve as well, with new economic models to be put in place so as to capture the nature of the emerging agreements. Services will be formed by composing functionalities offered by different providers, a process that will be mostly user-initiated. Existing proprietary network domains will open up to user-formed networks, as a means to expand their last hop access network coverage. As a result, new interconnection economics paradigms will arise. Following these innovations, key concepts like reliability, security, privacy, as well as intellectual property, will have a new meaning that must be supported by the new ICT-enabled functionality. In addition, potential barriers to transforming technological innovation into business innovation need to be debated, identified and removed.

Enterprise transactions, service composition, information management

Already, rigid supply chains have been replaced by more flexible value networks in many sectors of industry. In the future, transaction chains in value networks are expected to be arranged in real-time using dynamic service composition and other new features/mechanisms, and on a scale that vastly exceeds current practices. This changes the way that organizations manage information, as already evidenced by cloud computing and mobile access to information. In the future, billions of "things" – with their own identities, physical attributes, virtual personalities and intelligent interfaces – are expected to become active participants in business processes, which may become integrated in some manner with social processes. This raises several major challenges.

First, future transactions - being very complex - may become unobservable, possibly ungovernable, extremely difficult to exploit (e.g. in data mining), and almost impossible to monitor. Problems here relate to service management models (e.g. centralized, distributed, federated), information integrity, and organizational as well as (new) legal & regulatory requirements and compliance.

Second, new types of information and record creation, flow and management will be required; in particular those produced by mobile and/or sensor devices and actuators (as opposed to today's paper-based paradigm). Also, how do we deal with information structures moving across the complex transaction chains described above?

Third, these changes are expected to have a profound impact on the operational processes of enterprises. The Internet of Things and its related vision of Real World Internet (RWI), will change the way that companies manufacture products, consume and provide services, control processes, and perform delivery and maintenance, with potentially new forms of value exchange and within potentially a new generation of value networks. For example, RWI could transform enterprises' conceptualization and creation of extended products that could themselves offer some kind of service, i.e. a product that gives instructions on how it must be assembled.

Fourth, ICT-based methods and tools to enable enterprises to innovate need to be an integral part of the Future Internet offerings. There is a view that the real innovation will take place at a "meta-level", i.e. to interlace ICT innovation with business innovation in order to obtain a virtuous cycle of innovation that spans different sectors of the economy, which can become even more fully integrated than that of today. In this regard, the demand and supply sides of the Future Internet may also become increasingly less clear cut, and actors on all sides need to re-think their roles and their added value in the economy of the Future Internet. Additionally, future enterprises may have new attributes in a changing environment reflecting values beyond economic values, leading to new approaches to characterise enterprises."¹⁸

As I participated only one of the parallel group discussions, official notes give a better overview from discussed issues. The following text is thus copied from there¹⁹:

Question: In Europe, only 13% of enterprises use ICT for inter-enterprise collaboration. The figure for SMEs is still less. What can be done to improve this situation?

Compared to large enterprises, SMEs have huge barriers in ICT adoption: awareness problems, resource problems, ICT skills problems. Critical mass is key. Targeted measures for SMEs are needed in:

- Education, knowledge dissemination and knowledge exchange
- Greater involvement in research
- Clear value proposition of collaboration with others
- Trust (eg. hosting data in cloud, remote backup of sensitive data); measures need to focus on conveying trust
- Public availability of data (eg. address databases) would benefit SMEs.

Commoditisation is a key trend in the ICT landscape. How can ICT providers benefit in providing (low to zero cost) commodities/utilities?

- This question applies to all technologies (eg. mobile phones, etc.); therefore is not specific to FI.
- The question is about motivating infrastructure investments. It is about ROI and rules.
- It will be a trial and error process. Solution will emerge organically.
- Market dynamics will define the solution to this problem. Don't try to anticipate market dynamics, assuming that were possible. Solution is likely to be related to policy (define the regulations and policies that set the playing field, but leave the details to be sorted out by the market dynamics).
- How important is the public ICT infrastructure? Is it in the public interest to be supported/provided by government?
- Low to zero cost utility provision requires policy decisions (deregulation and market dynamics) to enable the development of appropriate business models under market conditions.

Question: People, Things, Services and Content are currently four fairly self-standing research streams. Is it an issue?

- How can people be connected to content? Is content driving technology or vice versa? What is the role of the service platforms relative to the rest? What is the glue between the pillars? Could it be the innovative aspect that is being looked for in research?
- FI discussion goes largely in the direction of how to do it (technology), and not what we can do with it (application).
- Pillars don't seem to mix very well (as such they don't seem to have a business relevance).
- The silo way of research may be the reason for the pillars. Silo thinking is not the right way. The EC is too silo oriented up to now in terms of research policy.
- Collaboration between the pillars needs to be looked for and be motivated. It should not be assumed.
- Innovation life cycle is not generally covered by SMEs (they hardly follow the entire innovation life cycle - Idea, Opportunity, Research, Experimentation, Development, Commercialisation). This needs to change.

Question: "European way to the Future Internet" - what are the specific European issues we are looking for and how can we leverage them to develop a key position?

- Culture, language and Value Systems are key differentiating factors.
- European enterprise landscape is based more on SMEs than, for example, the US economy. This should be turned into an advantage.
- In some countries (e.g. Spain), it is difficult for SMEs to adopt new technologies. Regulation can also be a hindering factor.
- The Internet is a worldwide issue, not a European specific issue.

Question: What are we waiting for? What are enterprises waiting for? Do enterprises really care about FI?

- We need more business from FI!
- We need more concrete description of what the FI is all about
- FI is a continuous thing (there will always be a today and a tomorrow). Therefore the notion

¹⁸ Full text with references available online at: http://services.future-internet.eu/index.php/Enterprises#Background_and_Objective

¹⁹ Available online at: http://services.future-internet.eu/images/0/0b/Enterprises_report.pdf

of what are we waiting for is meaningless.

- We cannot sell the advantages of FI if it is still not deployed.
- Use Ethnography (studying people and what they want) and apply the insight to FI development.
- But the opposite is also true - we have this technology, what possible usage patterns can you imagine? This is the essence of serendipitous innovation

Social-Economic aspects

The approach in this area should be set by the enterprises; specifically, enterprises should set the questions. We need to solve concrete real problems and not a technological proof of concept. The innovation should not only be technological. We need to establish examples of how FI can improve the way the enterprises work, including examples of new emerging business models, concerning both big enterprises and SMEs.

Internal structure vs. External Relationships of enterprises: The former is more important. The latter comes as a second step. The (expected) changes will lead to more "fluid" structures and the boundaries between the "inside" and "outside" of a company will become increasingly blurred. Enterprises may become less structured but need the capability to restructure itself in response to business development. There is a need to focus on collaboration among enterprises and SMEs that will allow them to be more competitive.

Nature of Work: We need to study the new forms/ways of work that (will) emerge, how they evolve and how FI technologies can help towards this direction. Trust & Privacy are very important issues, and not only from the technology perspective.

Internet technology adoption by enterprises is still low. Reasons for non-adoption include:

- Lack of awareness of available technological solutions by particularly smaller companies
- Profit-driven decisions by enterprises impede initial investments, e.g. IPv6 and PKI are not (fully) used
- High costs on operation and maintenance (here, cloud computing can potentially offer solutions)
- Long term goals of FI vs. short-term objectives of enterprises
- Constantly changing technological landscape does not provide any assurance The main question is whether the adoption of technologies will lead to financial success. We need to come up with examples of new business models that will make FI technologies viable.

Additional issues requiring further discussions: IPR, the role of users in the overall picture, new contracts and governance system to manage relationships, evaluation methods of enterprise adoption of (Future) Internet technologies.

Technology aspects

Using Social Network paradigm / tools in the enterprise

- Distinguish the internal vs external (open) use
- Enterprise constraints
- We consider employees in a broad sense, but in an open scenario there is a problem of trust & security
- Risk of working for another enterprise
 - Masses of data generally means cost in the economy, the value of data needs to be understood
- Measuring and compensating more productive people in the enterprise
- Problems of private life (e.g. working late in the morning)
- The local (national) culture may make the difference (e.g. trust, hierarchy, etc.)

Internet of Content & Knowledge

- Dramatic change in Corporate IPR, not in "personal IPR"
- There will be a gap in the future, how will it be addressed
- There will be a gap also in terms of the technology used by individuals (e.g. at home) and in the enterprise
- Who holds the Knowledge? Employees or the employers?
- Proposal: introduce new business patterns that will be an asset of the enterprise
- Divergence between legal (enterprise owns) and factual (employee owns) situation for IPR
- Enterprise of Experience: it is a form of content / knowledge

Internet of Things and distributed knowledge / decision making

- Increment of sources for Business Intelligence: sensors' networks, processes' traces, etc.
- Intelligence built into machines, that contribute to decision making
- What about things that start to behave differently from the expected pattern?
- Increasing the number of intelligent entities will not increase the global intelligence of the enterprise. Another view is that smart devices can reduce the amount of information flowing (preprocessing is performed locally)
- Reducing message traffic to alarms, when something goes wrong

Enterprise in the Cloud

- *Under what conditions would enterprises migrate into the Cloud?*
 - *Clouds will come certainly. Company will benefit: savings driven strategy.*
 - *We need to better define "Cloud": Corporate? Yes (e.g. BMW.) Public? ...*
 - *Quality and accountability are needed.*
 - *Difference between SMEs and Large Enterprises in their needs.*
 - *Migration will be application dependent. Non-critical apps are more promising for clouds*
- FI universal business infrastructure?*
- *The current infrastructure is still relevant in 20 years' time, because it requires big investment that will not be "thrown away"*
 - *Some innovative enterprises, e.g. eBay, will base their full business on FI*
 - *But many enterprises still run Cobol programs. Too costly to change*
 - *We have legacy that will not disappear*
 - *Role of Government? Divergent views were expressed*

Tuesday 24 November

9.00 – 11.00 Session IV.7 Future Content Networks

From the point of view of broadcasting²⁰ mass media as we have known it is coming to end; because the Internet has changed everything, audience is now taking a control over content. As a result of rising global competition 65 000 journalists have been fired during recent years all over the world. Traditional TV channels were producers and aggregates, but now they have to compete with new media content producers in the Internet, as users have broken the wall between production and consuming (they have become prosumers) and they can compete with big players just by 2 euros investment via sites like YouTube etc.

Nowadays it is more important than ever to cater to users and get their loyalty, thus one has to be close to users, engage them and answer their needs; media has to reach the people. A TV content has to be moved automatically to mobiles and Internet, and the users have to be given access to raw signals e.g. from sport events so that they can choose a camera they want to follow.

This development is facing many challenges. Firstly the capacity of bandwidth will be a problem, as success can kill you; new users for your service should not cost anything to you. Secondly interoperability and standards are needed. Thirdly brand and business roles have to be rethought. Fourthly as video is becoming new text as a medium of self-expression, we need new search methods. And fifthly we need a new IPR systems, as it is impossible to maintain the release windows based system.

Also the role of journalists has to change, as they are facing a huge competition from amateurs. But it should be remembered that also in the future, people who do not have time will be ready to pay for edited material. Therefore journalists will be those who select the most relevant material for you, but they will not be gatekeepers anymore.

From the point of view of evolutionary and visionary approaches to content centric networks²¹ the users behaviour has changed dramatically in the Internet. Nowadays the vast majority of traffic is related to the content and user generated content is expected to proliferate in near future. Consequently the future Internet will be much more dynamic and no one will know where hotspots will be at one single moment, as users can do and will do what they want.

Thus new approaches are needed to enable this development to continue. The evolutionary approaches (operating in an application/service layer and starting from previous content delivery architectures) are based on old delivery approaches and develop them further (P2P, Co-ordinated overlay networks etc.). The visionary approaches (operating across layers, from a network layer upwards, and change fundamental naming and addressing assumptions of IP) originate from the fact that most of the Internet interactions are user-to-content instead of host-to-host and they are based on the new visionary networks (native routing based on ID's instead of network addresses making video search possible etc.).

It can be said that when we add the content centric networks of the future to the future Internet we will have a future media Internet (FMI). And currently Europe has a unique possibility to influence on what this media Internet will be like.

From a perspective of content centric networks themselves it can be said that now the content is connecting information instead of wires or nodes. This means that content services and content stored where an end user is have to be separated. And at the same time, the increasing use of video will need more

²⁰ Rosalia Lloret, TVE

²¹ George Pavlou, UCL

and more bandwidth. Also security issues are becoming a huge challenge, as well as finding relevant content by searching tools.

It has to be also remembered that more support is needed from regulators, as some of the major issues are not technological anymore, they are legal: e.g. how to fight against child pornography, how to do cashing for videos etc.

The Future Media Internet Co-ordination Action (nextMedia)²² co-ordinates European efforts towards European the future media Internet. This means that they are creating and coordinating groups trying to reach a common European FMI architecture, co-ordinating research projects and liaison with FIA, creating the Future Media Internet International Roadmap and doing a dissemination and standardization co-ordination.

From this perspective the quality of experience (QoE)²³ is a huge question and in the end it is question of quality of experience of who, user or producer? Meanwhile the beginning of convergence means more and more costs for everyone. Thus QoE is not only a question about pipe and error free content, therefore a holistic approach is needed, which should include among others: user interface, the ways of participation and contribution, and interactive and immersive 3D. At the same time television is moving quickly to mobile services. Thus the services have to work in wireless networks and in all platforms.

What we talk now as quality of service used to be called quality of user interface and it is hard to measure it. Therefore more research on that is needed, because currently the quality of experience is not researched on the map of quality of service parameters. Also new ways of payment are needed, like micropayment systems where people should be able to transfer money very easily.

Better service classes are also marketing problem: how to make consumers to pay for services? ISP's, setbox manufactures, broadcasters, gadget providers, service provider, content owners, network operators etc. want to have their share on new TV, but in the end the quality of service will win and we will have a Google-TV for everyone.

Also a pan-European ability is coming, when a European legal system and platform for it is created. Services really should look same everywhere in Europe.

Conclusions and next steps by FCN:

"Main Results

- At the Architectural Level the different ideas are maturing and converging. This will lead to a federated approach between FCN, FISO, MANA and IoT based on Socioeconomic

- Areas of interest:

- Converged Network Architecture*
- Emphasis in Home Networks*
- Push/pop Paradigms for content delivery*
- Content Identification and Packet Inspection*
- Immersive Media Experiences & Quality of Experience*
- Content Streaming*

Other Key Results:

- Simplicity & Federation: Interoperability and backwards compatibility are and will be a key parameters*
- Trust, Reputation and Privacy should be inherent in the network architecture*
- Objects and Components Polymorphism may boost Future Internet*
- Evolution Architectures are closer to what we may expect in the next few years*
- Innovation Architectures could be the Internet Revolution*

Next Steps:

- Future Content Network Group – 20 January 2009, Brussels*
- Future Media Internet Task Force – 4th February 2009, Brussels*
- Future Media Internet Architecture Think Tank – FIA, Valencia*
- ETSI Special Interest Group*
- UCMedia, 9-11 December 2009*
- FIA Valencia Keynote speakers: Van Jacobson, Palo Alto Research Center (Formerly Xerox PARC) and Tsuhan Chen, Cornell University"*

11:30 Plenary closing session

²² Federico Alvarez, UPM, nextMEDIA CA presentation

²³ Quality of Experience panel. Chairman: Vali Laloti (BBC). Members of the panel: Ian Mecklenburgh (Digital TV Group), Pierre-Yves Danet (FT/Orange), Rosalia Lloret (TVE), Federico Alvarez (UPM), Hans Einsiedler (DT)

According to Ericsson²⁴ currently Europe develops mediums while USA develops content.

IT&Telecoms can be seen as the fifth technological revolution. In every one of them there has been two parts: first an installation phase (first 20-30 years), whose winners are old players, and after that a deployment phase (following 20-30) years, whose winners are new players. There is always a crisis between those phases and we are going through it now, when we are entering to digital society.

At the moment environmental sustainability is a major issue in the world. The European Commission is trying to reduce emissions by 50–80 percent while tripling the GDP. Currently ICT counts about two percent of the emissions, but it can be used to reduce CO2 emissions on the other industry areas up to 15 to 20 percent.

Another megatrend is a broadband explosion. At the moment there are 4 billion mobile phone users and 400 households with fixed internet connection. Soon 50 billion devices will be connected with each other. In 2015 there will be 3 billion people who have an access to broadband, 80 percent of them will be mobile and 20 percent fixed connections.

The amount of mobile data has been growing 12 percent per month from 2007 to 2009. LTE will make the future growth possible, if there is enough spectrum and investments on infrastructure. It is also important to have an opportunity to discriminate users by prioritization of P2P traffic in order maintain the growth. Also flat rate connections have to go away, because at the moment a broadband access costs same for a month than one pizza, which is not economically sustainable for ISPs. On poor areas (like in Etiopia) people are ready pay 10 to 20 percent of their income for connectivity. This should be the case also in Europe.

At the moment communication is financing connectivity and no one is willing to do investments for free.

Conclusions:

FISE – Future of Internet Socio-Economics:

- “Incentives for the digital economy – importance of the balance of power between providers, users, and prosumers:*
 - complex burring between all parts of the ecosystem*
 - relationship between traditional and user-driven economics (e.g. user-provided networks a (WLAN etc.) and open source)*
 - how to support investment in large-scale platform development (when to have government backing)*
 - protection of interests through copyright and patents (even business models but no successful litigation)*
 - contradiction of “free” Internet and sustainability*

Various opinions on Europe’s response to globalisation – assets of culture, languages in Europe → societal effects – but difficult to commoditise culture in a global marketplace

User modelling and technology design:

- today social science focuses on empirical studies rather than design*
- qualitative research of users’ motives, values and expectations*
- wealth beyond economic wealth but difficult to measure*
- wider range of metrics that combine technical, business and social*
- social identities and related theories*

Misc:

- trust in information sources used as the basis for statistical studies*
- FI SE effects not well reflected current reports (e.g Stieglitz report)”*

MANA – Manage and Service Aware Network Architectures:

“Research Priorities / Roadmap:

- Open & Standard Languages / tools/models/APIs for groups/composition of resources description and use (for management and virtualisation); instantiated in different areas; extensibility of the languages; assurable capabilities; programability of resources*
- In-system self-management (coordination of run time different management control loops: service-nets-resources loops: dependency; statefull, service view, all operations; multi-domain, federation; integration)*
- Mechanisms for orchestrations of different systems; stability & integrity guaranties; orchestration APIs; operation APIs)*
- System Oriented Cloud Infrastructures: rethink and redesign networking, computing, storage, resource and content as planetary scale infrastructures/ fabrics of FI : Convergence of Internet*
- Integrate general capabilities in the design of FI (identifiers, security, dependability, ... : different areas,...)*
- Methodology to define architecture • How to evaluate an architecture*

²⁴ Håkan Eriksson, Ericsson

- What are the metric? (meeting the requirements, what are the constraints)
- Might help the comparison of given architecture – How to evaluate the value of an architecture (apply different metrics)
- Restructure/Evolution the traditional plane (data, control, management) approaches; How fit services into the picture”

T&I – Trust And Identity

“ID provisioning approaches for the Future Internet:

- Networks using identifiers across many layers of the stack
- Understanding the issue across MANA/T&I/Services domains
- Next steps focus on short term (for PPP) for Valencia, and medium/long term

How to Measure Trust

- Promising initial experiments in trust measurement and vulnerability prediction
- Discussion of • relating lab experiments to application for internet scale scenario
 - Availability and sharing data on vulnerabilities and incidents
- many ideas about how to take this forward being discussed Smart Cities
 - Clear need and opportunity to engage T&I issues for smart cities infrastructure and services
 - FIRE
 - A Safe place for testing attack scenarios at network and service level”

FIRE – Fireworks (Usage of Facilities)

“Outcome:

- Action for creating necessary specifications to satisfy deployment requirements on FIRE facilities
- Action to draft a paper elaborating on the fundamentals of the methodology and its benefits

Deployment

- A common language for resource descriptions
- A common language to describe experiments
- A common language to describe results
- Standardized APIs to access resources
- Single sign-on / one-stop shop – i.e., a common approach for managing user credentials

Methodology

- The terms used for the methodology formulation should be elaborated and clearly specified – contribute to the experimentation vocabulary
- The users election process for the involvement in the experimentation should be addressed per use case class
- The methodology will encompass several iterations
- The methodology will be complementary to e.g., benchmarking, prototyping etc.
- Develop a position paper to reach consensus on the above”

FISO – Future of Internet Service Offer:

“The Future Internet is polymorphic infrastructure, where between silo systems are changing and blending and where the emphasis is on the integration, interrelationships and interworking of the architectural elements through new service-based interfaces.”

The real world Internet

“ Summary:

- How to handle exceptions (detect and manage them)
- Common FI reference model and taxonomy
 - Reconciled assumptions
 - Gap identification
 - Convergence of ideas
- Event driven communication
 - Publish subscribe based communication
 - Explore synergies with FI community activities
 - General purpose software landscape is not ready yet
- More focus on the Internet as systems-of-systems
 - Solutions should be geared to support pluralism”

FCN – Future Content Networks:

“Main Results:

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- *Immersive Media Experiences & Quality of Experience*
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Other Key Results

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- *Objects and Components Polymorphism may boost Future Internet*
- *Evolution Architectures are closer to what we may expect in the next few years*
- *Innovation Architectures could be the Internet Revolution*

What next?

- *Online consultation (bottom-up) to identify and structure topics*
- *Caretakers meeting 22 January: identifying broad frame for Valencia*
- *FI PPP meetings with utilities, research institutes, cities ... (Dec09-Jan10)*
- *FI PPP Information Day, Brussels, first half of March 2010.*
- *Regular FIF meetings collocated with the FIA workshops, Valencia, Gent (Dec 2010), and possibly at ICT2010 (27- 29/09/2010)*
- *Calls and Work Programme 2011-12"*