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Final Report on Social Future Internet Coordination Activities

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V2.0	28 August 2012	Eric Meyer	Final report, checked for formatting and proofing

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1 Executive Summary

This document is Deliverable D3.2 “Final Report on Social Future Internet Coordination Activities” of Work Package 3 “Social Future Internet Coordination Activities” within the ICT SESERV Project 258138. The report provides the FISE (Future Internet Socio-Economics) community and the European Commission with the results of co-ordination activities for the societal aspects of the Future Internet (FI) over the full length of the SESERV project, but focusing in particular on the period from August 2011 to September 2012 as the previous period was reported extensively in D3.1. The purpose is to discuss societal issues which affect the development and success of FI technologies based on the collective thoughts and opinions, as gathered during the SESERV coordination activities, of social scientists and technologists working on FI research in EC Challenge 1 and beyond.

The Internet pervades our lives, professionally, commercially, within the context of our personal and leisure activities, and in our interactions with governments, educational resources, scientific materials, reaching into nearly every part of modern life to some extent. The proliferation of uses and involvement online is hugely significant for Europe and the rest of the world. The FI Ecosystem is now a complex and dynamic socio-economic space. **There is a significant increase in the diversity of roles, an increased emphasis on users, and a blurring of roles between major market players.** The concerns of the Internet have moved from structures purely targeting transit and delivery of data to socio-economic structures supporting exchange of information and knowledge according to the values of individuals and communities.

There are many societal concerns within the FI ecosystem that emerge as a consequence of FI R&D efforts. Major topics covered in particular in this report include understanding **users and user-centric approaches to the Future Internet**, how the **Future Internet ecosystem** is developing, and connections between the **Future Internet and the broader society**.

Since SESERV was first conceptualised **significant societal, economic and environmental events continue to pose huge challenges**. Economic progress has slowed across Europe and many parts of the world, and many countries are not experiencing the increased quality of life that they had hoped (and planned) for. As a result, some are suggesting that new value structures that consider qualitative measures may be needed to provide incentives for societal behaviour change. Such visions are attractive but there appears to be no credible and desirable vision for a sustainable future. With the tension between the common good and private interest (as embodied by the net neutrality debate) routes to sustainable socio-economic structures that offer trust and opportunity for all are not clear.

In this context, the goals of SESERV remain highly relevant. **Maintaining focus on assisting technologists in their understanding of the potential broader impacts of FI technology along with barriers and strategies for adoption through dialogue with social scientists is increasingly important.** The challenges facing society are larger than ever and the Future Internet will surely be an integral part of possible solutions. However, to realise the benefits all stakeholders will need to engage in discourse between those that study and those that build the Future Internet.

The nature of this project, as a coordination and support action for the FISE community and related stakeholders, means that it is not a comprehensive, research-based project. However, even given this limitation, SESERV’s engagement with FI technology

developers, social scientists inside and outside the FI community, policy experts, government personnel, and representatives of the business community have given us ample evidence to present both some **common frameworks** that have emerged from the conversations and a number of **recommendations** targeting a variety of stakeholders.

The following table (reproduced from page 50) summarizes some of the **challenges and opportunities** facing the Future Internet that were identified at SESERV events by the participants.

Table 3: Challenges and Opportunities for the Future Internet

	CHALLENGES	OPPORTUNITIES
NETWORK	***Security*** We need to consider whether there are enough risk and security experts available to be able to model and manage the risks of online attacks. In addition, even if all attacks could be monitored, we need to know whether there are enough people to monitor and control the attacks. ***Traffic volumes*** It is clear that continued growth in capacity is not sustainable. There is now a need to be able to optimise resource usage by whatever means rather than just plan for more and more capacity.	***Fast and universal access*** The promise is that we will all have the right to access any and all services irrespective of where or who we are. This offers tremendous opportunities to all sections of society to become truly digital. ***Pervasive infrastructure*** With the advent of smart cities, providing sensor infrastructures in support of any number of different societally beneficial services and applications, coupled with the advent of 4G, as well as ever-increasing capabilities in mobile devices, dynamically configured networks will allow for significant flexibility in support of *ad hoc* and dynamic services on demand and for all.
CONTENT	***Digital Rights*** Who owns content? The originator or the carrier/supplier? How should it be controlled, if it can at all? These are major issues which could potentially curtail the increasing flow of online content. ***Copyright*** From the outset, the Internet has posed problems for copyright and its control. With freely available information sourced from any location, efforts such as the Digital Agenda pillar 189 are fighting an ever-increasing battle.	***Digital Access*** The *Europeana* project, supported by the Commission, promises to allow access for all to our cultural heritage. This kind of approach, coupled with *open data* trends, should benefit the community in opening up significant stores of knowledge to all. ***Skill Enhancement*** Through online activity, users will become more aware of security and privacy issues, as well as be able to engage in more and more online activities.
USER COMMUNITY	***Lack of transparency*** The introduction of marketing and other commercially-based activities into SNS's may well have a significant impact on members of those communities who may become suspicious of how information they provide or interactions they engage in are used for purposes other than those original intended. ***Identity*** Identity management mechanisms that are able to balance privacy concerns with persistent digital identities across platforms and borders are needed to increase usability and portability of digital information linked to particular identities.	***Inclusion*** Online communities offer a context for people of similar interests and backgrounds to engage with one another. As such, it can encourage all sectors of society to engage, ensuring that even those from marginal groups can find a voice online. ***Participation*** The benefits of online engagement include growing skill levels through experience, rather than separate and explicit instruction. This has the advantage that users are then better able to make informed and appropriate decisions on matters of privacy and trust.

	CHALLENGES	OPPORTUNITIES
ENVIRONMENT	***Limited resources*** Predictions of massive increases in ICT utilisation will inevitably lead to significant depletion of dwindling resources in terms of energy and the environment. This needs to be addressed if the FI is to be able to fulfil the promised central role for the future. ***Economic growth*** Current trends and strategies are driven by a belief that continued economic growth is required and desirable for the future. This mind-set may need to be challenged to provide a sustainable future for ICT.	***Grid-based utilities*** There is some potential for sharing energy not only in terms of solar power sourced electricity being fed into the national grid, but in managing the effective sharing and distribution of unused energy from one user to another. ***Participative networks*** Sharing of this type (ie energy grids) leads on to a whole range of other activities and behaviours where participation by end-users is encouraged not externally, but internally: the users themselves share information and data from their own experience to benefit others who may use that information in a novel and beneficial way.

This report also provides 22 recommendations (listed below) which are of interest to a variety of stakeholders, as identified in the following table. These are revisited throughout the text, and the in the conclusions to the report. These recommendations are grouped into six major themes that have emerged from the project: Project Design and Development, Participant/User Experience, Internet Data, Regulation and Public Policy, Transparency and Trust, and Citizenship, Awareness, and Education. These themes, discussed in the conclusion of the report, proved to be those key to SESERV participants, although others certainly exist. In addition, the primary stakeholders who are the key audiences for each recommendation are shown and again discussed in the conclusion to the report. These stakeholders include some obvious FI participants (technology developers, technology providers and businesses, project managers, funding bodies), but also some which have been less present in the FI community to date (civic society advocates, citizens, technology users, content businesses).

Table 1: List of Recommendations and Page Numbers

RECOMMENDATION 4 p. 23

Create flexible structures and funding incentives to facilitate multidisciplinary teams coming together for a problem focused effort or an area study, such as promoting projects which specifically include stakeholders from all appropriate areas.

Theme: Project Design and Development

Primary stakeholders: Technology developers

RECOMMENDATION 5 p. 24

Create teams built on mutual trust by establishing expertise, managing expectations from different partners, and establishing boundaries of which aspects of the project are open to change, and which are fixed.

Theme: Transparency and Trust

Primary stakeholders: Project managers, technology developers

RECOMMENDATION 6 p. 31

Continue to support technology projects which involve skilled user experience (UX) design and user-oriented researchers as a core part of multidisciplinary teams.

Theme: Participant/user experience

Primary stakeholders: Technology developers, project managers, funding bodies

RECOMMENDATION 7 p. 31

Fund longer projects, or fund second rounds/follow-ups. There needs to be a mechanism or funding model to go from a technical proof of concept through to a real product, with the kind of iterative development/release cycles often found in mainstream, commercial technology developers.

Theme: Project Design and Development

Primary stakeholders: Funding bodies, project managers

RECOMMENDATION 8 p. 32

Provide funding for a ‘champion’ after the project has ended to stay engaged with the community to create continuation. Alternatively, find caretakers in communities and support them with funding and time. Let the users ‘take-over’ and make the process bottom-up with some help.

Theme: Project Design and Development

Primary stakeholders: Funding bodies, project managers, user communities

RECOMMENDATION 9 p. 34

Don’t let the ease of collecting user data be done to such an extent as to let the user feel under surveillance or under threat (or more simply put off).

Theme: Participant/user experience

Primary stakeholders: Technology developers, governments, civic society, technology providers, business

RECOMMENDATION 10 p. 35

Increase transparency about how data is being used, and make understandable and clear choices available to the public (e.g. simple frameworks more like Creative Commons rather than 10-page legal documents).

Theme: Internet Data; Transparency and Trust

Primary stakeholders: Citizens, civic society, technology providers, businesses, governments, regulatory bodies

RECOMMENDATION 11 p. 35

Create better methods for informing users what their data is worth, and what they are getting in exchange for sharing it (and what the consequences of using services is).

Theme: Participant/user experience; Citizenship, Awareness and Education

Primary stakeholders: Technology developers, governments, civic society, technology providers, business, citizens, businesses

RECOMMENDATION 12 p. 40

Understanding the forms *and* uses of data is often more important than just understanding the size or structure of the data itself. The static aspects of data management (storage and search/retrieval) are relatively easy to manage; the dynamic aspects (data transmission to support particular real or perceived Quality of Experience) are where the real problems lie.

Theme: Internet Data

Primary stakeholders: Technology providers, businesses

RECOMMENDATION 13 p. 42

Look at what users actually do, how they interact and what they expect. Users need to be included, not only as significant FI stakeholders, but also because without user-involvement, there can be no empirics and therefore no science.

Theme: Participant/user experience

Primary stakeholders: Technology developers, project managers

RECOMMENDATION 14 p. 44

There need to be transparent technologies and new business models to ensure all stakeholders in the network are treated fairly in the context of user expectation that the technology is transparent and QoE is the most important factor.

Theme: Transparency and Trust

Primary stakeholders: Businesses, technology providers

RECOMMENDATION 15 p. 45

QoE not QoS is what matters; privacy and trust are concepts that end-users are better qualified to determine. Look at what users actually want and the form of the data they use, not the content of the data itself. It's user experience that matters, not what technology is used to deliver what data.

Theme: Participant/user experience

Primary stakeholders: Technology developers, technology providers, businesses

RECOMMENDATION 16 p. 64

Focusing on commercially-based cross-border content is not enough. Much of the content currently being shared is of little commercial value but is straining the network. The debate over net neutrality should take into account both commercial and social factors. The Digital Agenda would do well to look to users and how they use content to be able to define urgently needed regulation in this area.

Theme: Regulation and Public Policy

Primary stakeholders: Governments, regulatory bodies, users, content businesses

RECOMMENDATION 17 p. 65

It is vital to involve all interested parties – paying special attention to the changing nature of the FI ecosystem and associated stakeholders. The FI will become more and more IoT-like, built on cloud-like shared facilities. Legislation and regulation need to keep pace with the ever-increasing pace of user-driven change. A common language and terminology to facilitate multi-disciplinary debate will be key.

Theme: Regulation and Public Policy

Primary stakeholders: Governments, regulatory bodies, users, technology providers

RECOMMENDATION 18 p. 67

More direct involvement of end-users in the design and validation of trust and security issues, along with some flexibility in allowing users to set their own boundaries. Access to appropriate risk and security expertise should be provided, including ensuring sufficient resource is available to handle alerts and attacks. Some incentives may be required as we begin to understand how to maintain and restore trust. Ultimately though transparency rather than legislation is needed above all.

Theme: Transparency and Trust

Primary stakeholders: Project managers, governments, regulatory bodies, technology developers, technology providers

RECOMMENDATION 19	p. 69
Investment in infrastructure is not enough, and may not even keep pace with projected traffic. There is already a need to optimise usage rather than let traffic spiral out of control. Further, rural and last-mile provision may need careful monitoring by suitably empowered industry watchdogs to ensure end-to-end QoS irrespective of user type. Ultimately, though, the business model around the "virtuous cycle" may well need revision.	
Theme:	**Regulation and Public Policy**
Primary stakeholders:	**Governments, regulatory bodies, technology providers**
RECOMMENDATION 20	p. 70
Research and innovation directions do include issues which have been identified as strategic. It is time to start to incorporate the findings of current projects in shaping what should be the focus in Horizon2020 and beyond, as well as the mid-term review of the DAE. For the "Better Society" arm of Horizon2020, how users actually use services and applications, as well as what that will do to the infrastructure needs to be examined carefully. Without user involvement, though, there is no empirical evidence of what really happens in the Internet.	
Theme:	**Participant/user experience; Regulation and Public Policy**
Primary stakeholders:	**Funding bodies, governments, civic society, regulatory bodies**
RECOMMENDATION 21	p. 71
Providing appropriate support and education to increase digital awareness will enable users to make appropriate and informed decisions about security and risk, increasing their levels of trust. In addition to user involvement, it is important though to introduce ethics into the development of infrastructures. Once more, though, it's important to look at what users are actually doing, and their expectations; they are becoming increasingly sophisticated in what they do and what they demand.	
Theme:	**Citizenship, Awareness and Education**
Primary stakeholders:	**Citizens, technology users, businesses, governments, civic society**
RECOMMENDATION 22	p. 73
There is an urgent need to review actual usage alongside the focus on the optimisation of resource exploitation. Individual users develop their own concepts of what they are prepared to share and how it should be protected. Usage projections suggest that they are rapidly becoming a concern if not completely unsustainable. It is unwise though to try to fix what is worthwhile (or "cultural") and what is not.	
Theme:	**Regulation and Public Policy**
Primary stakeholders:	**Governments, regulatory bodies, users, technology providers, content businesses**

The evidence gathered from stakeholders during the SESERV project identified some key threads running throughout the events: the **importance of understanding the social implications of technology** and the role people have in using it; the **difficulties of multidisciplinary collaboration**; and the **challenges of getting stakeholders from one domain to cross over into other domains to share knowledge and expertise**.

However, also running throughout the project were the many causes for optimism, including the wide range of expertise in engaging technology and social issues represented by SESERV speakers and participants, and the strong level of interest in SESERV events.

In the conclusion to the report, we indicate that the recommendations in this report are suggestions for further conversation that we hope will be taken up by the FISE community and beyond. None are the final statement on the issues raised, but are intended to stimulate thought and conversation in the coming years as the Future Internet continues to develop. Done right, this Future Internet will support important social values, economic development, personal growth, and fundamental human needs and rights, a goal all SESERV participants shared even when their ideas for how to reach that lofty goal were in

disagreement. The next steps are as important as the previous ones – and this project has given us cause for optimism that the groundwork is in place to build a Future Internet with a solid socio-economic base grounding it.

2 Introduction

2.1 Purpose of D3.2

The report provides the FISE community and the EC with the results of co-ordination activities for the societal aspects of the FI over the full length of the SESERV project, but focusing in particular on the period August 2011 to September 2012.[1] The purpose is to discuss societal issues which affect the development and success of FI technologies based on the collective thoughts and opinions of social scientists and technologists working on FI research in EC Challenge 1 and beyond.[2]

The document aims to bring together the outcomes of engagements[3] with the FI community. These include surveys, Future Internet Assembly (FIA) sessions, workshops, focus group results, a session at the Digital Agenda Assembly, and direct engagement with a selected number of FP7 projects.

The goal is to highlight challenges and priorities within the FI ecosystem and to raise awareness of how these challenges can affect societal challenges posed by the Digital Agenda.

2.2 Document Scope

This document is Deliverable D3.2 Final Report on Social Future Internet Coordination Activities for the ICT SESERV Project.

Section 3 briefly discusses the methodology used by WP3 in year 2. This methodology is discussed in greater detail in D1.5.

Section 4 focuses on the themes arising from the WP3 focus groups and survey.

Section 5 discusses the societal aspects of the FI ecosystem considering key societal concerns.

Section 6 discusses the relationship between the Future Internet, the Digital Agenda, Horizon 2020, and includes thoughts for the road ahead.

Finally, Section 7 summarizes the recommendations from the report for incorporating societal concerns in the design of the Future Internet.

2.3 Abbreviations

BBC British Broadcasting Corporation
CDN Content Delivery Network
CNO Collaborative Network Organisation
DA Digital Agenda
DAE Digital Agenda for Europe

[1] The period from August 2010-September 2011 was documented in the previous deliverable D3.1, which reported on the first year of the project. D3.2 (this document) both updates the conclusions of D3.1 and provides new content arising from the activities of year two of the project.
[2] http://cordis.europa.eu/fp7/ict/programme/challenge1_en.html
[3] Detailed descriptions of the engagement efforts are detailed in the deliverables of WP1.

EC	European Commission
EU	European Union
FG	Focus Group
FI	Future Internet
FIA	Future Internet Assembly
FI-PPP	Future Internet Public Private Partnership
FISE	Future Internet Socio-Economics
FP	Framework Programme
ICT	Information and Communication Technology
IoT	Internet of Things
IPR	Intellectual Property Rights
ISP	Internet Service Provider
NGA	Non-governmental Agency
OSN	Online Social Network
PC	Personal Computer
PDA	Personal Digital Assistant
PPP	Public-Private Partnership
PTT	Poste et Télécommunications[4]
POTS	Plain Old Telephone Services
QoE	Quality of Experience
QoS	Quality of Service
R&D	Research and Development
SLA	Service Level Agreement
SME	Small to Medium Enterprise
SNS	Social Network Site
WG	Working Group
WP	Work Package

2.4 Acknowledgements

This deliverable was made possible due to the large and open help of the SESERV consortium, members of the FISE-WG and other Challenge 1 projects. The authors would like to thank:

- All FISE-WG members who have contributed over the past 24 months
- Participants at SESERV workshops, focus groups, talks, and discussion panels
- SESERV partners

[4] The traditional telecommunications companies

3 Methodology

The methodology for SESERV year 2 is described in D1.5 in detail. In short, WP3 used the results of the project's second year **survey** to select topics for **focus groups**. These focus groups were then organized around the topic societal and socio-economic topics.

In addition, WP3 used **direct project engagement** with a selected set of projects with societal concerns; these were critically reviewed to identify what technology is being produced and its impact on the FI ecosystem (see D4.2 for a full list of engagements; and D3.1 for the projects and related analyses). Risks and opportunities with regard to the Digital Agenda and the Social Impact studies were discussed at SESERV events and in focus groups, and these discussions informed the conclusions drawn in this document (see Sections 4, 5 and 6). Such risks and opportunities were identified initially by participants at the focus groups and during the discussions at the various SESERV organised and attended events, but have been cross-referenced and summarised into a set of specific recommendations by the authors of this report (Section 7 *et passim*). A view of the main stakeholders and the value relationships were analysed (Section 5), along with any specific links between the projects and the views expressed by participants and project partners during the SESERV workshops (Section 4).

3.1 A Note on Users, End-users, Actors and Participants

With the exception of compound terms such as *user-centric* where context should clarify anything specific nuance of meaning, the terms *user* and *end-user* have been used in this document to distinguish different identities, with occasionally different goals and characteristics. There is a general problem with the word *user*, in that it is possible to view the concept of user as an outmoded concept insofar as it implies passive *use* of the Internet and other technologies, rather than active selection, use, repurposing, moving, linking, re-transmission, contribution, and creation that is increasingly common, as noted by Kuczerawy[5] in the SESERV Brussels workshop. The primary value that Internet participants, or actors, bring is increasingly based on their active participation in the Internet ecosystem. Minton[6] and de Freitas,[7] at the same workshop, noted that this can range from the value that can be drawn from big data that requires the traces of people doing things online. Hartman[8] also noted that trust is based on the perceptions of active participants (not passive users), de Freitas pointed out that games require active participants, and Minton argued that social technologies simply do not work without actors who are being social with their friends and acquantances. Finally, von Bornstaedt,[9] in arguing for prioritization technologies, showed that for these technologies to work, actors online must be able and willing to identify their priorities both individually (e.g. paying extra for business-class wifi at a hotel) and societally (e.g. prioritizing emergency ambulance or credit card financial services at peak times).

[5] http://www.slideshare.net/ictseserv/aleksandra-kuczerawy-privacy-issues-in-future-internet-seserv-se-workshop-june-2012
[6] http://www.slideshare.net/ictseserv/stephen-minton-tech-transformation-in-the-age-of-uncertainty-seserv-se-workshop-june-2012
[7] http://www.slideshare.net/ictseserv/sara-de-freitas-the-gamification-of-everyday-life-seserv-se-workshop-june-2012
[8] http://www.slideshare.net/ictseserv/alan-hartman-trust-measurement-and-management-seserv-se-workshop-june-2012
[9] http://www.slideshare.net/ictseserv/falk-von-bornstaedt-networks-perspectives-and-analysis-in-the-future-internet-seserv-se-workshop-june-2012

In general parlance, of course, *user* is meant to refer to any consumer of a product, technology or service. Thus a government agency making use of the results of a population survey would be a user, as would a content provider whose product is accessed across a network. In such cases, *users* tend to part of a larger group whose members share similar requirements and wish to achieve similar goals. By contrast, an *end-user* in the technical community is any individual consumer of a product, technology or service with needs and goals which may be distinct from any higher-order group to which they may belong. Thus, an individual citizen using an eGovernment portal may share with all citizen *users* the same requirement to be able to access and interact with government services, but have specific wishes as an individual *end-user* in terms of which specific services they want, their own individual trust levels of an online service, and their level of competence in using the service. In the main, we are interested in this document with the social actors and participants who are, in a simplified sense, often acting as *end-users*, and in understanding how they see the Future Internet (FI), what they want from it, and what concerns they have. Their predicament or views may well be shaped by other *users*: their Internet Service Provider (ISP) responsible for guaranteeing their privacy, as well as by other *end-users* such as contributors to social networks and content sharing services. However, it is important to keep in mind that even when we rely on the term *user*, one should not only think of the single-dimension of passive use, but to understand that these actors are also engaged in a myriad of activities online, some of which are more toward the end of active creators and others which are more aligned with passive use. For the individual, these shifting roles and activities come naturally, but understanding how these nuances should affect the design, policies, and implementation of technology is much more difficult.

3.2 Focus Groups: Topics

During the first year of the SESERV project, a number of societal topics were identified in D3.1, mainly as a result of a survey and a workshop held in Oxford, hosted by the Oxford Internet Institute. The workshop brought together technologists, policy makers and experts across various Challenge 1 ICT projects and socio-economic projects. As a result of that work, eight major topics were identified that participants highlighted through a number of break-out sessions on various subjects.[10] In addition, the work led by WP2 identified seven major topics[11] through its work on tussle analysis.

As discussed in D1.5, for SESERV's second year, and given how successful and informative the SESERV workshop breakout sessions had proved to be, a survey was run to rank the fifteen cross-sectorial topics in order of relevance and interest to the participants. The results were used to identify appropriate topics for the focus groups to be run as part of WP2 and WP3. For WP3, the selection of topics turned out to be relatively straightforward (see D1.5 for details on how these were selected).

The top topics from respondents' rankings clearly show two very significant societal issues:

1. The importance of multi-disciplinary collaboration to the success of the Future Internet; and

[10] SESERV Deliverable D3.1: *First report on Social Future Internet Coordination Activities*
[11] SESERV Deliverable D2.1*: First Report on Economic Future Internet Coordination Activities*

2. Whether there is a need for more user-centricity and control in the design and use of online services.

These topics were thus chosen as the way to shape the *focus groups* in respect of the societal challenges facing the Future Internet: there is a clear concern that progress on these issues must involve collaboration across different disciplines, as well as direct involvement of end users in consideration of the design and control of online services.

3.3 Focus Groups: Participants and Locations

Two focus groups were held at the following locations:

1. Digital Social Research, A Forum for Policy and Practice,[12] Oxford, UK (13 Mar 2012). Topic: Multi-disciplinary collaboration.
    - Seven participants from Europe (3), North America (2), the Middle East (1), and Australia (1)
    - Facilitated by Eric Meyer (Oxford)
2. Future Internet Assembly meeting[13] in Aalborg, Denmark (10-11 May 2012). Topic: User-centricity.
    - Four participants from Europe
    - Facilitated by Anne-Marie Oostveen (Oxford)

3.4 Focus Groups: Methodology

Summarising our approach in respect of the general methodological description in D1.5, participants for the societal focus groups were drawn from attendees at the various events highlighted above. The intention was to organize small groups: some four to six respondents. In keeping with the literature on running successful focus groups, it was felt that starting with smaller groups of this type would help to keep the discussions more focused as well as to decide whether participants should be invited back to attend at other groups, should more be held.

The focus groups themselves took place in suitable rooms at each event venue. The sessions were recorded and professionally transcribed.

As to participants, given the nature of the targeted events, we did not try to cover all FI ecosystem stakeholders. By targeting events which tended to involve motivated individuals and projects (see Section 0 for who took part and their general background), we tried to get the most value out of each session. Such motivation would help to get round the need to have any specific seeding activity; the groups still, we felt, profited from being started with an acclimatization exercise, but the nature of attendees from the events would make topic-specific introductions less relevant. This reflects the lessons from the SESERV Athens workshop focus groups, which introduced the sessions with a fairly lengthy project presentation to set off the discussion.

[12] http://www.oii.ox.ac.uk/events/?id=487

[13] http://www.future-Internet.eu/home/future-Internet-assembly/aalborg-may-2012.html. Note that this session was in addition to the official FIA sessions to which SESERV contributed. WP3 and WP2 both contacted participants in advance and planned logistics for access to a small room suitable to hold the focus groups.

Finally, in respect of logistics and payment, it was decided to audio record all sessions to ensure appropriate and reliable coverage of what was said and how interactions proceeded. Transcripts were made of each session, with the participants being anonymized for the purpose of reporting what happened. The transcripts and recordings formed the basis of analysis presented below. In addition, no payment was made, capitalising on the fact that participants were already at the events and so would more easily delay departure or make time during the day to attend the focus groups. We did provide catering as an incentive to participants. In summary:

Method	Focus groups
Group size	Target: 4 to 6
Group composition	Representatives of the FI ecosystem stakeholders, including technology developers as well as technology users and social-scientists
Recording	Audio recording
Length	Up to 1.5 hours for discussion; 2 hours in total
Tools	Questionnaire, presentation material, lists of issues; focusing exercises; consent forms
Input for Analyses	Transcripts and summaries from the focus group meetings, along with the audio tapes. Only summary information will be made publically available

4 Focus Group and Survey Outcomes

When experts from different fields work together on a common subject within the boundaries of their own discipline, they are said to adopt a multidisciplinary approach. From the focus groups it becomes clear that multidisciplinary collaboration in Future Internet projects is seen as having a lot to offer. By bringing a team of people of varied expertise together to "solve a problem" quite often a more efficient solution is achieved or a solution is obtained when one may not be possible without the multidisciplinary approach. An individual or an individual specialism can quite often develop "tunnel vision" when examining a problem where it is difficult to look beyond the "usual way of doing things". By forming a multidisciplinary team or by working with other disciplines it becomes possible to think creatively and in diverging directions. This ability to think this way may be essential to solving the problem in question. It might also be the case that the problem to solve is so complex that its solution requires expertise across a range of disciplines.

According to the participants, interesting and valuable work comes out by having experts in computer science working together with researchers from social sciences and life sciences, and good output comes from the interplay of these disciplines. However, it is clear that successful multidisciplinary collaboration takes time and is challenging. Understanding the concepts underlying a discipline other than your own, finding a common language to communicate ideas, trusting research you haven't the skills to assess yourself, and finding somewhere to publish are only a few of them.[14]

Social scientists find it very challenging to show technologists that, in designing technology, social and organisational issues are involved.

One of the things that technology projects say is, "We don't know any social scientists. We don't necessarily understand the value of it. The Commission tells us we should take these things into consideration" – but they shrug their shoulders a bit. Oxford FG

Additionally, it is difficult to have a combination of both challenging technical concepts and systems that really fit into some social need.

So we have a large group of people saying, "You must do some market research, you must do some real good persona research on what people really want," and then at the same time all the technical people say, "Okay, yeah, thank you, I understand that," and they just go on with the work that they did, which is quite understandable because it's difficult to combine the two. And I have seen examples of projects here [at the Future Internet Assembly in Aalborg] that either started completely from the social perspective and then the technical solutions they used were not very impressive. And on the other hand the technically impressive projects, they almost completely ignored the way people would use those solutions. Aalborg FG

I've been working with quite a lot of things that work with using technology and new technology and imagining, trying to come up with new ideas of how you can use and mix technology with other things, but always the main motivation is that it should make sense and bring some new value to people rather than just technical curiosity even though that could be part of it as well. Aalborg FG

RECOMMENDATION 1
Demand clear time in first months of projects allocated for conversation between partners from different disciplines to accomplish true multidisciplinary collaboration and dedicate resources to this.

[14] Pain, E. (2003) Multidisciplinary Research: Today's Hottest Buzzword? Science Careers Magazine. American Association for the Advancement of Science.

Multidisciplinary collaboration should be seen by all partners as a learning process and this clearly takes time. A longer timeframe is therefore seen by most participants as one of the main conditions that would contribute to more successful multidisciplinary collaboration in FI projects.

4.1 Finding a Common Language

Interdisciplinary research requires either that an individual researcher gains a depth of understanding of more than one discipline and be fluent in their languages and methodologies, or more frequently that multidisciplinary teams assemble and create a common language and framework for discovery and innovation.[15] Coming from different disciplines and backgrounds, it is often difficult for project partners to understand each other. Research fields have their own methodologies, theories and concepts. It takes time to become familiar with each other's approaches.

It's a learning process. Well, normally – in my experience, at least, in these large technology projects, the first expectation is that you're there for the acceptance part, so comforting the users to accept it. And the challenge is to show the technology people that, in designing technology, social and organisational issues are involved. Not in terms of a general story, but if you can translate that into design decisions, then at a certain moment, a learning process starts. One interesting example was a development project for the European Commission. Okay, we started as a very applied government project, but we ended as a very fundamental research project in possibilities and constraints of e-government. So then you see this learning process taking place, but it only works if you can really point at very specific moments – so here we have either design choices, which are, to a large extent, social and organisational – or where you can show that what they tried to develop is actually developed in a social way but doesn't work. And then this learning process starts. And, at least on some occasions, that really changed the project and the collaboration. And then, of course, you can't be too theoretical, so you need to adapt your language into something other people understand. So it's not being a translator but change your own language. Oxford FG

People need to adapt their language into something other people understand. They do not necessarily have to be a 'translator', but they need to be able to change their own language and it takes expertise and time to learn how to do this and to get beyond a superficial level:

I came up through math and computing, and then crossed over into social sciences. So I started with that language, I had to learn the social science language. So, granted, that puts me in a stronger bridging position. Oxford FG

I have a technical background, I very well understand software engineering and the technical side of work, and I also understand social science, and then I could bridge these two gaps. So in part what I was doing was looking at the established social science theory and models and then translating part of that to design requirements. So I'm taking this body of research which is descriptive and analytic and not really meant for design, and then I'm extracting design requirements and making hypotheses that we actually can build and test in terms of our technology based on that body of knowledge. And it worked quite well because I could speak both languages. Aalborg FG

One participant pointed out that getting familiar with each other's 'language' requires a fair amount of investments and a bit of an anthropological approach. There are no shortcuts for that. In order to have people from different disciplines really engage with each other, it is important to have time allotted to that process at the beginning of a project, for instance by organising weekly meetings in the very early stages. This will help to bring in the expertise and to get a truly collaborative project rather than having people going along on their own separate paths and, at the end, trying to force things together.

[15] Trawella, J. (2009) Multidisciplinary research – an essential driver for innovation. Speech delivered at the Australian Financial Review Higher Education Conference, 9 March 2009.

I think one of the issues we had is that there is also risk that it branches off, even within a project that you have a user study side and then there is one core technical thing that just goes this way no matter what happens here. Aalborg FG

By sharing (for instance) important readings and discussing relevant concepts, project members will realize that they have different ways of doing things, and different understandings of issues.

I think actually TA2 was much of an exception to that, where we actually were able to a large degree to integrate these barriers, different perspectives and disciplines. So for instance, of course the major part of the work went into technical development, but besides that we put quite a lot of effort on investigating theories and models from various fields of social science, like sociology, psychology, and social psychology, linguistics, communication studies and so on. And then we developed a kind of theoretical framework vocabulary for really in detail talking about the different nuances of group based social interaction, especially distributed group based social interaction, which fed back to the technical developers and they actually picked up these terms like interaction, rituals, and strong and weak ties, and so concepts that come from different parts of social science, and used that extensively within the technical development teams. So I think that TA2 actually was much of an exception that it really did manage to integrate a lot of these different ways of thinking. Aalborg FG

By addressing these differences early on and reaching a mutual understanding, a synergy can evolve which can also lead to changes being made to the research agenda. Otherwise there is a risk of being locked into a particular way of doing things:

But you suddenly go, "Oh, so, when you say that, you mean this, because it comes from there" – so it was like that backward chaining to understand where those different origins had been. But it then enabled us to move forward in a really unified fashion because you recognise and acknowledge that there are some differences that you can live with, and then there are other ways that you can work forward. Oxford FG

Unfortunately, the importance of this 'learning each other's language' and reaching a common ground is not always acknowledged by the funding bodies:

We can't have lots of fast-moving goals in those early stages. I don't know, if that project is anything to go by, the second iteration lost its funding from the government basically because they felt it wasn't showing enough fast activity, which is really sad. Oxford FG

RECOMMENDATION 2
Do not concentrate too much on having fast-moving goals in the first stage of projects; allow for additional iterations. Do not initially evaluate the project solely on 'fast activity' or 'product output', but on other indicators such as uptake or usability.

4.2 Training Researchers to Work at the Interfaces of the Disciplines

Training researchers who can transcend the barriers that exist between the disciplines requires innovation in teaching and learning. In current university settings, training programs largely focus on in-depth training in a discipline or a set of closely related sub-disciplines. To develop the pool of researchers who are best prepared for multi-disciplinary research, we need undergraduate programs that provide depth in the major discipline(s) while also enabling students to participate in interdisciplinary courses and be exposed to research experiences that transcend the discipline of their major. The earlier in the training students are exposed to different languages and methodologies, the better they are able to understand the potential contributions that may come from outside their main discipline.

So you could have an intermediary – someone to translate what the social scientists say to the technological people, and the other way around. And we found graduate students do that quite well, actually. And that involves sending your graduate students to other departments or schools, and welcoming graduate students

from other departments and schools, and having a university infrastructure that allows that to happen without penalty for the students, which not all universities have – many have, but not all universities have. Oxford FG

PhD programs need to consider the benefits of broader exposure. Lowering the barriers to students moving between institutions and even disciplines would provide the ability to train the next generation of interdisciplinary researchers and researchers who are facile at participating in interdisciplinary teaming. We need to recognize the benefits for students who gain training in one discipline to be able to acquire training in another – and enable it to happen. When the focus group participants were asked how they motivate students to move between institutions and disciplines the answer was clear:

I tell them it's where the jobs are (laughter). Oxford FG

RECOMMENDATION 3
Target training at identifying students with skills that can be developed to become 'bridgers' and tie this to the economic benefit of this for both the individuals and for society.

This recommendation need not refer specifically to "students" in higher education: that happens to be a reflection of those taking part in the FG discussion. However, it is intended to refer to those in education and training who should be encouraged to develop appropriate skills at whatever level.

4.3 Engaging Stakeholders

Most of the participants of the focus group have engaged with technology projects as social science experts. They were asked what their strategies are to identify stakeholders who are outside the main domain of the project. How do they get the attention of stakeholders and get them to participate with the project. What are good strategies that projects can use to identify the right stakeholders and to get their attention; if they want to really consider the bigger social issues that their projects are part of? For the Future Internet one could think of stakeholders such as big decision-making bodies, government, or society as a whole.

We've done this upfront, in that including other people, the domain experts, keep people in the domain as partners, right from day one. Not necessarily day one of writing the proposal but, certainly, they're included in the proposal as active participants, and they get support – financial support – as well. For us, then those people have helped make connections for us with other stakeholders in the domain. Oxford FG

Another way of engaging different stakeholders is to get embedded in different communities:

Well, to answer you directly, is to recognise that we live on the computer science borders, so it was actually a Microsoft faculty retreat, where I was a token social scientist, and a few others part of it. So I spent a lot of my time in the computer science community, and I go to places like the American Association of the Advancement of Science, where I'm an officer of the section on Information, Computing & Communication. So I try to embed myself in those communities. And it's making those opportunities, as opposed to others that, I think, have opened a lot of doors. Oxford FG

There are different ways to build connections, and to create opportunities for building connections between different stakeholders.

I think there are three models. So, in many projects, I've been in the stakeholder part in it – they also get resources to do this – which is typically the European Consortium model. But everyone knows that because we've been together many times. But there may be two other models. So in some of my science policy studies work, stakeholders pay – not very much, but they do pay something, and that creates commitment of

time. So, for example, we did a project on how to evaluate research performance in fields where this was considered to be difficult, like architectural models, and these kinds of fields where they don't have web of science-based indicators. And there we tried to collaborate. And that was rather successful with faculties and different universities, and they paid part of the project – not very much, something like 30,000 Euros. Because they stepped into it and they paid it, there was commitment over time, and they actually used the resource. And the third model is – but that doesn't happen very often – but you can also work with stakeholders who are really interested, having their own big interest in something. So I once worked with architects in a project, and they were simply interested in the outcome, so they invested in it. Oxford FG

According to one participant it is a matter of picking some fairly obvious targets.

The area that I've worked in most is information retrieval, where the expertise of search is something that is much needed, and I do five years with the national academies on the future of the domain name system and where Internet search... And that led to contacts where I now know some of the core IETF guys and some of the heads of the Internet Architecture Board, and now I know who to call on some of those. So that's an area we can influence. And then there's the work on Values in Design that Geoff Bowker and Helen Nissenbaum have got a group going there. And Katie Shilton, my student, is part of that. And they're actually embedded in the Genie project within the States, which is the Future Internet, and so they've managed to pick pieces off there. And so I'd say some of those. And then privacy is the other, where I think the social sciences can have some real influence on the architectural design. So pick some key points, as opposed to saying how can we influence society and the Internet. If you say here's some areas where social scientists have particular expertise that balances where the technologists are working. There's a number of areas there that we understand well. So I'm more… I think there's low-hanging fruit, and then showing good value and good product there then gets the respect where you can build that into many more peripheral areas. Oxford FG

Each stakeholder must feel that they benefit from participating in the team's research programme –there must be mutual benefit.

RECOMMENDATION 4
Create flexible structures and funding incentives to facilitate multidisciplinary teams coming together for a problem focused effort or an area study, such as promoting projects which specifically include stakeholders from all appropriate areas.

4.4 Trusting Each Other

In multidisciplinary collaboration it is important that people trust each other, and trust research that they do not have the right skills to assess themselves.

I was thinking of collaboration – it can fail in the sense that people working in different areas may not actually, in the end, convince each other, or not even convince but be able to communicate some parts of their paradigm, but still the collaboration might be successful insofar as it's productive, there are publications that come out of it, and people are generally happy with what's been done. But, at a deeper level, they just never really convince each other. Oxford FG

In a multi-disciplinary project it is important that each team member must be valued for their contribution. There must be mutual respect by members of the team for each other and there must be a willingness by the team members to attempt to understand "where the other team members are coming from."

And I think it can be useful to enlist the focus from other disciplines when you're trying to make a point or persuade folks. So, in a collaboration with domain experts, computer scientists, and myself, one computer scientist kept on questioning the domain experts, and the domain experts repeat the answer and provide more data, and repeat the answer and provide more data – nothing was satisfying the computer scientists. So I stepped in and I said, "If you don't trust him as your domain expert, you need to get another domain expert, or you need to begin to trust him, because we're not getting anywhere." (laughs) "And you've asked the same questions at least half-a-dozen times. You've gotten the answers. Those are the answers so-and-so can provide." So he looked at me and said, "Oh, okay" and he stopped questioning that domain expert.

Unfortunately for me, he then started questioning my work (laughter), moving on, and, again, it was the same thing – he would ask the same questions, I would give the same answers, and we were going round and round. And I went to the domain expert, and we were having a meeting, the three of us, and I said, "I know he's going to ask the same questions, I'm going to give the same answers – what can we do about this?" And the domain expert said, "Don't worry – I have the solution." I said, "Oh, okay." He went into the office, and the first thing the domain expert said, "We're here to discuss these issues for as long as you want. Just understand one thing – we're not changing anything." (laughter) We were asked two questions, and then we moved on to other topics, and the project moved forward. I thought that was a great line – "We'll discuss it as long as you want, but we're not changing anything." (laughs) Oxford FG

Participants agreed that one of the biggest stumbling blocks that needs to be overcome in projects for them to become successful is the absence of trust. If there isn't sufficient trust to start with, it can be build, but then you need institutional of infrastructural support to be there.

RECOMMENDATION 5
Create teams built on mutual trust by establishing expertise, managing expectations from different partners, and establishing boundaries of which aspects of the project are open to change, and which are fixed.

4.5 User-centricity in the Future Internet

As we have seen, the design of socio-technical environments, such as the evolving Internet, cannot solely be based on technical considerations. By definition, integration of the requirements of users and technology has to take place. Users need to be included as significant Future Internet stakeholders. End-users are now legitimate participants, not just recipients, in the online value chain and should be treated as such. The Future Internet will have more users, a greater diversity of users and support a greater diversity of Internet applications. Therefore it is important to identify users' requirements. Only through such identification will it be possible to achieve customer satisfaction that leads to the success of any commercial system.

In order to investigate users' motivations and to understand their needs, desires, and concerns it is recommended that designers and engineers involve users continuously throughout the development process. We were interested to find out whether Future Internet projects support user-led innovation and empower in this way ordinary people, citizens and non-commercial entities. To determine actual attitudes and practices of those working in the Future Internet industry towards user-centricity, we involved participants at the 2012 Future Internet Assembly in Aalborg by organising a focus group on user-centricity and distributing a survey.

The focus group discussed with a small number of participants (see Section 0 for detail on who) in what way end-users could or should shape the Future Internet. It investigated whether current Future Internet projects are user-centric and what kinds of methods are used to give users an active role – a voice – not just as commentators on ongoing Internet developments, but as innovators and shapers of technology. The focus group discussed whether Future Internet projects need to assign as much importance to the needs of ordinary users as to the requirements of industrial players. We asked what is more important: user needs or technical possibilities. We also examined whether involving users stifles creativity and innovation. The survey, which was distributed among the delegates at the Aalborg FIA and in LinkedIn groups focused on Future Internet technologies, asked similar questions. The survey consisted of 3 parts. In the first part the respondents were

asked some background questions (gender, age, area of work, Future Internet project involved in, etc.). The second part asked about respondents opinions about user-involvement in general, while the third part of the survey asked about user-involvement in the respondents' own Future Internet project.

4.5.1 Background

The survey was completed (in May-June 2012) by 55 respondents (of which 4 female) working on 35 different Future Internet projects. The age distribution is shown in figure 1. Half of the respondents worked in academia, mostly in the fields of computer science or engineering. A quarter of the respondents worked in the technology industry, while the remaining respondents worked in government and policy units, as IT and data service providers, or as project managers in telecommunications. On average the respondents have worked in their current fields for about 11 years (ranging from 1 year to 40 years).

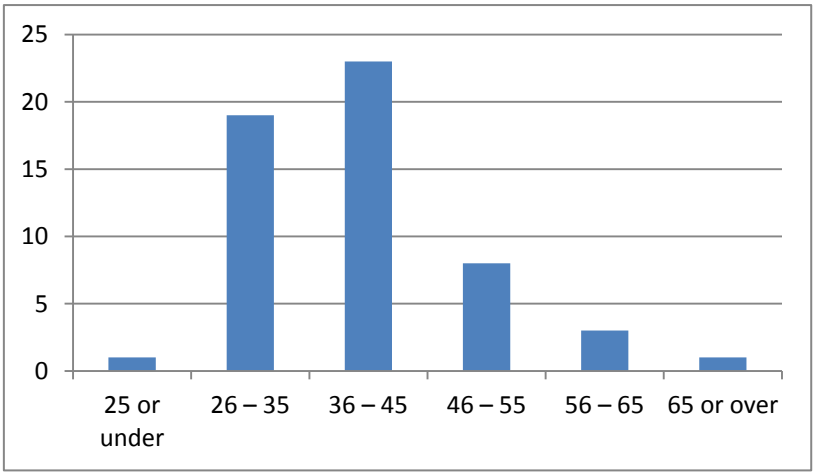

Figure 1: Age Distribution of the Survey Respondents

4.5.2 User Involvement in General

Overall, the respondents have a positive attitude towards user-involvement. About 94% agree or agree strongly with the statement that continuous user involvement throughout the development process will result in higher adoption rates. Users should be seen as active research partners according to 81.6%. Almost all participants (96%) agree that involving end-users will maximise the societal benefits of Future Internet infrastructures and applications. The majority (71.5%) feels that the quality of information obtained through user involvement is high and they would recommend (81.6%) that other development teams spend effort on user-centred design activities. Three quarters of the respondents feel that the expenses incurred by such activities are offset by savings elsewhere in the development process or life-cycle of the product.

The 'Towards a Future Internet: Interrelation between Technological, Social and Economic Trends' report[16] (2010) explains that in the early days, a specialized technical community has overseen the Internet's development, while today major commercial Internet players have a stronger influence, especially in the key open standards setting committees. The

[16] Blackman, C., Brown, I., Cave, J., Forge, S., Guevara, K., Srivastava, M., et al. (2010). Towards a Future Internet: Interrelation between Technological, Social and Economic Trends. Brussels: European Commission. Retrieved from http://www.Internetfutures.eu/wp-content/uploads/2010/11/TAFI-Final-Report.pdf.

report argues that the future should see a strengthened role for the end-user and user-led design. We asked the Future Internet community who they think is currently driving the development of Internet technology. Their opinion reflects the Towards the Future Internet report with 57% stating that commercial players dominate, 29% claiming that technical developments drive the technology and 10% saying that end-user innovation is the main driving force. When asked who should be driving the development of Internet technology in the future 33% say end-user innovation, 22% say technical developments, 14% say large commercial players, while 31% indicates that there should be a balance between the three players.

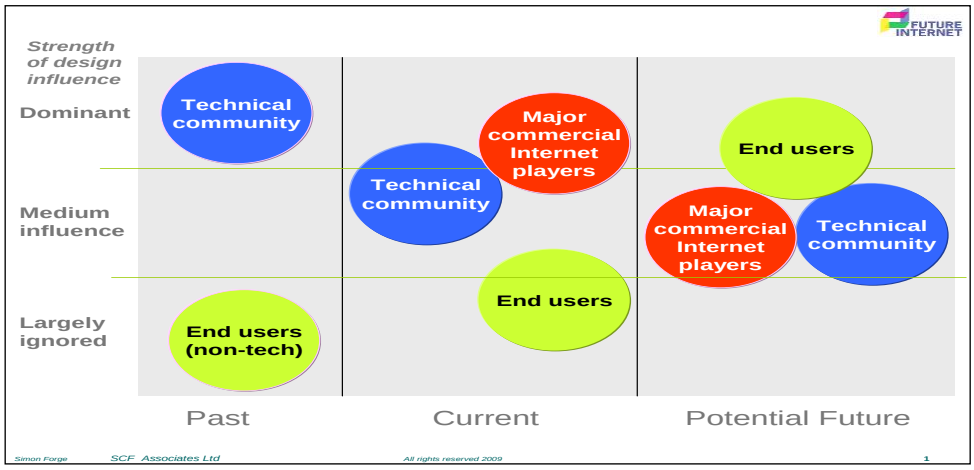

Figure 2: Who Influences the Evolution of the Internet?

(Source: TAFI Report, 2010)

The focus group participants pointed out that what guides or controls technology development is a really political issue, and may be becoming one of the most important political issues. There is a lot of debate about privacy, surveillance and similar issues, which is really about where the technology will go. The political frameworks, the global distributional production, and so on, set a role for what kind of technology can be developed. Funding models are also considered to have an impact on who sets the agenda. One participant did not agree with the 'current' depiction in Figure 2:

I would say that the major commercial players are not so dominant in coming up with new ideas. Rather, to some extent end-users and primarily lead user types, so different types of technically fluent end-users and to some extent new startups. It could be commercially driven but it's not the major players who come up with the new ideas. I mean, it is the startups that then get bought by some of the major players after a year or two. But the major innovation is not within the big players. Aalborg FG

Although it is acknowledged in both the focus group and the survey that end-users need to be involved in the development of the Future Internet, two-thirds of the respondents agree that users do not always know what they want and that they frequently make bad choices. So, does it follow from this that end-users are seen to be hindering innovation? We posed three statements about this. First we asked whether end-user involvement will hinder innovation because end-users have too minimal technical skills to understand the possibilities and constraints of Future Internet applications. Only 10% agreed with this statement. We then wanted to know whether end-user involvement will hinder innovation because a 'user-centric design focus' creates sameness and therefore stifles creativity. Again only 14% agreed with this statement. Finally, we wanted to know whether end-user involvement will hinder innovation because end-users tend to be conservative in their tastes, preferring the familiar over the innovative. This statement found more resonance among the respondents with 29% agreeing to it. Overall though, we can state that Future

Internet designers and engineers do not feel that user-involvement will have a negative impact on innovation.

We addressed this issue in the focus group as well and one participant explained that users involved in an ICT project in the health sector were not open for technical solutions, indeed preferring the familiar over the innovative: 'They used to have their methods, their… "ICT, no, we don't like it, please give us our notebook"… And it took some time but we said, look, okay, there are advantages if you can improve the efficiency, you can do this, this, and this. In our first project I think it took one year before we understood each other. This is just a process of different types of people.' An interesting discussion ensued:

AMO: You gave the example of the health sector and you said, they didn't want it, they said give us our notebooks. You say 'it took us a year basically to convince them that this was the thing for them'. Are we then talking about a technology push, or are we still talking about listening to what users actually want? Because is technology always the solution?

F: You have to try to inform them because they don't know what it is. For them, a PC, they are not used to using it and they are afraid of it, so please, I don't like to work with this thing. But then, if you try to explain it to them and if you develop an application so that it is tailored to their activities, after some time they see, yes, we can have advantages, yes, it's not that bad. But it really took time because they were very sceptical in the beginning.

M1: I don't think this is a sign of technology push, I think it's a sign that people don't really care, and they are not interested. What you sketch is very good. You are interested in the technology part and also interested in the psychology part, but many people are not. They are either a technician, either customer oriented. So if this health representative says, "No, we're not going to use computers," that means, "I'm not really interested in computers, go away with your technical stuff." They're not open to, and they are not –

F: They are not open for changes. Normally people don't like change.

M2: I actually don't think that it has so much to do with fear of technology or technical things. I think it often has a lot to do with organisational things. That if people, for example in a health organisation, feel that the change comes from above, this is the bosses who have decided it should be this way, and if you are a nurse or something and have a paper notebook you can use it in informal ways. You can write things in the margin or something that is not really sanctioned from above. If you have a computer programme, maybe that fear is that this will be precisely controlled by the way the administration think the work is done, while in their perspective they always have to find ways to work around it to actually make it work. So I mean there's quite a lot of research on these things that how often the sort of ground work in an organisation is so different from the view of the administration, and technological change or bureaucratic changes and so on is kind of out of touch with this reality and the people there have to find work arounds and so on. So I think it can also be this view of where does the technology come from? Who is it that actually…? Not that it is a technology push but it is like a push from above in the organisation.

M1: And usually they have some experience with it. Usually when something is imposed upon them there are always things in it which are not optimal and in the end they have to work harder because it's not well thought out. That's previous experience which you see in a lot of companies as well. Oh, we have this new system for you, it will make life easier. Aha. Yeah. Right.

M3: But also the people who decide, do I admit in the first place that my people are thinking of changing, are thinking of allowing technology of any kind into my process? There are also people who are just saying, "That's technology. I don't want to think about it. Because I don't believe that technology will help me at all." I see this stance also a lot. And on the other hand and technical side I also see the stance, the position, let's say, "Hey, it can be so much smarter, it's just a matter of explaining and convincing, they're so stupid they won't understand." That means they are not interested in their world, so it's also, I think it's very much you have to be interested in the world of the other side.

F: That's why once you have this communication and once you involve them it is better because they see it. But initially this was quite hard to establish this relation.

M2: Yeah, and we must acknowledge that if you introduce new technology in organisations, say healthcare or something like that, then it's not only the technology change. I mean it always comes with organisational change and power balances, and all these other things that you must acknowledge and recognise that you cannot avoid that, it always changes, and so people might say, "I don't want the technology," but it's really on

the grounds that it's changing who is in power and who is in control and how do you coordinate things, which perhaps are not made explicit. Aalborg FG

The way to deal with the different needs and priorities are specific to different organizational cultures. For instance, in commercial settings with strong top-down hierarchical managerial control, it may be sufficient in some cases to impose work structures on collaborative teams. However, in many more cases, flexible approaches tend to prove more successful, such as setting up small incubators that allow multidisciplinary teams to work in close proximity and intense contact for short or extended periods. In some settings, majority/democratic decision making can work, while in others, strong charismatic leadership can inspire multidisciplinary teams to work out their differences in pursuit of a commonly share goal that is perceived to be more important than the differences initially dividing the team. Unfortunately, there is no 'one size fits all' approach here that fits all settings.

When asked about their knowledge of user-centred design tools, 43% of the respondents admit not to be well aware of the standard tools. 44% indicate that they have never attended a user test session, and 57% have never helped to conduct a user test session. The following section gives more detail about the actual user-involvement in the projects of the respondents.

4.5.3 User Involvement in the Future Internet Projects

From the 55 respondents 29 indicated that their Future Internet project applied a user-centred approach. From these 29 respondents, 17 said that it had been easy to identify the end-users in their project, while 12 disagreed with that. In the focus group one participant argued that the term 'user' is becoming less clearly defined:

The term "user" already presupposes a certain technical configuration, where you have on the one hand someone who develops the technology, manages it, owns it, controls it, and then you have the end-user who then maybe can feed back into this but is not really in control. So if you compare it to free software, then the distinction between who is the developer and who is a user is kind of arbitrary. There was a project out there about community owned Internet infrastructure, where you also have no distinction really between the managers and the users. So I think it's important to be a bit careful with this term, and maybe you can involve users so much that they cease being users and become something else. Aalborg FG

Deciding how many users to involve in a project is another issue developers have to deal with, and varies from anything like a handful to well over a hundred. Usually it boils down to being a pragmatic issue. Projects have only got a limited amount of time and money. Then again it is also related to the kind of research questions being asked as pointed out in the focus group:

I mean is it something where you want statistical relevance, where you are really comparing one system to another to show that this is so much better with some significant thing for instance? Or is it a more general enquiry into understanding what are the possibilities, because then it is a more qualitative investigation, and then you apply different types of methods. So you need to understand what you are looking into, what kinds of approaches are relevant. What are the research questions that you are investigating? And then apply appropriate methodology.

Overall, the respondents that had experience with user-involvement in their project were positive about the impact. In the relevant projects, 87% had made user-involvement a priority. It was felt by most of the participants to have been effective (87%), to have made the project more innovative (77%), leading to major new insights (70%). User-involvement seems to have had a real practical impact with 60% of the respondents claiming it had changed the developed technology.

We have applied observations and interviews in the real home environment or the real context where people actually are, and found that quite useful, and then also different levels of co-creation or participatory design

to some extent, where we actually make sure the people who we were working with understand the general issue of what we are trying to do. Once they are used to that to some extent then we can introduce ideas, and based on the feedback we can suggest technical ideas that address the needs that they express, and then have an ongoing discussion in a quite agile or iterative way, and develop new technical ideas and try them out and have this kind of process. Aalborg FG

Only 13% were of the opinion that user-involvement had been a hindrance, while 17% agreed that it was just creating more work and was too expensive.

Between technologists and users, sits an additional layer: the user researcher and UX (user experience) designer. Depending on the skills of this team – whether they pick up the important aspects that users express, and how they communicate what they discover to the technologists – designers and engineers will have different experiences with user-involvement. We asked the respondents whether the user researchers/UX designers in their projects were able to clearly communicate the user needs to the people developing the technology. Only one person felt that they were not able to communicate their findings clearly due to 'speaking a different language'. About 64% felt that there are some difficulties translating the user requirements into technological terms. Just over a quarter of the respondents thought that the user researchers were able to pick up on the important user aspects and explained them well to the technologists. In the focus group we saw a similar result:

In many cases we do interviews. Well not me, but the people from the social sciences. They have their methods. So we are not bothering with them. We are together in a project and at the beginning of a project they will organise with a different type of users, they do many interviews, and this is the approach they follow. They try to create persona, and then they make a kind of summary page for each persona, to understand how their life is organised, what they expect so we understand those people. We don't have to participate in this interview but at the end of these interviews, we - the technical persons - understand what they are expecting and we take that into account. Then we come to more technical requirements, so what is expected from the system. And then the technical people get involved and create the architectures and concepts and things like that. Then the user, at least not in healthcare, you cannot involve Alzheimer's patients, but nurses stay involved in the project and follow up what is happening, are also involved in these technical proof of concepts, but there sometimes you see that it's a bit too technical for them. There is sometimes a mismatch. Aalborg FG

From the survey we learn that the projects that apply a user-centric approach have many different methods to give end-users an active role. Figure 3 gives an overview of all the methods used by the Future Internet projects represented in the survey. The most popular user-centred design tools are interviews, questionnaires, focus groups, usability testing and field studies. But fully functional prototypes, practical workshops, and scenario-based focus groups are also used frequently. Less common are methods such as shadowing, in-home observation, and user diaries. This might be because these methods are very labour intensive and time-consuming (either on the part of the researchers or on the part of the end-users). Relatively novel methods based on stimulus materials such as comic strips, theatre performances or dramatised stories are not very common but might increase in popularity over time. However, in comparison to the more popular methods these stimulus methods are in general very expensive.

The participants in the focus group also applied a rich set of methods in their projects. They were of the opinion that if you use the classical waterfall design (business requirements, functional requirements, and functional design) it separates the technology and content developers from the outside world so they don't need to understand why a function is needed. Whereas in the more agile types of development it is much more common that the developers are talking to the users (themselves or through an intermediary), and they are hearing what the users are saying. One participant illustrated the user-involvement in a project as follows:

In earlier projects the focus was still more on the technical, and also the industry expected a purely technical project. But now this is evolving. We once had a project where we had several use cases in healthcare, things like that, where we really had very nice and interesting user studies where we were creating a kind of personas to understand what the users expect from our solution. So where there was peer feedback from these requirements to the technical solutions it was greatly appreciated, also by technical industrial partners, and we see now in more recent projects that even industrial partners like to follow this approach, and take more into account the needs from the user and also applying internally these kind of techniques to match their products more to what user needs. So this is interesting. Aalborg FG

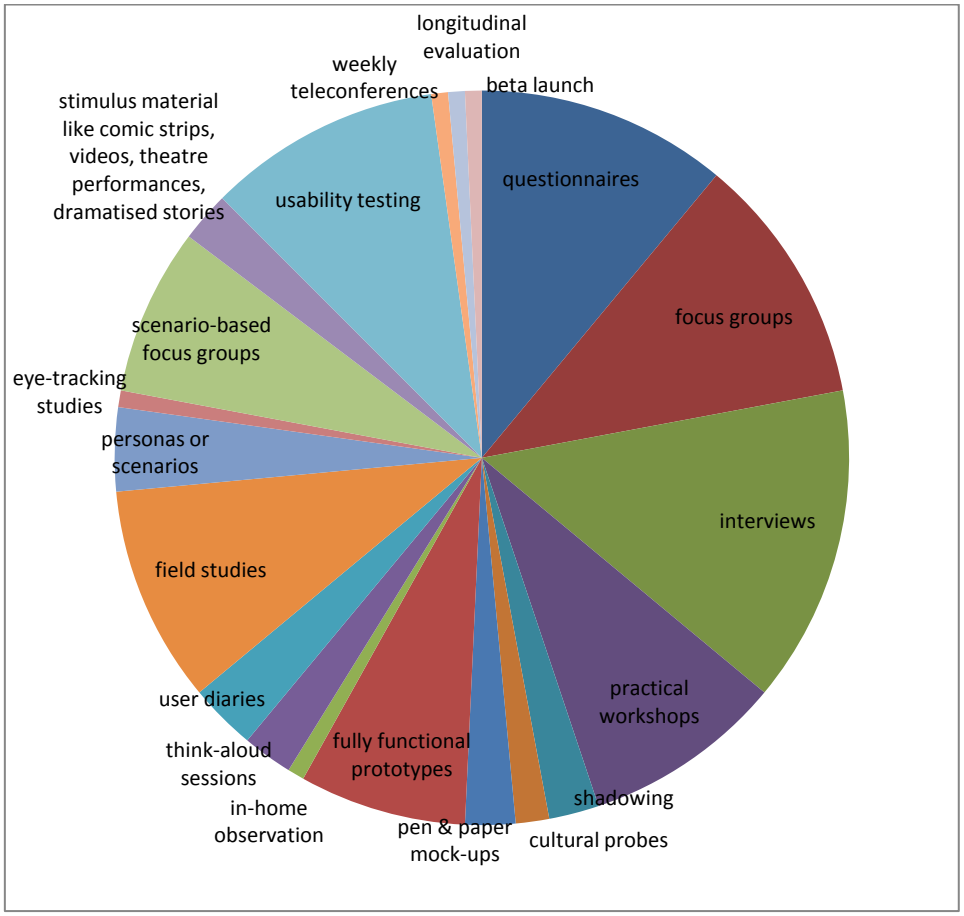

Figure 3: User-centred Design Tools Used in Future Internet Projects

(Source: SESERV Survey)

Again, interviews, field studies, and fully functional prototypes are popular methods, but the participants also used in-home observation and personas. Involving the users can be challenging though.

When testing a fully functional prototype, it can have a very negative impact when the prototype does not immediately function as it should. I have a very nice example. We had a system which worked by speech recognition and it was used by the people who check the tickets in public transport. We had some speech interface so that you could look up information from a database. There is for example somebody without a valid ticket, and then they could speak the name and have information on this person. They didn't want to use it. Why? Because if you spoke a name… 'Hans Andersen'. "I did not understand correctly. Please restate the name." 'Hans Andersen'. You can imagine yourself standing there with this guy, with his friends, and you are speaking to a device which doesn't react, which doesn't work. You are a complete loser. So they didn't want to use it, because the image that they created by using this was so negative. Aalborg FG

Another participant had the same experience with failing tests:

We also try to go to kind of a field test. But this is not always the case, and again I said earlier, you have to be careful, in the beginning we did more field tests. But then if a field test fails, if it is not working for the first time, if you have to come for example at home several times to fix it they really don't like that. If it goes wrong

RECOMMENDATION 6
Continue to support technology projects which involve skilled user experience (UX) design and user-oriented researchers as a core part of multidisciplinary teams.

when you test it for the first time with real users that is really a bad thing, while we as technical people say, "Look, yes, it can happen. We do it again and then it's okay." But you can't do this with users because they expect it to work from the beginning. If you go to the field, you should be shown that it is working from the first time, otherwise you will, even if it is a good solution, people, they don't trust it anymore and they are sceptical. Aalborg FG

4.5.4 Time-scale: Moving Beyond 'Technical Proof of Concept'

The duration of a project has an impact on both the success of user involvement and a successful outcome. Typical two-year projects are seen as too short to accomplish anything beyond a mere technical proof of concept, possibly leading to a mismatch in expectations of the involved end-users. They should be followed-up by product development projects.

A two-year project is not that long if you have to do the whole cycle of having requirements and development and implementation and proof of concept. And what we see sometimes at the end, that users are a bit disappointed about the technical solutions we offer, which is not really the technical issues that are a problem, but we are making a research proof of concept, and users are expecting a fully integrated project with a nice design and form factor and everything, and then they say, oh, this is not a nice thing. Aalborg FG

From the conversations it appears that, particularly in the domain of eHealth, going beyond 'proof of concept' or prototypes is difficult due to the funding models.

In healthcare another thing is because if the government is not coming into play, and I think the involvement at least it is in Belgium, but the involvement of the government is very low in this kind of project. And I think if this is not stimulated these kind of solutions, because for healthcare generally there is some refunding, it's social security, and if such a system could become part and part of it could be refunded then you'll have a system that can work. But the industry, as long as it is not supported by the government it will say look, it costs too much, we will not have enough customers. So there are several parties and in Belgium what we believe in this area what is missing is the involvement of policy makers and government and things like that. They are not involved, we involve the users, we involve the technical people, but we do not involve the policy makers. Aalborg FG

In general, the problem is that projects often stop after the first iteration because of a lack of money and time. This is why applications which would be highly appreciated by the end-users do not come into final products.

RECOMMENDATION 7
Fund longer projects, or fund second rounds/follow-ups. There needs to be a mechanism or funding model to go from a technical proof of concept through to a real product, with the kind of iterative development/release cycles often found in mainstream, commercial technology developers.

There are however alternative ways to go beyond the actual duration of a project, as one participant points out:

Instead of the project coming in with something and then after a project ends, leave, let's say you have to find some caretakers of what the project is about, and you are sort of helping them to grow. So you make the project through them, or let's say, I don't know, if you want to improve a neighbourhood in some way you find some organisation that's there and you just improve something there but they can continue afterwards, so

there's some sort of caretakers for things to do. It's not always possible to do, but that's just one way that…if you do that then you can make sure there is some kind of continuation. Aalborg FG

Another participant shows that this is indeed a viable solution by giving an example of such a project:

Here the community is so strong that you just only have to give them small bits of information, and of course you have to find some funding, etc, but then they take it out of your hands while you're working at it. And I think that is one illustration of, if you have a strong local community and you have to invest a lot of time in it and in discovering what it would really need, and you have to find people who are enthusiastic, the caretakers, then well it just keeps on running, then you just have to feed in the correct technical infrastructure and they will take care of it. You sort of help them create rather than create for them. But well, this project that I was sketching, that's the only project that I know of which works this way, completely bottom up. And I have invested an awful lot of time in it. Aalborg FG

RECOMMENDATION 8
Provide funding for a 'champion' after the project has ended to stay engaged with the community to create continuation. Alternatively, find caretakers in communities and support them with funding and time. Let the users 'take-over' and make the process bottom-up with some help.

4.6 Users and Their Data

In the preceding sections, discussion was based directly on the specific focus groups organized in WP3, and concentrated on encouraging multi-disciplinary teams working collaboratively on projects with a more relaxed schedule, allowing for greater consultation as well as the direct involvement of user-facing expertise. Directly related to those discussions, though, is a wealth of relevant observation and comment from different sources which looks not so much design and multi-disciplinarity, but instead at the various facets of user and especially end-user data. In this section, we look at some of these other sources as it relates to and extends the observations and conclusions from the FGs around data, its creation and how it is used.

Web 2.0 has encouraged users to publish content and to comment on other people's content. The role of the passive audience therefore has shifted since the birth of New Media, and an ever-growing number of participatory users are taking advantage of the interactive opportunities on the Internet to create independent content. The active, participatory and creative audience is prevailing today with relatively accessible media, affordable tools and applications, and its culture is in turn affecting mass media corporations and global audiences. All digital media technologies are included, such as question-answer databases, digital video, blogging, podcasting, forums, customer review-sites, social networking, mobile phone photography and wikis. In addition to these technologies, user-generated content may also employ a combination of open source, free software, and flexible licensing or related agreements to further reduce the barriers to collaboration, skill-building and discovery (Wikipedia, 2012).

In order to participate on the Internet people publish a lot of personal data. While the widespread use of social networks and blogs offer new opportunities for interaction and communication they also raise new privacy concerns. There are many potential negative consequences for individuals of online (self-) disclosure (e.g. legal or institutional

disciplinary consequences, rejection from employment, identity theft, etc.). For instance, one-third of employers now use social networking sites to connect to potential recruits.[17] Social networking sites create a central repository of personal information. These archives are persistent and cumulative.[18]

Figure 4: New Information on the Network

(Source: Minton, Brussels SESERV Workshop[19])

Most users do not have their social network profiles set to be fully accessible to the public. This may suggest that to a certain extent users are aware of potential privacy threats online and that many are proactive about taking steps to minimize potential risks. However, not having your profile visible to all Internet users does not mean that all of the information posted on the social network is invisible unless one is part of the friend's network. With Facebook for example, certain information is visible to everyone because it is essential to help people find and connect with people on Facebook. Name and profile picture are visible to everyone so that: 'real world friends can recognize you, and so we can display them when you write on someone's Wall'.[20] Gender is also public and networks are visible to everyone so people can see who else is part of someone's network (and will have access to their information if they accept a friend request). Other information such as hometown and interests, are visible by default to help friends and other people who have things in common to connect with each other, but can be changed by setting different privacy settings. Most users have a certain amount of personal information floating about freely on the Internet - partly posted by themselves on blogs, social

[17] The Guardian (2009) First Class. Recruiters linking in to social network. http://www.guardian.co.uk/money/2009/jun/20/graudate-jobs-news-social-networks/print
[18] Barnes, S. (2006) A privacy paradox: social networking in the United Sates, First Monday 11 (9), July 2006.
[19] http://www.slideshare.net/ictseserv/stephen-minton-tech-transformation-in-the-age-of-uncertainty-seserv-se-workshop-june-2012
[20] http://www.facebook.com/privacy/explanation.php

networks and video or photo sharing sites, and partly posted by others and tagged with their real names (often without having asked for consent). Overall, users are nowadays both active creators of information and passive sources of activity data.[21]

The data shared by users can be split in two categories. First of all, there is the unique identifiable information. In social psychology personally identifiable information (PII) is any piece of information which can potentially be used to uniquely identify, contact, or locate a single person. Although the concept of PII is ancient, it has become much more important as information technology and the Internet have made it easier to collect PII, leading to a profitable market in collecting and reselling PII. Items which might be considered PII include, but are not limited to, a person's: full name (if not common), national identification number, telephone number, street address, email address, etc. Secondly, there is the information which is still quite personal but doesn't give uniquely identifying clues because

RECOMMENDATION 9
Don't let the ease of collecting user data be done to such an extent as to let the user feel under surveillance or under threat (or more simply put off). Also, citizens have a responsibility to careful about what information they share online, and regulators need to educate the public about and enforce data protection laws.

many people share the same information such as gender, race, age, religious views, political views, relationship status, etc. Note that information can still be *private* or *sensitive*, in the sense that a person may not wish for it to become publicly known, without being personally identifiable. Moreover, sometimes multiple pieces of information, none of which are PII, may uniquely identify a person when brought together.

Users also create a digital footprint outside of social network sites, when they for instance search for information, buy products or interact with governmental sites. A study by Krishnamurthy and Wills[22] shows that it is possible for third-parties to link personally identifiable information, which is leaked via social network sites, with user actions both within these social network sites and elsewhere on non-SNS sites. Third party servers are increasingly used to provide content and advertisements for web pages belonging to first-party servers. The authors refer to the ability to link personally identifiable information and combine it with other information as "leakage". Such leakage would imply that third parties would not just know the viewing habits of *some* user, but would be able to associate these viewing habits with a specific person. They point out the two immediate consequences of such leakage: "First, since tracking cookies have been gathered for several years from *non-OSN* sites[23] as well, it is now possible for third-party aggregators to associate identity with those *past* accesses. Second, since users on OSNs will continue to visit OSN *and* non-OSN sites, such actions in the *future* are also liable to be linked with their OSN identity".[24]

[21] Dutton, W.H. and Blank, G. (2011) Next Generation Users: The Internet in Britain 2011. Oxford Internet Institute, University of Oxford.
[22] Krishnamurthy, B. and C.Wills (2010) On the Leakage of Personally Identifiable Information Via Online Social Networks. ACM SIGCOMM Computer Communication Review, Volume 40, Number 1, pp. 112 – 117.
[23] OSN stands for Online Social Network
[24] Krishnamurthy, B. and C.Wills (2010) On the Leakage of Personally Identifiable Information Via Online Social Networks. ACM SIGCOMM Computer Communication Review, Volume 40, Number 1, pp. 112 – 117.

Dozens of companies have sprung up that will prowl into a person's past for as little as a few pounds/euros. These "data broker" or "people search" companies compile personal profiles by using computer tools to mash together public information that, in the past, would have been located in a variety of physical locations. Many brokers also add additional layers of information garnered from public Internet sites like Facebook or from financial service firms. Just as there are increasingly more 'data brokers', there is also an increase in companies who will delete your data for you. This, however, is a far more expensive exercise. This shift illustrates a fundamental change in the economics of privacy: it has become cheap and easy to pry into the lives of others at the same time that protecting our own lives has become time-consuming and expensive. You can ask citizens to rely on a 'pay for privacy' approach, but this doesn't acknowledge the new economic imbalance in which personal data is cheap and anonymity is expensive.[25]

RECOMMENDATION 10
Increase transparency about how data is being used, and make understandable and clear choices available to the public (e.g. simple frameworks more like Creative Commons rather than 10-page legal documents).

For users the digital 'right to be forgotten' is of great importance.[26] The EU wants to pass laws to enforce this right to be forgotten. This means that embarrassing, inaccurate or simply personal data will have to be deleted from the Internet and company databases if consumers ask.[27] The move will mean that social networks such as Facebook or Twitter will have to comply with users' requests to delete everything they have ever published about themselves online. It will also mean that consumers will be able to force companies that hold data about them, such as for Tesco's Clubcard, to remove it.

One example of the importance of more control by users over their personal data is nicely illustrated when we look at the impact of online profiles of potential employees on future employers. When, for instance, students enter the job market after graduation, they will not always have thought carefully about online reputation management when they were still in college. Once they start looking for a position in a company, many of them might have regrets about past posts and comments on blogs or on social network sites. Not only will prospective jobseekers want to self-censor and clean up their own previously posted content, but they will also need to make sure that others have not posted any 'digital dirt'

RECOMMENDATION 11
Create better methods for informing users what their data is worth, and what they are getting in exchange for sharing it (and what the consequences of using services is).

about them. A study commissioned by Microsoft found that 75% of US companies have formal policies in place that require hiring personnel to research job applicants online. In the UK slightly fewer than half of the companies surveyed had implemented similar

[25] Roberts, J.J. (2012) Big Data and the changing economics of privacy. http://paidcontent.org/2012/07/11/big-data-and-the-changing-economics-of-privacy/
[26] Mayer-Schonberger, V. (2009). Delete: The Virtue of Forgetting in the Digital Age. Princeton: Princeton U Press.
[27] Techniques such as 'crowd-blending privacy' have been suggested to increase privacy using technological means. See Gehrke, J., Hay, M., Lui, E. and Pass, R. (2012). Crowd-Blending Privacy. Advances in Cryptology – CRYPTO 2012. Lecture Notes in Computer Science, 2012, Volume 7417/2012, 479-496.

policies.[28] More shockingly, 70% of US employers and 41% of UK employers have rejected potential employees because of information found out about them online. Because employers are increasingly searching the Internet and are tracking social media content to find addditional information about candidates, we see an increased awareness of the importance of online reputation management among users.

Another consequence of these 'right to be forgotten' laws is that businesses will have a duty to inform regulators and anyone affected by data breaches "as soon as possible". Critics of these new European laws have warned that in the case of large scale hacks, informing millions of users that their data is at risk could impose an unreasonable burden on firms, and risks dissuading the development of innovative services. According to EU Justice Commissioner Viviane Reding, however, the "proposals will help build trust in online services because people will be better informed about their rights and more in control of their information".[29]

4.7 Concluding Remarks

The WP3 ran a number of focus groups in connection with two different related events with social scientists which provide a suitable forum for discussion amongst suitably experienced and motivated participants on the one hand about multi-disciplinary collaboration and on the other user-centricity. From these FGs, recommendations centre on ways to establish and promote multi-disciplinary teams, working on loosely scheduled projects geared towards iterative and user-centred development, enabling ongoing improvement and the inclusion of the experience of suitably diverse collaborators.

In addition to the direct FG-based conclusions, however, and concentrating specifically on users and their data, further recommendations became apparent in terms of the concerns end-users have in connection with their data and how such data are used. Irrespective of specific technology projects and those who collaborate on them, the context of Web 2.0 and a trend towards prosumption, it is clear that trust relies on end-users retaining control over the ways their own data is accessed and used.

[28] Microsoft (2010) Online Reputation in a Connected World. Report by Cross-Tab Marketing Services, commissioned by Microsoft. http://www.microsoft.com/privacy/dpd/research.aspx

[29] Warman, M (2012) Digital 'right to be forgotten' will be made EU law. The Telegraph. http://www.telegraph.co.uk/technology/news/9038589/Digital-right-to-be-forgotten-will-be-made-EU-law.html

5 The FI Ecosystem – A Societal Perspective

5.1 Users Have Become Participants and Are Now Central

In the SESERV Oxford Workshop,[30] one of the major themes that emerged from discussion between those building and those studying the Future Internet (FI) was the fact that users are now more than just consumers of services and content: they have become participants in the Internet and in consequence there is a real need for user-centricity in design and discussion. This was taken up again in the SESERV Athens Workshop,[31] where it was acknowledged that user behaviour is causing challenges for operators.[32,33] Even more than that, users are now savvy technology adopters whose opinions are ignored at the operator's peril[34] (see especially the views of the Transit ISP). Finally, at the SESERV Brussels Workshop,[35] it was very clear that technology is now everywhere and regarded as a commodity,[36] not so much a "must-have" but a "so-what's-next" where innovation is very much driven by the users.[37] The transition is very clear and not unknown in the business innovation literature: what starts as a technology push ends up being market demand, if not user drive.[38] Indeed, the notion of a technology-driven *versus* a societally-driven FI was the subject of the first SESERV debate in Oxford.[39]

In all of the SESERV-initiated FISE conversations, from Oxford onwards, discussions have frequently been around the ultimate tussle between an increasingly sophisticated user community and the technologists and operators trying to catch up if not retain control the advantage. Table 2 summarises some of the practicalities.

Against this background of technology push moving to social demand which has come up repeatedly in the SESERV events, there have been clear indications for *technology development*, *societal changes*, the way *business* is handled, and the *regulatory framework* within which the former operate. In this section, we will review each of these areas in light of the discussions of the SESERV-initiated FISE conversations. The important thing for the mid-term review of the Digital Agenda for Europe (DAE)[40] some eight years before the 2020 target date is to focus on the *use* of Internet connectivity by the end-users who are now probably the most significant stakeholders[41] as yet under-represented in the ongoing debates.

[30] http://www.seserv.org/fise-conversation/workshopmemoriesandmediascapes%E2%80%8E
[31] http://www.seserv.org/athens-ws-1
[32] http://ww.seserv.org/athens-ws-1/webcasts#briscoe
[33] http://www.seserv.org/athens-ws-1/webcasts#bornstaedt
[34] http://www.seserv.org/athens-ws-1/focus-groups/fg3-report
[35] http://www.seserv.org/fise-conversation/seservworkshopsocio-economiccertaintiesandchangeforthefutureInternet
[36] www.slideshare.net/ictseserv/stephen-minton-tech-transformation-in-the-age-of-uncertainty-seserv-se-workshop-june-2012
[37] http://www.slideshare.net/ictseserv/javier-salcedo-cloud-computing-seserv-se-workshop-june-2012
[38] *i.a.* Åsterbro & Dahlin http://www.rotman.utoronto.ca/bicpapers/pdf/03-04.pdf
[39] http://www.seserv.org/panel/conferences-webcasts#debate
[40] http://ec.europa.eu/information_society/digital-agenda/index_en.htm
[41] http://www.seserv.org/panel/conferences-webcasts#dewandre

Table 2: Themes, Topics, and Practical Issues Raised During Engagement

THEME	TOPIC RAISED	PRACTICAL ISSUES INVOLVED
Technology push	**Little regulation**	Regulators need to catch up with what goes on in the marketplace: they don't know at the start what does and does not need to be controlled. For example, voice charges were set at whatever level the provider wanted; mobile roaming charges are only now being addressed.
	Fixed network	The infrastructures needed are finite and predictable, in much the same way as POTS (plain old telephony services) were designed, rolled out and maintained.
	Traffic is predictable[42,43]	There are few surprises. The technology was designed with a specific view in mind and is deployed with that in mind. Capacity is predicted in advance with great accuracy and provisioning is well understood.
	Users have to be "educated"	This is effectively the "early adopters" phase. Users have to be encouraged to use the technology, often coaxed to use something that they have done without for years.
Technology adoption	**Illicit behaviours emerge**	Regulators need to observe common practice to decide whether there is a need for control. Behaviours, such as passing on subscriber details without their knowledge, will continue until there are enough complaints to introduce control. At the same time, as services expand, the business model becomes blurred: the transit ISP, for instance, is expected to continue to guarantee QoS without additional payment for resource-hungry content (see the Athens Focus Group (FG) discussions[44],[34]; the "sender pays" proposal[42]; and the illicit traffic shaping in the UK network[45])
	Mobile network	As adoption increased, new ways are sort to expand and grow the market. Most recently (though some decades ago now) the big change for telephony services came with the introduction and subsequent adoption of mobile telephony, which then developed into data services as well.
	Diverse formats	There are now more types of content to deal with: voice, data (text, images, multi-media, etc.). Capacity planning becomes more of a challenge: a dedicated stream for video (i.e. large, time sensitive packets of data) is one thing

[42] www.slideshare.net/ictseserv/falk-von-bornstaedt-networks-perspectives-and-analysis-in-the-future-Internet-seserv-se-workshop-june-2012

[43] There is an interesting discussion in von Bornstaedt's presentation in Brussels (*q.v.*): the network is often configured for a normal load of 30%, which allows for one or two major network failures without too much issue. If they design instead for a 60% load, then this is significantly less expensive, and they can still cater for one major incident. The issue is: over-provisioning at whatever level only "works" if traffic volumes remain at fairly constant levels. As soon as they become less predictable, the extra capacity is soon used up; similarly, if traffic volumes increase over time, then capacity must increase constantly to maintain the over-provisioning target.

[44] http://www.seserv.org/athens-ws-1/focus-groups/fg1-report

[45] http://www.seserv.org/athens-ws-1/focus-groups/fg3-report

		and easily managed; the effect of mixing smaller packets in with that stream (e.g. tweets and text messages) degrades performance rapidly and significantly[46]
	Technology becomes mainstream	As the users see the benefits for the early adopters, they too buy into the technology. In some cases, like the Internet and mobile telephony and data services, they will become almost a must (e.g., visa application online).
User driven	**Regulated**	There is an attempt to protect and control activities; such as the release of subscriber information in social network sites (SNS); attempts to copyright legislation[47].
	"Smart"	As fixed POTS led to first mobile voice and then data services, so sensors have led to the Internet of Things (IoT) and the congruence of mobile telephony and sensor data[48]. There is almost an expectation now that my mobile device does not only allow me to make calls, send text and multi-media messages, but also first connect to the Internet, and more significantly control my environment[49]
	Heterogeneity of format	Formats are heterogeneous and therefore highly unpredictable. It now becomes increasingly challenging to handle the demands of the traffic across the network: it's not necessarily possible to predict what traffic will be transmitted and when. This effects over-provisioning[50], and forces operators to enter into new business agreements to maintain Quality of Service (QoS)[33,34,42].
	Users take control[37]	*Users take control*[37]: An obvious example is SNS used beyond the confines of keeping up with friends and family: the Arab Spring[51] and London Riots[52] show the power of online and *ad hoc* communities. What is effectively happening now is that users expect the same Quality of Experience (QoE) for whatever they do 24/7; and they will decide what they do with the technology. The providers and operators now need to address QoE and not just QoS.

[46] One reason, perhaps, for Briscoe to propose charging for the contribution to traffic congestion any transaction makes, rather than raw byte size of what is to be carried.
[47] Italian providers are responsible for the content which they provide access to irrespective of where it is sourced; off-shoring of pornography services, even the forerunner *Radio Caroline* broadcasting from beyond UK waters.
[48] Cf http://www.larces.uece.br/~celestino/RSSF%20I/Wireless%20Sensor%20Networks%20a%20Survey.pdf
[49] Cf the current British Gas advertising campaign; Augmented Reality services for tourism etc.
[50] Cf von Bornstaedt's remarks in Athens (*q.v.*) relating to network outage in Taiwan.
[51] http://www.guardian.co.uk/technology/2011/jul/07/telecomix-arab-spring
[52] http://www.dailymail.co.uk/news/article-2022670/The-gangsta-gunman-death-sparked-riots.html

5.2 Evolution of the Socio-Technical Network

5.2.1 Technology Evolution

An Internet based on access from anywhere to anywhere, with point-to-point as well as one to many connections between individuals, between individuals and machines (automated services) and machine to machine is already extremely powerful. But the technology has moved on significantly. Von Bornstaedt points out[42,33] that the fixed and the wireless networks have already converged: access is not just from a desktop or individual machine with its own storage and so forth, but now is equally available from any number of mobile devices. People surf the web and access online services from their mobile phones and devices. That's not all. As we move forwards, Minton states that there are more non-desktop-type devices attached to the converged network than PCs.[36] Furthermore, the number of sensors available to provide information continues to soar[36]: there are effectively more such devices than anything else. Even when connection is made by a device owned and directed by a human rather than a sensor, there is no longer the expectation that long-term storage and processing capacity should necessarily be on the device itself. Salcedo claims that private, personal and public clouds have become endemic;[37] more than that, though, their use is expected and transparent to the user in many cases, who demands ever quick time-to-market for the services. This converged network is serviced by *appstore*-like software packages (Minton, *op cit*), and innovation is very much in the hands of users across all demographic groups (Salcedo, *op cit*). The advent of tablets is also beginning to shape network usage,[42] as end-users exploit the freedom offered to surf and consume content whenever and wherever they like.[53]

At the same time, there is one usage area which seems to set the standard for technology expectation: gaming.[34,42,54] From a purely technology perspective, and notwithstanding any cultural or business implications (see below), gaming provides ever-increasingly realistically rendered virtual reality within more and more "plot" or scenario complexity. Many gamers use not the dedicated devices that were originally deployed and independently of the Internet, but are instead online with geographically distributed community members co-experiencing the same high quality rendering. Quality of Experience (QoE) is paramount, and the gamer expects this whatever the Quality of Service (QoS) levels are agreed with whatever networks service their needs. But the same quality is the *de facto* standard elsewhere. Gaming is possible on phones, along with video and other multi-media services. Despite form factor, QoE is still the main priority. The technology that made high-quality gaming possible on dedicated devices is expected

RECOMMENDATION 12
Understanding the *forms* and *uses* of data is often more important than just understanding the size or structure of the data itself. The static aspects of data management (storage and search/retrieval) are relatively easy to manage; the dynamic aspects (data transmission to support particular real or perceived Quality of Experience) are where the real problems lie.

[53] Hence the term: *bed-surfing*.
[54] The final WP2 focus group took place at the FIA in Aalborg, May 2012. It is reported in the SESERV D2.2 deliverable (http://www.seserv.org/publications under "Deliverables").

across the converged fixed-line and mobile network. It's not just gaming, though, that makes obvious this QoS to QoE progression. Any online activity is expected to provide the highest levels of QoE to end-users for their acceptance.

The technology then has progressed from curiosity (being able to be reached by phone and message on the move) to a user-demand-driven commodity providing high quality experiences anywhere and everywhere. The data generated and consumed are no longer predictable voice or text packets which can be statically modelled. Instead there is a whole range of different forms from simple character strings delivered on a best-can-do basis through to multi-media interactive content to be delivered to the highest QoE demands. The technologists have to cater for such dynamically heterogeneous content, driven by the expectations they created with the end-users who care little about the technology, more about the speed of service delivery and QoE. The data they produce and consume range in size and complexity from simple text-based messages right through to annotated video. Each of these *forms* imposes different constraints and are used in different ways and contexts. Mixing forms is common, such as when end-users comment on the video content that others like them have created; but at the same time, Internet-based services, such as health and education, are similarly dependent on a mix of forms. Irrespective of some inherent value associated with the data or what it is used for, the technology must cater for them all to the same level of QoE.

5.2.2 Social Evolution

As the emphasis has moved away from the technology itself, it's important to broaden out the examination of what end-users, or society, are doing with the technology they, in the developed West at least, take for granted. The Digital Agenda focuses on commerce, participation in government and providing access to the cultural heritage of mankind, but actual activity where possible tends to be around social networks (SNS)[55], including commercial,[56] and political engagement,[57] whether regarded as worthwhile[51] or nefarious.[52] It is clear though that such value judgements are dangerous and largely irrelevant. The world of memes[58] is regarded as trivial and symptomatic of cultural "dumbing-down",[59] and yet provokes a lot of download traffic;[60] and *tweets* are no better.[61,62] Social networking is a significant force and challenge for the Internet in terms of traffic, privacy and even death.

There's more to online activity though than SNS membership. The first SESERV Oxford workshop discussed at some length the issue of online identity as well the need for user-participation in all aspects of online communities[63] among other pertinent topics. Identity is not static and there is some motivation to regard our virtual ("online") and real-world (our

[55] http://blog.insites.eu/2011/09/14/347-million-europeans-use-social-networks-results-of-a-global-social-media-study/
[56] http://www.sociosproject.eu/
[57] http://www.scribd.com/doc/55260687/Legislative-Tensions-In-Participation-And-Privacy
[58] A "meme" as coined by Dawkins based the conflation of *gene* and *mimema* (the Greek for "something imitated") is supposed to be a single, autonomous cultural entity capable of replication and onward transmission.
[59] http://www.weeklystandard.com/articles/meme-generation_645912.html
[60] Labash *op cit* claims 100 Million downloads and counting for only three YouTube memes gone viral.
[61] http://www.jeffbullas.com/2011/09/21/11-new-twitter-facts-figures-and-growth-statistics-plus-infographic/
[62] The claim (*loc cit*) is that only 4% of all tweets are actual "news" the rest is what sociolinguistics have called "phatic conversation" for many years: nearly 40% is "pointless babble" and a further 35% "conversational".
[63] https://46b90981-a-62cb3a1a-s-sites.googlegroups.com/site/seservtest1/panel/Cross-thematictrendsofbreakoutsessions.pdf

"legal") identities as converging.[64] One special community, where virtual identities abound, is gaming, as discussed above. As an activity, it imposes specific and very real challenges for operators working independently or in collaboration with other providers.[34,54,42] But it represents much more than this. A significant result of the gamers' demands for ever more realistic rendering in their games and the growth of their online communities participating in a distributed and shared activity seems to offer real social benefit: the Serious Games research activities are providing a valuable service of social benefit in training and crisis management which protects the end-user participants from the immediate dangers of disaster scenarios, yet ensures an effective immersive experience.[65] What may have been seen originally as a niche activity of little cultural or social significance has led to important developments both commercially[42] and socially,[65] provoking the network debates[31,54,66] maybe not in isolation, but certainly as an end-user activity with broader implications.

Finally, perhaps one of the most significant online activities today is entertainment, the consumption of broadcast material on-demand[42]. As providers such as *LoveFilm* and *NetFlix*, along with traditional broadcasters with the advent of services such as the BBC's *iPlayer*, have succeeded in taking high-quality video content to consumers, and at the same time the upsurge in the capabilities of mobile devices such as tablets began to take effect, then consumers have begun to expect to be able to access these materials online at their own convenience, with the same (or almost) the QoE traditionally provided by broadcast media. Broadcasters have responded with reality television and more sports coverage which almost by definition can best be consumed as it happens. Nonetheless, services such as *NetFlix* demand a significant proportion of network bandwidth;[42,33,67] and more than that, at times when the user decides, not the service provider.[33,53]

User activity is predicated on high expectations of QoE. Activities may be overtly social (SNS), though even there can be commercial or politically oriented, for leisure (gaming and entertainment such as video and broadcast on-demand), and even culturally suspect (blogs, tweets, meme culture). Whatever these activities are, it is clear that users take the lead in what the service providers need to support and generate. Whether we consider online identity, communities, commerce, political life, or entertainment and leisure, the users must be involved and treated as equal stakeholders. End-users are legitimate participants, not just recipients, in the online value chain[68] and should be treated as such. What they do affects all aspects of the FI: privacy[63], trust[69], community building[63], irrespective of inherent value[59,61].

RECOMMENDATION 13
Look at what users actually do, how they interact and what they expect. Users need to be included, not only as significant FI stakeholders, but also because without user-involvement, there can be no empirics and therefore no science.

[64] Panel session at the Brussels workshop http://www.seserv.org/fise-conversation/seservworkshopsocio-economiccertaintiesandchangeforthefutureInternet
[65] www.slideshare.net/ictseserv/sara-de-freitas-the-gamification-of-everyday-life-seserv-se-workshop-june-2012
[66] www.slideshare.net/ictseserv/vesa-terava-net-neutrality-in-europe-seserv-se-workshop-june-2012
[67] http://www.washingtonpost.com/business/economy/video-viewing-on-netflix-accounts-for-up-to-30-percent-of-online-traffic/2011/05/17/AFNWg55G_story.html
[68] www.slideshare.net/ictseserv/alessandro-bogliolo-workshop-introduction-seserv-se-workshop-june-2012
[69] www.slideshare.net/ictseserv/alan-hartman-trust-measurement-and-management-seserv-se-workshop-june-2012

5.2.3 Business Evolution

The original concept, or dream, was that the Internet should be free to all and for the benefit of all. Over time, it has become accepted that users (subscribers) should pay for connection, and then to the carrier as well as the service provider (the transit ISP and the edge ISP, effectively). On top of that, though, there may also be a charge on the basis of pay per use: subscription charges to specific service (content) providers, as well as an additional premium for bandwidth usage above and beyond the basic package the subscriber has requested. Over time, it seems to have become a necessity to manage traffic,[70] though in turn this has led to perhaps unfortunate legislative and regulatory intervention in an attempt to maintain parity of service.[71] A significant problem, of course, is that the carrier network may not receive appropriate payment for the transmission of content[32,33,34] or indeed to justify future investment.[42] There are at least two approaches: the first, treat all traffic the same; the second, allow priority of transmission to be set (either by financial incentive or on the basis of content).[72]

There is a fundamental problem here: just like adding lanes to motorways in an attempt to relieve traffic congestion, the networks cannot simply continue to expand *ad infinitum.*[32,33,42] There is also a question about making the business case or getting it approved even for the projected capacity requirements.[42] The pragmatic solution, probably the "illicit behaviour" in the introductory table, is to shape the traffic[70] as best suits the carrier. But there is a problem with this: why should the carrier decide on who gets the better QoS? (There's also the question of *how* they decide which is dealt with below.) This led to a suggestion that net neutrality – where all traffic is dealt with on an equal footing – was the way to go.[66,73] Unfortunately, this does not encourage the carrier,[74] nor provide the necessary capital for investment.[34,33,42]

The alternative is preferential treatment, here on financial grounds. Using the model of the traditional postal system, the sender pays[33] for the traffic they release into the network. It may not be clear whether this should simply be on the basis of the volume of traffic, or its effect on network congestion[32]. This may lead to conflict though: content providers and even retailers would then have to reimburse providers for the traffic that end-users pull from them,[44,34] perhaps leading to the radical approach of them building their own content delivery networks (CDNs).[34,75] Additionally, Wyatt argues strongly against this approach as an economic fix to a more serious and pervasive problem.[39] Perhaps another, "free market" approach would be to charge on the basis of packet type: the "golden packet", backed up by premium rate, would get preferential treatment through the network.[42] This may not necessarily solve the problem though. If enough end-users based on a drive for QoE pay the premium, then all or most packets will turn "golden" and the network once again will be swamped with data to transmit unless prices can be adjusted.

Net neutrality seems worthwhile at first sight. But it may not always provide the benefits the user envisages.[74] From a business perspective though, the bigger issue is that while the end-user drives traffic across the network with the consumption of content as outlined

[70] http://www.seserv.org/athens-ws-1/webcasts#cooper
[71] www.slideshare.net/ictseserv/vesa-terava-net-neutrality-in-europe-seserv-se-workshop-june-2012
[72] A third possibility, discussed by von Bornstaedt in Brussels (*op cit*) would have any technology provider whose technology contributes to congestion should pay. He cites the example of Samsung in South Korea.
[73] http://www.seserv.org/athens-ws-1/webcasts#mason
[74] http://www.thecommentator.com/article/319/leading_dutch_telecom_raises_rates_after_net_neutrality_enforcement
[75] http://www.seserv.org/athens-ws-1/focus-groups/fg2-report

RECOMMENDATION 14

There need to be transparent technologies and new business models to ensure all stakeholders in the network are treated fairly in the context of user expectation that the technology is transparent and QoE is the most important factor.

above and other activities social, commercial and political, the network operators (the Internet Service Providers or ISPs) need to be treated fairly in order to be able to maintain and make the necessary capital investments. Sender pays or golden packets may not be the solution to balance the need for investments in new infrastructures (possibly based on premium services) while continuing to upgrade the existing 'Best-Effort' Internet appropriately to support continued social and economic growth.

5.2.4 Regulatory Evolution

The final area in this section is the responses of the regulatory bodies to the *status quo*. The DAE seeks to ensure access-to-all across high-speed networks, and smooth the path to cross-border business and the management of copyrighted materials. There should be no prejudice for those connected,[66] and perhaps worryingly, the EU seeks to influence the adoption of the right to connect to those it chooses.[76] But perhaps there is more to it than this. There is some concern that regulatory intervention may be missing the mark. The issue behind net neutrality and the unfortunate knock-on effects for the user were discussed above.[74] In addition though, the EC setting targets on coverage may in fact not be having the desired effect: artificial targets for coverage do not necessarily correspond to take up; more importantly, attainment of one target may easily lead to an even greater digital divide.[68]

Are there cases though were preferential packet transmission may be the right thing to do. Wyatt argues against charging on the basis of the source of the data, but allows that the *type* of data is a different matter.[39] Von Bornstaedt[42] cites the example of a problem scenario where due to damage in the network (cables were snagged by shipping), financial services effectively stopped in Taiwan. Should, he argues, credit card transactions be given priority over entertainment and leisure (video download and on-demand broadcast)? An implicit "golden packet" mechanism seems justified. Despite its failings (see above), at least this makes money available to the carrier to manage the traffic appropriately. On the other hand, though, both he and Terväsä mention a second possibility: perhaps socially important content (medical or law-and-order exchanges[77]) should by definition be treated as a priority[42,71]: but who decides *when* to track packet type, and *how* do you decide[78]? Furthermore, how do we square this with privacy and data protection? Do I really want the operator to have access to my medical details? And what is to stop them selling the data to, say, insurance companies? There is clearly a need for careful legislation and regulation. But as was highlighted in Oxford,[79] surely in these

[76] www.slideshare.net/ictseserv/andrea-glorioso-no-disconnect-strategy-seserv-se-workshop-june-2012

[77] This is already a theoretical possibility in the West in times of National Emergency.

[78] There is an obvious difference in terms of priority between a text message containing important medical detail (such as blood group) and standard tweets (containing performance grades); or a video of one of the many medical broadcasts and actual diagnostic information from a paramedical team. But how do you know?

[79] In the session on *Privacy*: https://46b90981-a-62cb3a1a-s-sites.googlegroups.com/site/seservtest1/panel/Cross-thematictrendsofbreakoutsessions.pdf?attachauth=ANoY7cqhWWXg8-WBNX6aQRh3PvyKY1IvYNS8KMWAWH2SwIBK3g9eZf-v6Vm6ptxEAP0RK_AqdFTRC4U9yC0SPaC5IfS_7SaHtziE1WqieMCjlcPx7P5jVwqFw5QIaRk5k_CKzn_wMYdreiJwsp7

scenarios it is vital to engage directly with the end-users. As with the case of medical systems, it is the end-user who is in the best position to decide on the risk and value to disclosure: to deal with their own levels of trust.[69]

An area that the DAE needs to tackle as a matter of urgency is interoperability and the associated data privacy issues of cross-jurisdiction operation.[80] Salcedo claims that clouds are now pervasive as a commodity technology driven by the needs of the end-users,[37] an assertion to some degree borne out by Minton's statistical overview.[36] Once more, though, it is the end-users who really need to set the tone. Their demands of the technology and the commodity approach to it suggests they are already embracing it for what it is. Just as *facebook* had to catch up with privacy and security settings when subscribers discovered that intimate and personal information could be accessed by all, so the regulators need to catch up with real cloud importance and usage.

The net neutrality debate and its unfortunate results in the marketplace suggest that legislation and regulation may not best be handled by government and NGA in isolation. As throughout this section, it is apparent that end-users and how they engage with the technology should be paramount: this is the basis on which priority areas (cross-jurisdiction cloud operation) emerge and influence approaches (e.g. non-neutral treatment of end-user determined content on the basis of benefit to them) towards appropriate control and management.

RECOMMENDATION 15
QoE not QoS is what matters; privacy and trust are concepts that end-users are better qualified to determine. Look at what users actually want and the form of the data they use, not the content of the data itself. It's user experience that matters, not what technology is used to deliver what data.

5.2.5 Remarks on the Socio-technical Network

The Internet and related services and environments (the wireless network, the IoT, and so forth) are now regarded as commodity: our lives run with them, and are seriously compromised if disruption occurs.[81] However, against the discussions about how the operators, and especially the networks, should protect their own interests,[82] there is a danger that a significant point is missed: what the end-users expect from the services they consume, the content they use as well as generate, and their demands for involvement are creating the real requirements for the FI. It is right for the DAE to look to ensure connection for all, appropriate trust and security measures as well as skills for inclusion. However, the goal is no longer the continued turning of the *virtuous cycle,*[83] based on commercial activity driving investment; instead, it is to take whatever measures are needed to maintain and expand the technology in support of and in response to user requirements and behaviour. This is not as anarchic as it may seem. Against the backdrop of a cautious note on the DAE targets for bandwidth penetration,[134] and the realisation that increased

sWOthTP9ApPb0NspnApnlmVFUymV49OtLs6x8bjdDHD_nr3D6-wKQTeYaw1URzG8RXGd2BdlyMEuzP3JC8FlVlw7WHF0m8V4UsMWZ7vnSXNuYsBKot2QLGdaI&attredirects=0

[80] See http://www.internet-science.eu/blogs/27-07-2012/323

[81] Cf von Bornstaedt's discussion of capable breaks in the Mediterranean and Taiwan; and Mubarak's attempts to restrict access http://www.thefastertimes.com/mediaandtech/2011/01/29/egypt-the-Internet-and-the-human-right-to-connect/

[82] http://www.seserv.org/athens-ws-1/focus-groups

[83] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2010:0245:FIN:EN:PDF p.4

capacity is indeed not necessarily the answer[33,9], there is still a need for investment in technology. The issue now is exactly what investments are actually needed and where. As gaps between what the technology provides and what users need are identified, it is up to the policy makers to help all providers without prejudice understand what the users really need. Policy makers, technologists and users should all work together in the multidisciplinary teams suggested above (see Sections 4.1, 4.2, 4.3 and 4.4) to move forward and refocus the virtuous cycle for the FI.

6 The Future Internet Connecting to Broader Society

6.1 Centrality of the Internet to Society

In the West at least, the Internet has become an essential part of the infrastructure of the modern world. To engage economically, socially, and politically is increasingly linked to the ability to be online and to engage with civic institutions and with one's fellow citizens. The challenge, then, for those building the future form of this essential piece of infrastructure is to find ways to support fundamental human values while expanding economic, social and political opportunities for all. Some of the debate of how to implement policies to support this is taking place in the Digital Agenda programme, which will be discussed below (see Section 6.2, p. 60), and in the new Horizon 2020 funding initiative, which will also be touched on.

6.1.1 Balancing Power

The FI ecosystem brings together the interested parties for any FI discussion. The challenge as we move forward is how to continue to engage those stakeholders on appropriate topics and understand the relationships between them.

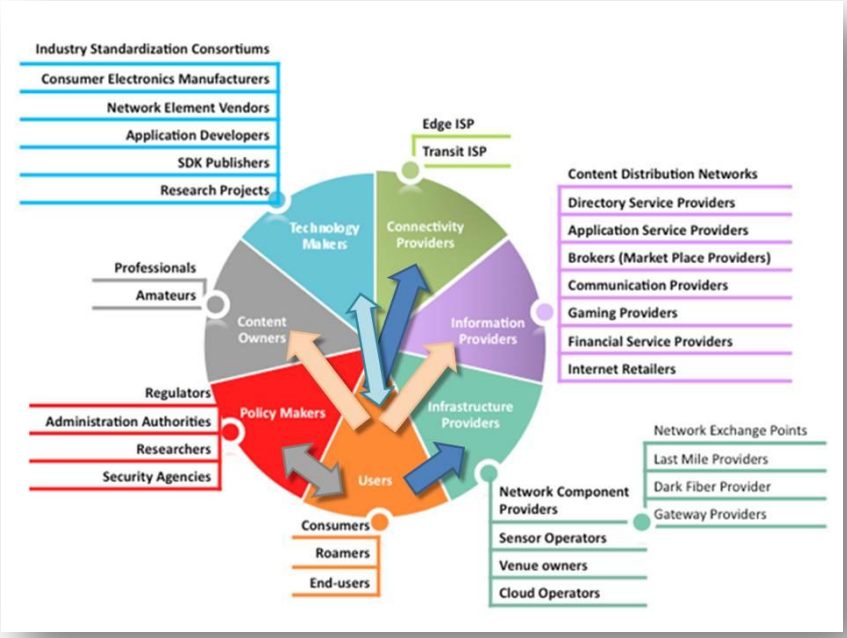

Figure 5: Interactions Between Users and Other Groups in the FI Ecosystem

Repeatedly in the SESERV Oxford workshop, the point was made that discussion and design should always involve the users: those groups exploiting the potential of technology advances. At the SESERV Athens workshop, the importance of user perceptions in terms of QoE and not just QoS was underlined;[31,35] and in Brussels at the third SESERV workshop, the point was made that innovation is now user driven.[84] Underlying such assertions is the expectation that technology has something to offer; that users will adopt the technologies and explore them; that in so doing, usage exposes new areas (opportunities) that may be developed, whilst highlighting challenges (risks) which need to be thought about and addressed. The flow of offering to adoption to exposing challenges and new potentials is supported by the various ecosystem stakeholders (see Figure 6 and Figure 7 below). In these figures, the outgoing arrows represent FI technology reach (i.e. more technology is becoming available and affecting a variety of areas as a result). The folded arrows coming back over the edge represent the requirements and demands from those areas on the technology (i.e. once the technology is adopted, users and usage rates start to drive matters). This is also reflected in Table 2 with detailed descriptions).

Users relate to the FI ecosystem stakeholders in various ways (Figure 5, which is based on the proposed ecosystem developed in WP2). With *policymakers*, for example, users may have an expectation that their interests and rights will be protected under the auspices of the policies and guidelines set out by the former. Often it is assumed that they should be dealing with the risks associated with technology use. With *connectivity and infrastructure providers*, the assumption is that they will provide the environment which allows the users to engage and exploit the services and applications that *information providers and content owners* supply. Defining all of this, to some extent, is what the *technology makers* deliver. Users expect perhaps to be able to provide requirements to the technologists and expect them to deliver technology which satisfies those requirements, as well as enables other activities as yet not considered.

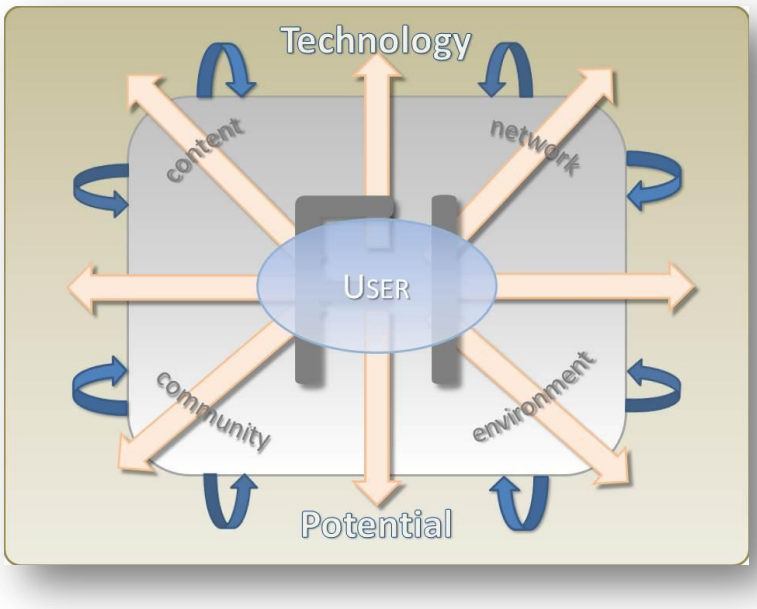

Figure 6: Users at the Centre of Technology Opportunity and Potential

[84] www.slideshare.net/ictseserv/javier-salcedo-cloud-computing-seserv-se-workshop-june-2012

Figure 6 provides a schematic view of the FI: with the technology itself – the future internet – and technology users interlinked: it is no longer clear whether it is the technology or the users driving innovation.[86,135] The technology produced though permeates all aspects of our life (outward spreading arrows):

- The *Network* itself, the infrastructures which enable participation, remote and distributed connectivity (Section 6.1.2.1);
- Content (Section 6.1.2.2) is generated, accessible and shared, from the digitised cultural heritage of Europe as part of the DAE to the prosumption of inherently questionable video clips and podcasts;
- Communities (Section 6.1.2.3) can develop, from social networks to self-help groups and experts; and finally
- The *Environment* (Section 6.1.2.46.1.2.2): users and end-users can co-operate to monitor and report on their immediate environment as well as receive information about it; at the same time, increased ICT penetration imposes greater demands on the environment unless this is specifically called out and recognised as an issue;

But as the technology extends into these different areas, so users will adopt and adapt it, using technology in ways that were not previously envisaged or designed for. It is now the users and end-users who begin to demand different, specialised and more function (the returning blue arrows in the figure). This ebb and flow of new requirements and technology features characterises the Internet now and is likely to shift towards user pull for the FI (see Table 2).

In the debate between those who develop and those who study the FI, reviewing more closely the contribution and expectations of users will be an important step: user-centricity has been raised across the socio-economic debate presented by SESERV, and was ranked one of the most significant themes in the online survey SESERV did with the community of technologists and experts. Similarly, the societal themes arising out of all three SESERV workshops, the focus groups, and both surveys all have an end-user perspective which deserves further investigation. In this section, therefore, we will consider the user in relation to the *network* (how does the underlying infrastructure affect user opportunities and what are the associated challenges), *content* (how does prosumer activity affect the FI), *community* (what do online communities bring to the FI debate) and the *environment* (how do FI activities depend on and affect the environmental setting).

6.1.2 Taking a User-centric Approach

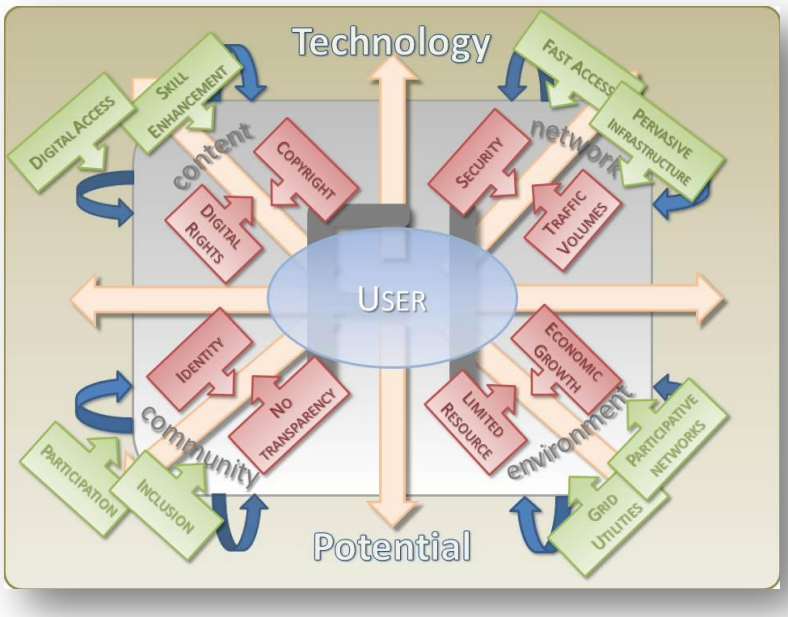

Figure 7: Opportunities and Risks Associated with Technology Exploitation

Previously (see Figure 6), it was stated that as users engage with what technology offers, so they exploit it in various ways as they see fit during adoption.[65,85,86] This will often highlight new areas for development (opportunities, represented by green boxes returning with the flow of user and end-user requirements and extensions during technology adoption in Figure 7) whilst exposing challenges (risks, shown as red boxes in Figure 7, constraining the outward spread and adoption of technology) which need to be addressed. In the sections below, each of the four areas – network, content, community and the environment – are considered in regard to the risks and opportunities associated with them and any significant factors for the FI. Summarising, the main challenges and opportunities may be expressed as follows:

[85] www.slideshare.net/ictseserv/javier-salcedo-cloud-computing-seserv-se-workshop-june-2012
[86] http://www.seserv.org/panel/conferences-webcasts#debate

Table 3: Challenges and Opportunities for the Future Internet

	CHALLENGES	OPPORTUNITIES
NETWORK	***Security*** We need to consider whether there are enough risk and security experts available to be able to model and manage the risks of online attacks. In addition, even if all attacks could be monitored, we need to know whether there are enough people to monitor and control the attacks. ***Traffic volumes*** It is clear that continued growth in capacity is not sustainable. There is now a need to be able to optimise resource usage by whatever means rather than just plan for more and more capacity.	***Fast and universal access*** The promise is that we will all have the right to access any and all services irrespective of where or who we are.[87] This offers tremendous opportunities to all sections of society to become truly digital. ***Pervasive infrastructure*** With the advent of smart cities, providing sensor infrastructures in support of any number of different societally beneficial services and applications, coupled with the advent of 4G, as well as ever-increasing capabilities in mobile devices, dynamically configured networks will allow for significant flexibility in support of *ad hoc* and dynamic services on demand and for all.
CONTENT	***Digital Rights*** Who owns content? The originator or the carrier/supplier? How should it be controlled, if it can at all? These are major issues which could potentially curtail the increasing flow of online content. ***Copyright*** From the outset, the Internet has posed problems for copyright and its control. With freely available information sourced from any location, efforts such as the Digital Agenda pillar 1[89] are fighting an ever-increasing battle.	***Digital Access*** The *Europeana* project,[88] supported by the Commission, promises to allow access for all to our cultural heritage. This kind of approach, coupled with *open data* trends, should benefit the community in opening up significant stores of knowledge to all. ***Skill Enhancement*** Through online activity, users will become more aware of security and privacy issues, as well as be able to engage in more and more online activities.
USER COMMUNITY	***Lack of transparency*** The introduction of marketing and other commercially-based activities into SNS's may well have a significant impact on members of those communities who may become suspicious of how information they provide or interactions they engage in are used for purposes other than those original intended. ***Identity*** Identity management mechanisms that are able to balance privacy concerns with persistent digital identities across platforms and borders are needed to increase usability and portability of digital information linked to particular identities.	***Inclusion*** Online communities offer a context for people of similar interests and backgrounds to engage with one another. As such, it can encourage all sectors of society to engage, ensuring that even those from marginal groups can find a voice online. ***Participation*** The benefits of online engagement include growing skill levels through experience, rather than separate and explicit instruction. This has the advantage that users are then better able to make informed and appropriate decisions on matters of privacy and trust.

[87] http://www.seserv.org/panel/conferences-webcasts#dutton
[88] http://www.europeana.eu/portal/

	CHALLENGES	OPPORTUNITIES
ENVIRONMENT	***Limited resources*** Predictions of massive increases in ICT utilisation will inevitably lead to significant depletion of dwindling resources in terms of energy and the environment. This needs to be addressed if the FI is to be able to fulfil the promised central role for the future. ***Economic growth*** Current trends and strategies are driven by a belief that continued economic growth is required and desirable for the future. This mind-set may need to be challenged to provide a sustainable future for ICT.	***Grid-based utilities*** There is some potential for sharing energy not only in terms of solar power sourced electricity being fed into the national grid, but in managing the effective sharing and distribution of unused energy from one user to another. ***Participative networks*** Sharing of this type (ie energy grids) leads on to a whole range of other activities and behaviours where participation by end-users is encouraged not externally, but internally: the users themselves share information and data from their own experience to benefit others who may use that information in a novel and beneficial way.

6.1.2.1 Users and the Network

Table 4: Users and the Network

Significant factors	• Networks cannot keep pace with current and projected traffic • Advent of 4G networks • Commitment to access for all (DA: inclusion)
Socio-economic challenges	Provide access for all in an environment of limited if not decreasing resource.
User risks	• Security • Traffic volumes
User opportunities	• Fast and ubiquitous access • Pervasive infrastructures • Collaborative access • Personalized (IoT-level) access

The Digital Agenda includes specific action items focused on increasing network reach as well as speed and capacity to all.[89] But as the SESERV Athens Workshop demonstrated,[90] it is not enough to assume that adding more and more resources will provide an appropriate answer for all service requirements; continuing to add bandwidth, for instance, may not even be sustainable. At the same time, what capacity is available is being rapidly consumed for entertainment,[161] user-driven innovation,[84] and sensors as well as mobile devices.[136]

Consider first the various market failures around the Internet. Trying to identify potential problems and indeed resolve them on the basis of monitoring traffic volumes is bound to failure: the byte itself is not the appropriate metric. Instead, it is maintained,[91] bytes should

[89] http://ec.europa.eu/information_society/digital-agenda/index_en.htm; see in particular Pillar 4, as well as Pillars 6 and 7.
[90] http://www.seserv.org/fise-conversation/Outcome-of-the-SESERV-workshop-on-the-interplay-of-economics-and-technology
[91] Bob Briscoe in the first keynote presentation at the SESERV Athens Workshop *q.v.*

be weighted in accordance to the contribution the traffic they represent makes to overall congestion: it is not the volume *per se* that needs monitoring and pricing, it is the effect that volume has on overall use.

Notwithstanding what metrics to use, there are other things which need to be taken into account as we move forward. Although users seem to want to double their bandwidth requirements every two years without increasing their bills, irrespective of who ultimately pays, increasing network capacity is not the solution. We need look no further than congestion on the roads: add another lane to a motorway and this does not necessarily ease the traffic. Perhaps instead, we need to consider different pricing models. For example, and in line with what the postal services do, the *sender* – the person or party who *adds* to the network payload – should cover the cost of its transmission through the network. Similarly, it is suggested that it should be the sending party network that pays if end-to-end QoS is to be assured.[92]

In practice, this would mean content providers, in the broadest sense including for instance retailers, would pay to have their content transported to the consumer. The ultimate consequences of such a model will significantly affect the move towards more prosumer-type activity (see Section 6.1.2.2 below). The benefits though could, it is argued, help optimise network utilisation. At the same time, some of the more resource hungry applications, such as gaming (cf Athens FG[34]), is becoming mainstream because of other, societally beneficial reasons.[65]

Perhaps an easier approach to direct intervention around business models and pricing would be to let the "market decide": competition, after all, might force providers to price appropriately for QoS guaranteeing those who pay for it more effective transmission across the network than the best-effort provided to those unwilling to pay. It turns out[93] for the UK at least traditional competition mechanisms, such as price, do nothing for overall QoS. Nearly all providers employ traffic shaping to manage throughput almost despite, it feels, their users' expectation to use bandwidth at the times most convenient to them. Regulation has little effect, it is asserted: it's only subjective observation by the end-users themselves that helps identify the effects of shaping, such as poor performance at busy times during the day.

The challenges for the network in catering for projected volumes are significant: increasing capacity will not work and instead optimisation of limited resources seems the way to go. The situation, however, is set to get worse. The advent of 4G networks promises much for connectivity and therefore bringing impressive QoS to all with suitably equipped access devices. There is already an issue though: 4G connection assumes 100 Mbps bandwidth capabilities.[94] Remember in this context that the Digital Agenda for Europe has a target of only 50% at or above 100 Mbps by 2020 (100% should have at or above 30 Mbps in the same timeframe).

If there is no or little increase in network capacity, then we are back to the optimisation of network utilisation. Perhaps one way is to think of the context-aware technologies and approaches. Cognitive radio,[95] for instance, is capable of modifying its behaviour in

[92] *Loc cit* Falk von Bornstaedt
[93] *Loc cit* Alessa Cooper
[94] http://www.slideshare.net/kuncoro/4g-mobile-network-applications Slide 7
[95] *Op cit* Slide 23

accordance with knowledge about its operational environment. And context awareness[96] for mobile applications is already able to respond to issues such as low battery power. Applications and services may therefore be able to go beyond context in the location-based services sense to embrace operational factors, offloading or delaying high cost function when there is network contention.

Pricing based on contribution to congestion, making the producer (the sender) pay and using traffic shaping approaches may all have their part to play in maintaining Internet utility into the FI. The applications themselves, however, must take some responsibility too and become "smarter" in how they use the resource allocated to them.

6.1.2.2 Users and Content

Table 5: Users and Content

Significant factors	• Move from consumer to prosumer activities with content • Growth of traffic • Increased developed of IoT and Cloud infrastructures
Socio-economic challenges	Maintenance of net neutrality in the face of increasing demand
User risks	• Digital rights including copyright
User opportunities	• Skill enhancement • Access for all

In light of a continued focus on the Digital Agenda for Europe,[97] despite some discouraging views for technology providers,[98] it is now time to revisit the *virtuous cycle* that was championed as a way forward in enabling continued European ICT growth. In a nutshell, the assertion behind the *virtuous cycle* is this: consumption drives investment in infrastructure which leads to increased performance and capacity. In consequence, European growth is sustained indefinitely. Obstacles to such growth were recognised at the time: on the one hand, the need for investment in infrastructure to improve performance and provide access to all; on the other, the more societally focused issues of trust, inclusion, digital rights and digital skill. Improvements in the underlying technologies are needed therefore, as well as in the way end-users (citizens) engage and become comfortable with exploiting what is available.

From the three SESERV workshops and focus groups, it was apparent that technology providers as well as social scientists remain concerned about the support required for online collaboration. Privacy and trust have long been recognised as concerns: what SESERV participants showed, however, was that individuals are at odds with legislation and tend to act as they believe beneficial rather than as regulators believe they should. Online communities should be handed over to members of that community to run and design as they see fit and satisfy their requirements. Online identity is really dynamic and fluid, not the static imposition of state regulation manifested through passports and health

[96] *Op cit* Slide 56ff

[97] See for instance the 2011 Annual Progress report: http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=7699&utm_campaign=isp&utm_medium=rss&utm_source=newsroom&utm_content=tpa-5

[98] Many technologists were not aware of the Digital Agenda in any great depth, or even saw it as irrelevant and out of touch with the reality of contemporary Europe http://www.seserv.org/panel/videos-interviews

or social security numbers. As an unstable concept, bound up with online identity is the issue of digital rights: can I request to be digitally forgotten? And if I don't want to be forgotten but to have online contributions persist, what is my responsibility in terms of the distribution, reworking or consumption of copyright material? If the driving force of the *virtuous cycle* is consumption, how do these issues – privacy, trust, digital rights, online identity and communities – play their part?

At the same time, the underlying infrastructures face challenges too. The keynote speakers at the SESERV Athens Workshop[99] stressed time and again that increased capacity, however funded, is not enough; measuring individual bytes of traffic doesn't help identify network requirements; infrastructures need to optimise use and flows to handle demand, much of which is subject to hidden shaping beyond the control of the consumer. Furthermore, as highlighted at Brussels,[131] connection is now increasingly via mobile devices rather than the traditional PC, and the exploitation of remote resources (like clouds). Our second feature of the *virtuous cycle* is undermined too: investment in more performance and capacity is not necessarily achievable.

If consumption or Internet use will drive investment and improvement, it is time to consider just what services and applications are being used. In D3.1 and a discussion of an eGovernment project,[100] we focused on collaborative and social networks. What started as self-defining online communities supported by the likes of *Facebook* and equivalent across the globe, has rapidly become a marketing and service creation instrument, a collaborative network for policy makers to interact with voters, and even a mechanism to stir up and monitor public engagement. There is one usage area though which has yet to be addressed: media. Just as incumbent PTTs have had to embrace the Internet, both wired and wireless, so public broadcasting organisations have moved in to capitalise or at least maintain presence in the network. The BBC's *iPlayer*, it was feared, proved so popular even in the face of competition from traditional terrestrial as well as satellite services that it was in danger of compromising the Internet itself.[101] But this is even true of the specialised media providers. It's claimed that NetFlix for example consumes a third of US Internet capacity.[102] Last year (2011), the University of Texas provided some estimates of bandwidth requirements for typical consumer/prosumer uses such as *YouTube* and *flickr* as well as interactive and more low-function communication channels (*Skype*, eMail and instant messaging)[103], see Figure 8.

The major usage categories here involve not just the consumption of content (*Netflix*, *iTunes*, etc.), but multi-media collaborative tools (Skype) and sharing communities (prosumer sites: *flickr, YouTube*).

[99] http://www.seserv.org/fise-conversation/Outcome-of-the-SESERV-workshop-on-the-interplay-of-economics-and-technology
[100] http://www.seserv.org/fise-conversation/legislativetensionsinparticipationandprivacy
[101] http://www.telegraph.co.uk/technology/news/4143794/Popularity-of-BBC-iPlayer-leads-to-renewed-concerns-Internet-could-grind-to-a-halt.html
[102] http://www.theatlanticwire.com/technology/2011/10/netflix-consumes-third-americas-Internet-bandwidth/44264/
[103] http://www.utexas.edu/its/help/wireless-and-wired-public/403

Bandwidth Usage per Activity

Activity	Average bandwidth per activity
One hour of text-based IM chatting on AOL or another IM client	~0.01 MB
Sending one e-mail via Webmail, Gmail, etc.	~0.2 MB if e-mail is plain text with no attachments
Uploading a photo to Flickr	Less than 1 MB, if the photo is resized to 1024 x 768
Downloading a three-minute song from iTunes, Amazon, etc.	2-5 MB, depending on the song and encoding quality
Watching a five-minute video clip from You Tube	~5 MB (1 MB per minute, on average)
Using video chat on Skype for 15 minutes	2.7-14.4 MB
Watching a two-hour streaming movie from Netflix, iTunes, Amazon, Hulu, etc.	~2 GB at 640 x 480 resolution
Listening to Pandora for one hour	56.25 MB, assuming 128 Kbps streaming rate

Figure 8: Bandwidth Usage

(Source: University of Texas Information Technology Service Sept, 2011)

Content generation and sharing does not only seem to pose a threat to the underlying infrastructure in swamping the already burdened Internet with traffic, but may well lead to a repositioning of the traditional stakeholders as well as their power bases. The concept of *spreadable media*[104] assumes that "the repurposing and transformation of media content" – i.e. prosumer interaction with media content – "adds value" (*op.cit.*). This challenges the more traditional approach to copyright and content control which sought to impose "centralized control over distribution and attempts to maintain [the] 'purity' of [the] message" (*ibid.*).

SESERV has looked over the two previous periods at the different dimensions of the socio-economic impact of technology: what concerns end-users and other stakeholders? What are the challenges and constraints on network service and infrastructure providers? And so forth. But if the Digital Agenda, marking a strategy to sustain European growth from 2010-2014, assumes that consumption (i.e. applications and services) drive the *virtuous cycle*, then we need to look at this last area of consumption and presumption: what are the implications of new uses of media types, the actual and anticipated social developments associated with the prosumption of content, and how will this impact on current business models, let alone affect social change?

If a spreadable media model is the logical extension of existing engagement in SNS's and CNO's, then there are broader business and social implications for media uses which could extend to all aspects of life and society (transport, environment, government, health care provision, education, crime, entertainment, minority groups, social interaction, and of course retail and finance). This needs to be investigated further as we move from the

[104] http://convergenceculture.org/research/Spreadability_doublesidedprint_final_063009.pdf

Digital Agenda's look at infrastructure and inclusion to the "Better Society" focus of Horizon2020. On a technical level, and as emerged from the WP2 workshop discussions,[99] we need to consider the impact of or necessity for different implementation options: what is the impact or benefit introduced by cloud providers, notwithstanding concerns over transparency, data storage and risk highlighted by the Oxford Workshop (*q.v.*)? How will local *versus* remote processing requirements be matched – this following on directly from the asymmetry issues of net neutrality highlighted in the Oxford workshop debate[105] as well as concerns around the last-mile (and edge ISP disenfranchisement) which came out of the Athens Workshop (*q.v.*)? What are the implications here for the design and implementation of the FI?

Further questions arise when looking at the use of media not only in terms of consumption and prosumption. Until now in WP3, we have implicitly assumed that how end-users make use of Internet-based services such as SNS's determines the appropriate way to go. If SNS participants are prepared to share private details within their own trusted community, then so be it, and legislation does not need to interfere. For media consumption, sharing and "repurposing", we need to take a different tack. What *are* the current and future trends with media content, and what impact will they have? How likely are these trends to endure or grow, seeding the market and going on to be a part of a long term shift in FI engagement?

Finally in this context, bringing those who develop and those who study the FI in discussing media content, we hope to uncover where the potential problems and challenges lie. We need to consider what the blockers may be to the effective use of media across all of the social and political areas highlighted above in respect of Horizon2020: will existing business interest try to block or embrace such changes? How will those concerns around trust, data privacy and protection, and digital rights already highlighted and discussed during SESERV's first year affect and influence media "spreadability"?

During the second year, SESERV therefore extended the successful discussions of the Oxford and Athens workshops to embrace media content.[130] This is a special case for social and collaborative networking which, at the very least, exposes the clash between digital rights (including copyright) and an underlying swell in the Internet world to move towards collective content repurposing and redistribution (see Section 5 above).

6.1.2.3 Users and Community

From the original survey of participants and stakeholders for the FI,[106] it was apparent that online communities are of relevance and increasingly so. Online communities should not be ignored by operators;[45] and certain types of community activity are beginning to spill over into more broadly beneficial activities for society.[64] Communities vary in nature from the pervasive SNS's now known not only as chatrooms and places to exchange information and media about personal and everyday life, to fora for political activism and social unrest, to expert communities[107] exchanging information amongst participants and opening up access to a "second opinion" about any and all issues of interest.

[105] http://www.seserv.org/panel/conferences-webcasts#debate
[106] http://www.seserv.org/fise-conversation/socio-economicpriorities
[107] http://unpan1.un.org/intradoc/groups/public/documents/un-dpadm/unpan043648.pdf

Online communities have been used in commercial contexts for some time: *Amazon* recommenders derive from a type of community interaction, which is just one manifestation of how word-of-mouth mechanisms are now very much part of the digital age.[108] This works well, when that is the primary focus of the community. Such online interaction can be and are used in commercial contexts to help support customers, with recognised expertise users helping others in the user group.[109] But increase incursions into more traditional SNS's is more worrying[110]: the initial five or so years of SNS activity served to give people the necessary comfort and familiarity with the environment so they felt comfortable. Commercial organisations are capitalising on that and encroaching on the social environment for retail gain.

Table 6: Users and Community

Significant factors	• Focus on increased digital inclusion • Encouragement of e-Involvement (participation at all levels, including eDemocracy and eGovernment)
Socio-economic challenges	Inclusion of users within online community development and maintenance: it is users not technologists who need to shape the communities
User risks	• Lack of transparency • Online identity
User opportunities	• Inclusion • Participation

Other risks to the community come from increasing cybercrime, itself a concern and focus within the Digital Agenda. There is no reason though why communities can't mobilise themselves to help identify and counter inappropriate online activity.[111] But this involves co-operation amongst members of the community: a common purpose and identity[112] may well develop over time. This may well be a major factor in the preservation of the effectiveness of the community over time, and contribute to the self-moderation of the community itself.[108]

The power of an online community often resides in areas tangential to the primary purpose. Online educators in the US[112] may well see the benefits of access to information: educational standards can be served; professional development can be enhanced; and subgroups can serve the general community in reviewing significant issues or topics and reporting back to the community as a whole. Content functions thereby in different ways: as resource, as a conversation point, and as the product of the community itself. More important though are the non-community-specific ones: the online community establishes a clear sense of purpose and collective identity, members engage in self-regulation with the goal to maintain and develop the community as a common and safe environment for all to participate in: as identified, they may well route out threats and deal with them on their own.[111]

[108] http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.129.5228
[109] http://robust-project.eu/
[110] http://calvinayre.com/2011/09/07/marketing/social-networking-moving-towards-commercialization/
[111] http://www.slideshare.net/ictseserv/resilient-communities
[112] http://connectededucators.org/report/2011/03/11/opportunities%E2%80%94and-challenges%E2%80%94for-online-communities-of-practice/

Against this background, it is easy to see the benefits that online communities represent for engaging participants in interactions with others: this is what inclusion is all about, and encourages the development of digital skills amongst mutually supportive members: online communities have a significant contribution to make to the goals of the Digital Agenda for Europe, as well as the "Better Society" strand of Horizon2020.

One final caveat though: online identity was rated as important as online communities in the original survey, and led to lively debate at the SESERV Oxford workshop. The economics of the network rely on some level of identity mapping: whether sender (see Section 6.1.2.1 above) or receiver pays, someone must be identified to pick up the bill. Trackability and traceability are important concepts within the privacy literature, but there are limits therefore.

Is there a level though, above the network provider, where identity can be completely anonymous (or pseudonymous at least)? Do individuals have the right to deliberate obfuscation or even to be completely forgotten? Online communities clearly have significant potential for inclusion and participation in the FI environment, notwithstanding the annoyance of commercial encroachment. However, the issue of inherently dynamic online presence is yet to be understood fully and in all its implications.

6.1.2.4 Users and the Environment

Table 7: Users and the Environment

Significant factors	• Focus on smarter and more efficient use of technology across the board (including health, transport, and supply) • Increasing reliance on ICT infrastructures
Socio-economic challenges	Continued drive towards access for all, including outlying and remote areas, against a background of resource constraint
User risks	• Resource constraints, against a background of a continued perceived need for economic growth
User opportunities	• Grid utilities (resource sharing) • Participative networks (for monitoring and mutual support)

The 4th FI Cluster workshop[113] was held in Budapest in May 2011, focusing on ICT and Sustainability, and bringing together interested parties from technology and academia. It was started with a keynote presentation from Rahim Tafazolly (University of Surrey) asking the bold, but germane question: *Are we really green or just energy efficient?* Ostensibly, this may look like the same thing; although related, however, they are each driven by different needs and have different implications for the FI in particular, not least because of a growing realisation that increasing capacity is not enough (see Section 6.1.2.1 above) to cater for growing service demands (Section 6.1.2.2).

It was back in the '70s that Paul Ehrlich, a leading ecological economist, proposed the I-PAT equation[114]:

$$I = P \times A \times T$$

where I is Human ***I***mpact; ***P*** Population, ***A*** Affluence, and ***T*** Technology.

[113] http://ec.europa.eu/information_society/events/cf/fnc7/item-display.cfm?id=5773
[114] http://www.sustainablescale.org/ConceptualFramework/UnderstandingScale/MeasuringScale/TheIPATEquation.aspx

It was originally conceived in connection with growing world-wide populations at a time when they were about half current levels. Although still relevant in that context, the approach may equally well be applied now with more of an emphasis on economic size and expectations (Affluence) alongside the capabilities on offer to end-users (Technology). What is significant though is that Ehrlich, unlike most other economists at the time, firmly believed that economic growth at the exponential levels assumed could not be sustained mainly on account of the physical limitations imposed by the environment.

There are already indications that the approach to ICT and its environmental impact need serious rethinking: massive predicted growth in Internet use, huge growth in energy consumption, the depreciation of natural capital necessary to keep the data centres, base stations and access devices running where all seen as the drivers for new energy efficient ICT solutions. The overarching driver is the increased growth, assumed to be necessary and the mainstay of the Digital Agenda for Europe.

Energy efficiency measures are there currently to reduce costs and increase profits. In fact, there is little technology under development that will actually save energy within the overall energy system. History shows us that efficiency will only increase consumption of ICT services, though there is a suggestion that appropriate ICT technologies will help address environmental issues.[115]

At the same time, service providers are focused on the maintenance of the potential for growth; this is essentially the “Buy One Get One 50% Off” supermarket view on energy saving unless of course the source of energy is from renewables. This poses an interesting dilemma: how are consumers incentivised to consume less, reduce ecological footprints and material expectations whilst maintaining constant expansion and growth?

Notwithstanding the implications of Tafazolly’s statement, inventing measures to increase the efficiency of ICT is a valuable and necessary endeavour considering the large role the Future Internet is expected to play in modern society. We just need to be clear on the separation of concerns and not confuse energy efficiency with sustainability of the planet’s ecosystem. Research projects are focusing on a range of strategies and mechanisms for energy consumption within the network infrastructure including:

- The investigation and proposal mechanisms to reduce energy wastage and improve energy efficiency of mobile broadband communication systems, without compromising users perceived “quality” of service and system capacity;[116]
- Energy saving technologies for multi-standard wireless mobile devices, exploiting the combination of cognitive radio and cooperative strategies;[117]
- The integration and virtualisation of optical network and IT infrastructures considering energy models that allow monitoring and decision support on active energy management;[118]
- Providing adaptive technologies for standby and performance scaling with consumption reduction by 50-80%.[119]

[115] http://www.itu.int/dms_pub/itu-t/oth/23/01/T23010000030002PDFE.pdf
[116] http://www.ict-earth.eu
[117] http://www.c2power.eu
[118] http://www.geysers.eu
[119] http://www.econet-proect.eu

An important part of the debate considered the pros and cons of centralised *versus* decentralised architectures. This covered mobile base stations (femtocells *versus* macrocells) as well as the trend to putting everything into the cloud.

The environmental context in which FI services will need to operate is one thing. How users interact in that environment and how they retrieve benefit from the FI is a different matter. Technology to provide improved situational awareness and decision support to better balance supply and demand considering the increased volatility from renewables and distributed generation may be considered a good thing in supporting the continued free and widely accessible use of the FI for all. But in addition, there are benefits from including end-users in the monitoring of environmental effects via the ICT infrastructures available to them.[120]

Such participation is highly important. On the one hand, there is the localised and immediate benefit to end-users of being able to share information about their own current observations and experiences not least to help others: the asthma suffering sharing information about pollution levels en route to work to help others make informed choices about their journey to work and so forth. But on the other, information is key: there is diversity, quantity and timeliness of data needed to provide actionable insight and make appropriate decisions. Information plays an "enabling role" to improve awareness as well as resolve issues.[121]

There are also practical measures that can be taken. Energy grids for instance may allow consumers to share resource amongst themselves, allowing others to benefit from periods of their own low demand.[122] Individuals can and do help energy efficiency in these contexts, and this may well be the way forward at least in respect of energy efficiency if not the complete "green" target that Tafazolly hints at.

Citizen engagement in monitoring and proactively improving the environment may ultimately help avoid the situation where the future is as much about understanding operational, legal, and ethical issues of switching the Internet off as it is to providing ubiquitous connectivity.[123]

6.2 Current Progress of the Digital Agenda for Europe

The Digital Agenda for Europe 2020[124] (DAE), a European instrument to cover investment and research focus for the period 2010 to 2020, provides for specific effort to be invested in areas of ICT to enable and sustain European growth. The 2011 progress report[125] was published in December 2011, highlighting progress up to that date as well as setting out the next steps to be taken in the period 2012 and 2013 (the next 12 to 24 months), and further progress on individual action items[126] is now available, along with an interim report

[120] http://participatorysensing.org/
[121] Simonov: *The enabling role of the information broker* at http://www.seserv.org/fise-conversation/informationasaneconomicgood
[122] Cf the FNSENY project of the FI-PPP http://www.fi-ppp.en/projects/finseny
[123] Assertion by Albrecht Fehske at the 4th FI Cluster Workshop
[124] http://ec.europa.eu/information_society/digital-agenda/index_en.htm and associated documents.
[125] http://ec.europa.eu/information_society/newsroom/cf/itemdetail.cfm?item_id=7699&utm_campaign=isp&utm_medium=rss&utm_source=newsroom&utm_content=tpa-5
[126] http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/review_101_dae_actions.pdf

in June 2012.[127] The European Commission recognises that "progress towards achieving key performance targets is mildly positive" [*op.cit.*,[127] p.2], attributable in part, it is believed, to the ongoing negative economic climate, and is now due for revision:

"By the autumn of this year, the Digital Agenda will be at the half-way stage, when the Commission will undertake a mid-term review to evaluate the priorities and implementation approaches in the fast-moving ICT world with the aim of adjust the Digital Agenda" [op.cit.,[127] p.17].

The SESERV deliverable D3.1: *First Report on Social Future Internet Coordination Activities*[128] looked at the Digital Agenda in the context of societal challenges and trends, and how they may affect the Future Internet (FI). In addition, the SESERV Oxford Workshop[129] in June 2011 and the SESERV Athens Workshop[130] in January 2012, with participants from technology providers, social scientists, including economists, as well as policy makers, highlighted concerns and issues of various stakeholders in the light of how technology is developing. Finally, the SESERV Brussels Workshop[131] brought together a similarly broad range of participants including policy makers, technologists, researchers, operators and social scientists and discussed the current status of issues ranging from trust and data protection to the *No Disconnect Strategy* and net neutrality. A number of significant findings from that workshop relate directly to the Digital Agenda for Europe 2020 and need to be considered along with the reported progress. In this section, we draw on the experience and outcomes of the earlier deliverable and the three SESERV events in summarising and assessing progress on the Digital Agenda for Europe, making recommendations as appropriate for possible revisions to the instrument itself.

6.2.1 Some Notes on Statistics

According to recently reported figures,[132] Internet penetration across Europe is at 63.51%, and within the EU 71.59%. This correlates well with the EU key performance target of 75% of the population using the Internet regularly by 2015. How they use their connection is a different matter. A significant proportion of the population use social networking sites (32.28% in Europe are with *Facebook*; though this figure may be as high as 73% if all other social networking sites are taken into account[175]); and there is a sizeable amount of network traffic associated with the sharing of *YouTube* videos.[133] The Digital Agenda is more interested, however, in commercial activities.

The figures need to be viewed with caution, however. Of the top six in terms of Internet penetration, two are non EU members (Norway and Iceland), and all six represent no more than 8.6% of the total population of Europe. Conversely, the bottom six represent 19.4% of the population and two are EU member states (Greece and Romania). There are only three states above 90% penetration, including one EU state (Sweden at 92.90%); at the other end of the scale, there are seven states with less than 50% penetration, of whom three (Bulgaria at 48.8%, Greece at 46.9% and Romania at 39.2%) are EU member states.

[127] http://ec.europa.eu/information_society/digital-agenda/scoreboard/docs/2012/scoreboard_progress_report.pdf
[128] Available from http://www.seserv.org/publications/deliverables
[129] http://www.seserv.org/fise-conversation/seservworkshopbuildingthefutureInternetthesocialnatureoftechnicalchoices
[130] http://www.seserv.org/fise-conversation/Outcome-of-the-SESERV-workshop-on-the-interplay-of-economics-and-technology
[131] http://www.seserv.org/fise-conversation/seservworkshopsocio-economiccertaintiesandchangeforthefutureInternet
[132] http://www.Internetworldstats.com/stats4.htm
[133] According to an article in the Weekly Standard, 100 Million viewings across a piano-playing cat (25 Million), a tourist dancing in mystery locations around the world (over 43 Million) and a man's wonderings at nature (about 35 Million) http://www.weeklystandard.com/articles/meme-generation_645912.html

A perhaps more worrying case was shown at the SESERV Brussels Workshop. Alessandro Bogliolo[134] points out that the coverage targets (100% >30 Mbps, and 50% >100 Mbps) may actually introduce a new and more damaging digital divide: member states who have met the 50% >100 Mbps target have little or no incentive to continue to strive for 100% coverage at these rates once take up reaches the target level. Targets, therefore, need to be viewed with caution. At the same event, Javier Salcedo[135] differentiated cloud usage, whilst highlighting its penetration and modern-day uses. The world of clouds is user-driven (they are the source of innovation), is pervasive and moving faster than ever (time to market in days rather than months or years): legislation around data privacy and interoperability for this environment needs to catch up. And Stephen Minton,[136] in amongst a wealth of statistics on trends and usage, makes the point very clear: mobile devices and the IoT are now more relevant than the traditional Internet: life online is now very much mobile.

At the same time, if the Digital Agenda is a "combined set of actions […] intended to stimulate a virtuous circle of investment in and usage of digital technologies" [*op.cit.* p2], it is difficult to see where investment will come from: in the table of Internet usage (see Appendix: *Internet Usage*) of the 33 states covered, Ireland (at number 17), Spain (18), Italy (23), Portugal (26), and Greece (28) have all reported significant problems during the economic crisis. They would therefore appear to lack the capital to invest in infrastructure whilst all showing lower levels of Internet penetration. Greece (€250M) and Portugal (€106M) have requested public funding to increase coverage in rural and remote areas (along with Poland, Latvia and Slovakia), but it remains unclear how this will affect take-up[137].

These observations all prove challenging for the Digital Agenda, and in approaching the midway review with the intent of making whatever revisions may be necessary, it would be worthwhile looking beyond the average targets, assessing take up as well as penetration, and examining what users are really doing online: the Future Internet may not be an extension of the existing set up used for eGovernment and eCommerce. Instead, it may be an aggregation of mobile devices and the IoT, using cloud facilities, for social interaction and leisure-based activities.

[134] www.slideshare.net/ictseserv/alessandro-bogliolo-workshop-introduction-seserv-se-workshop-june-2012
[135] www.slideshare.net/ictseserv/javier-salcedo-cloud-computing-seserv-se-workshop-june-2012
[136] www.slideshare.net/ictseserv/stephen-minton-tech-transformation-in-the-age-of-uncertainty-seserv-se-workshop-june-2012
[137] In the SESERV Oxford Workshop, a number of the projects discussed the issue of Internet connectivity in remote and hostile areas, concluding that connectivity alone was not enough: users, their expectations and the culture within which they operate all need to be considered, a strong case for user-centricity in policy and design. Further, the SESERV Athens workshop highlighted two major problems: last-mile and edge ISPs often feel disenfranchised when content providers and/or transit ISPs seem to be gaining the upper hand; and leisure content from the likes of Netflix is already causing significant strain on infrastructures. The SESERV Brussels workshop rounded all of this off with a summary of current and project usage patterns in view of the take up of intelligent digital devices in preference to traditional desktop-based connection.

6.2.2 Pillar 1: A Vibrant Digital Single Market

Table 8: Digital Agenda Pillar 1 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	21		This pillar is focused on issues of cross-border retail and commercial activities. Digital rights (such as data protection and copyright) need co-ordination within the EU to avoid current anomalies; commercial activities are also hampered by issues of cross-border jurisdiction
Complete	8	12	
On-track	8	8	
Delayed	5	1	

Focus for the next 12-24 Months[138], with expectations on the European Parliament as well as Member States

- *Digital content*: more on copyright and IPR enforcement with cross-border co-operation
- *e-Commerce*: effort to boost e-Commerce; review of eSignature Directive; focus on cloud computing
- *Consumer Trust*: Data Protection Directive; support for cross-border retail activities (new instruments and guidelines); EU online trustmarks
- *Single Market for telco services*: review of pricing (especially roaming) and non-EU telco market.

Relevant SESERV Themes:

The regulation of digital content across borders is a complex issue in its own right[139], and may not be directly related to cross-border commercial activity as the Digital Agenda to a large extent supposes. Cross-border online purchases are increasing but at a very slow rate[140], and often enabled only the sharing a common language (*loc cit*; "the only countries likely to meet the target by 2015 are small countries sharing a language with another country, and the Nordic countries"). There may be other issues to consider.

At the SESERV workshops and focus groups, it became apparent that transparency and trust are the major issues.[141] In the cross-disciplinary debate, the subject of net neutrality was raised in the context of asymmetry and content "value":[142] more and more users are involved with the consumption of "trivia" (*loc cit*), which is borne out by the popularity of memes.[133] The viewing of such content is one thing, but if it is edited and used in the generation of yet more content to be shared and consumed via online communities or even editorial sites, then directives already exist for how it should be treated in terms of IPR;[139] though such legislation does not extend beyond the EU for US-based or other such sites. Such issues are yet to be addressed by the Digital Agenda.

[138] These focus items are taken from the 2011 Status Report from December 2011. They have yet to be revised.
[139] http://www.scribd.com/doc/88693303/D5-1-2-Ethical-legal-and-regulatory-framework-for-social-and-networked-media-v1-1
[140] See the May 2012 report *op cit* p6: by 2011 it had risen to 9.6% up from 8.2% in 2009.
[141] http://www.seserv.org/panel#one
[142] http://www.seserv.org/panel/conferences-webcasts#debate

With the explosion of the generation and consumption of such content, one topic to be discussed at length at the SESERV Athens workshop was that traffic is already generating strain;[152] that edge ISPs and transit ISPs locked in battle[143] for who controls (and should control) how content is delivered; that content providers, generating and disseminating all this content, don't seem to be paying;[143,144] that traffic shaping is endemic[145] and geographically diverse. There are significant issues, therefore, being confronted in the network as a direct result of the proliferation of content. It is not commercial for the most part, though, but entertainment and social interaction. The Oxford workshop set off the debate about content in terms of its inherent cultural value; Athens picked up on the consequences for the network operators.

Finally, at the SESERV Brussels workshop, the leisure- and entertainment-based usage patterns of content consumption were again discussed. We know that Internet take up is becoming pervasive (at least in the Anglo-Saxon world) and especially via hand-held mobile devices.[135,136] But the content being accessed is now more than just entertainment: we are no longer talking about *YouTube* or even gamers;[146] these leisure pursuits, though important in terms of network bandwidth usage as seen in Athens, spill over now into serious augmented reality training and simulation activities.[147] In a *quasi*-serious discussion at Oxford bemoaning the triviality of content (the "dumbing down" of Web 2.0 picked up by Labash[172]), net neutrality was brought up: is this a good thing, asked Wyatt,[142] if the network is being swamped by culturally suspect value? Should traffic not be controlled on the basis of content rather than provider? In Brussels, von Bornstaedt put it another way (see footnote 144): as an operator, they have had to recover from events such as cable breakage; in an attempt to maintain appropriate service at such times, should they throttle leisure-based traffic (video and social-media downloads) in favour of financial transactions and sensitive medical communications? In such situations, it was argued that net neutrality as discussed within the EC[148] may prove counterproductive, which has already been seen from a commercial perspective in at least one of the member states[149] where the imposition of complete neutrality in the treatment of content (in this case services such as *Skype*) led to a blanket price hike.

RECOMMENDATION 16
Focusing on commercially-based cross-border content is not enough. Much of the content currently being shared is of little commercial value but is straining the network. The debate over net neutrality should take into account both commercial and social factors. The Digital Agenda would do well to look to users and how they use content to be able to define urgently needed regulation in this area.

[143] http://www.youtube.com/watch?v=FraoSpcS0Rs&t=9m44s
[144] http://www.seserv.org/athens-ws-1/webcasts#bornstaedt
[145] http://www.seserv.org/athens-ws-1/webcasts#cooper
[146] The power of the gaming community was illustrated in Brussels, when one operator stated they had lost a gaming customers on the basis of a 2ms QoS commitment (www.slideshare.net/ictseserv/falk-von-bornstaedt-networks-perspectives-and-analysis-in-the-future-Internet-seserv-se-workshop-june-2012)
[147] www.slideshare.net/ictseserv/sara-de-freitas-the-gamification-of-everyday-life-seserv-se-workshop-june-2012
[148] www.slideshare.net/ictseserv/vesa-terava-net-neutrality-in-europe-seserv-se-workshop-june-2012
[149] http://www.telecomtv.com/comspace_newsDetail.aspx?id=e9381817-0593-417a-8639-c4c53e2a2a10&n=47530

6.2.3 Pillar 2: Interoperability and Standards

Table 9: Digital Agenda Pillar 2 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	7		This pillar aims to improve ICT standardisation activities, including standard-setting, better use of standards and increased interoperability and innovation across Europe.
Complete	3	3	
On-track	3	3	
Delayed	1	1	

Focus for the next 12-24 Months, with expectations on the European Parliament as well as Member States

- Continued reform of European Standardisation: looking to improve common approaches and management of standards
- Multi-stakeholder platform set up: to encourage debate amongst industry, policy-makers and end-users on issues of standardisation
- Guidelines for public procurers: to enhance efficiency and avoid dependence on single vendors
- Feasibility study to get market players to license interoperability information: to promote interconnectivity for all involved
- Promotion of rules on IPR and licensing conditions, including ex-ante disclosure: to further co-operation

Relevant SESERV Themes: In the discussions and debates at the SESERV Oxford 2011 (*loc cit*) as well as brief survey of stakeholder interests,[150] it became abundantly clear that much co-operation and therefore innovation was being hampered because of the lack of a common understanding of terms and issues, as well as a failure to encourage and facilitate participation by all relevant stakeholders. Enabling multi-stakeholder discussion fora is seen as a positive step in the right direction, though the FI ecosystem is changing and new stakeholders, such as application developers and content providers, have increasing influence in relation to traditional incumbent operators and infrastructure

RECOMMENDATION 17
It is vital to involve all interested parties – paying special attention to the changing nature of the FI ecosystem and associated stakeholders. The FI will become more and more IoT-like, built on cloud-like shared facilities. Legislation and regulation need to keep pace with the ever-increasing pace of user-driven change. A common language and terminology to facilitate multi-disciplinary debate will be key. Demand clear time in first months of projects allocated for conversation among partners from different disciplines to accomplish true multidisciplinary collaboration and dedicate resources to this.

[150] http://www.seserv.org/fise-conversation/fise2012focusgroupssurveyresults

providers.

In the SESERV Athens workshop, it became clear that there was a definite need for all stakeholders to be actively involved in the debates, if key players were not to feel disenfranchised.[151] It may be time too to revisit the financial agreements between operators,[152] and to wake up to the fact that ISPs already shape traffic within the context of their own business models not the way the regulator thinks or the end-user expects.[153] We are at a time when Internet capacity cannot keep up with Internet usage, and this may force the debate. Already hinted at in Oxford, the need for multi-disciplinary debate now became a major requirement.[154]

Bringing all of this together, the SESERV Brussels workshop reviewed the take-up of cloud facilities[135] and highlighted how pervasive personal, public and private clouds have become, supporting an ever-increasing pace of life and driven by user innovation: the technologists no longer impose new ideas, the consumers demand them. In that context, the legislators need to address interoperability issues, especially customer mobility (choosing to leave one provider for another) as well as data privacy and transparency, as a matter of some urgency.

6.2.4 Pillar 3: Trust and Security

Table 10: Digital Agenda Pillar 3 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	14		This pillar embraces all aspects of network and online security, including attacks and online safety and privacy. There is significant emphasis on the protection and maintenance of critical infrastructure.
Complete	2	3	
On-track	10	10	
Delayed	2	1	

Focus for the next 12-24 Months, with expectations on the European Parliament as well as Member States

- Continued focus on network and information security to guard against attack: to maintain awareness and sustain readiness to respond to attack
- Recognising increasing dependency on online interactions, a collection of measures to guarantee online safety and privacy: looking at online privacy protection, security breach notification, and the protection of minors
- Protection for critical infrastructure: to maintain national infrastructures in times of crisis
- Cyber crime: to provide EU-wide guidance and support

[151] http://www.seserv.org/athens-ws-1/focus-groups/fg3-report
[152] Remarks by Briscoe (http://www.seserv.org/athens-ws-1/webcasts#briscoe) and Von Bornstaedt (http://www.seserv.org/athens-ws-1/webcasts#bornstaedt) http://www.seserv.org/fise-conversation/Outcome-of-the-SESERV-workshop-on-the-interplay-of-economics-and-technology
[153] Cooper *loc cit*
[154] http://www.seserv.org/fise-conversation/fise2012focusgroupssurveyresults

Relevant SESERV Themes: The SESERV Oxford workshop included discussions highlighting various concerns around trust and security from different groups: technologists noted that regulation was often heavy-handed, and might hamper genuinely beneficial work (such as healthcare systems); yet on the other hand, online identity is not the static concept associated with national identity schemes, but rather a dynamic feature of online activity.[128,155] In some cases, such as social or collaborative networks, participants may even define and be comfortable setting their own security and privacy boundaries.[156] Ultimately, users were more concerned about flexible privacy and presence management than one-size-fits-all legislation.

At the SESERV Athens workshop, one of the initial focus groups emphasised the issue that end-users may be reluctant to adopt new technologies with trust implications unless they receive appropriate incentives.[157] But in the SESERV Brussels workshop, there was a glimmer of hope: perhaps if trust is modelled correctly in terms of risk assessment and payoff, then it is conceivable that systems can be built which not only maintain trust once granted but may even help restore it when shaken.[158]

All of this needs to be seen in the context of usage, of course. The world is now ICT-oriented with mobile devices outstripping traditional PCs[136] – suggesting the FI will be more IoT-like – and much activity is already based on clouds.[135] Already in Oxford, looking at the infrastructures themselves,[159] it was felt that there are significant inherent risks which should be considered: both clouds and sensor networks may be prone to misuse from malicious users misappropriating resource or services. Many questions arise: who should take responsibility for protecting resource: the provider or users? How are data to be protected? Is there sufficient risk expertise available? Is there even enough manpower to handle attacks?[160] More than that, though, for acts-of-God failures, then traffic management may become a necessity[161] to ensure important (and lighter weight) content is prioritised over leisure. The risk there though is that users will begin to mistrust the service provider wondering just how much traffic shaping is going on, despite claims in the SLAs to the contrary [A. Cooper].[162]

RECOMMENDATION 18
More direct involvement of end-users in the design and validation of trust and security issues, along with some flexibility in allowing users to set their own boundaries. Access to appropriate risk and security expertise should be provided, including ensuring sufficient resource is available to handle alerts and attacks. Some incentives may be required as we begin to understand how to maintain and restore trust. Ultimately though transparency rather than legislation is needed above all.

[155] http://8784322205271196501-a-1802744773732722657-s-sites.googlegroups.com/site/seservtest1/panel/Cross-thematictrendsofbreakoutsessions.pdf
[156] http://www.seserv.org/fise-conversation/legislativetensionsinparticipationandprivacy
[157] http://www.seserv.org/athens-ws-1/focus-groups/fg1-report
[158] www.slideshare.net/ictseserv/alan-hartman-trust-measurement-and-management-seserv-se-workshop-june-2012
[159] http://8784322205271196501-a-1802744773732722657-s-sites.googlegroups.com/site/seservtest1/panel/SESERV_Security.pdf
[160] See Section 3.3.1 in *D3.1: First Report in Social Future Internet Coordination Activities* available at http://www.seserv.org/publications/deliverables
[161] www.slideshare.net/ictseserv/falk-von-bornstaedt-networks-perspectives-and-analysis-in-the-future-Internet-seserv-se-workshop-june-2012
[162] http://www.seserv.org/fise-conversation/Outcome-of-the-SESERV-workshop-on-the-interplay-of-economics-and-technology

6.2.5 Pillar 4: Fast and Ultra-fast Internet Access

Table 11: Digital Agenda Pillar 4 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	8		This pillar focuses on maintaining the EU position over and against the Far East in download speeds and connectivity. The overall target is download speeds of 30 Mbps, with capabilities of 100 Mbps not uncommon.
Complete	3	3	
On-track	4	5	
Delayed	1	0	

Focus for the next 12-24 Months, with expectations on the European Parliament as well as Member States:

- *Significant EU funding* (some €50B in total) has been ear-marked for the **Connecting Europe Facility:** to provide support in the provision of network and infrastructure
- *Broadband deployment*: promoting investment at a national and cross-EU level in ICT and broadband
- *Cohesion policy:* promoting environmental awareness, SME competiveness and innovation
- *Rural development:* encouraging access to high-quality ICT services across rural areas

Relevant SESERV Themes: the SESERV Oxford workshop included presentations from technology providers in support of commercial and other activities in remote areas. Perhaps more significantly, though, the SESERV Athens workshop[129] highlighted that traffic management remains far from uniform or indeed transparent especially at the edge of the network and in rural areas. Network and infrastructure providers are focused on high-value traffic and end-users are often consigned to best-effort whilst high quality of service (QoS) delivery goes to large business users. At the same time, keynote speakers at the event were unanimous in pointing out that capital investment cannot keep up with current traffic projections: there is a definite need to think more carefully about *how* traffic is managed rather than just the amount of traffic. It was also noted that existing and planned infrastructures may not be able to keep pace with demand[152][170]: actions associated with this pillar may be derailed already by the services being offered at the moment.

At the SESERV Brussels workshop, infrastructure usage came up again. Notwithstanding the statistical remarks made above and Bogliolio's analysis of the DAE coverage targets[134], the most important challenge arising constantly is what end-users are actually using the infrastructure for, and not just the fact that it's there. Mobile and smart devices are pervasive[136]. What this has done is shift usage patterns: there are now peaks later in the day/night due to bed-surfers[161].

At the end of the day, high-speed Internet coverage may be a laudable goal; it's what it's used for though that will be crucial. If the "sender pays" [von Bornstaedt][33,162] idea does not take off, and content providers offer no recompense to the carriers[163], then it is difficult

RECOMMENDATION 19
Investment in infrastructure is not enough, and may not even keep pace with projected traffic. There is already a need to optimise usage rather than let traffic spiral out of control. Further, rural and last-mile provision may need careful monitoring by suitably empowered industry watchdogs to ensure end-to-end QoS irrespective of user type. Ultimately, though, the business model around the "virtuous cycle" may well need revision.

to see how the DAE "virtuous cycle" can be fuelled. One possibility would be to allow services requiring premium connectivity. This would mean a revision to net neutrality to allow for service differentiation or lead to ISPs deploying dedicated networks.[164] It is time to review that particular model perhaps.

6.2.6 Pillar 5: Research and Innovation

Table 12: Digital Agenda Pillar 5 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	7		This pillar is geared towards maintaining competitiveness over and against the rest of the world, as well as trying to manage current disparate efforts.
Complete	1	1	
On-track	6	6	
Delayed	0	0	

Focus for the next 12-24 Months, with expectations on the European Parliament as well as Member States *(NB: although most goals are long-term, 2012-2013 is seen as crucial in providing the justification for continued investment.)*

- *Continuation of EC support:* move from current FP7 and CIP programmes towards Horizon2020,[165] including PPP and related partnering schemes
- *European Innovation Partnership on Active and Health Ageing*: to kick-start efforts in this area
- *European guidelines on key technologies*: providing guidance on governance for PP-run ICT infrastructures
- *Working documents*:
  - *Communication on scientific information*: promoting research infrastructures in support of open access to research data and publications
  - *EU Competitiveness on the Web:* identifying blockers to EU competitiveness

[163] http://www.seserv.org/athens-ws-1/focus-groups/fg3-report
[164] Such as CDNs in some parts of the US, as described in the SESERV Athens Workshop FGs.
[165] http://ec.europa.eu/research/horizon2020/index_en.cfm?pg=home

- *Strategy for cloud computing*

Relevant SESERV Themes: It was striking that individual projects and technologists attending the SESERV Oxford workshop only occasionally had any understanding of the *Digital Agenda for Europe*; even occasionally regarding such instruments as intrusive and unhelpful.[166] Yet already the major challenges were identified at that workshop: trust, transparency and usage. The SESERV Athens workshop continued the focus on net neutrality (ensuring all players are treating equally and fairly), traffic management in light of significant pressure from content suppliers and cascading agreements between providers in different geographies. Perhaps there is a disconnect between policy makers and technologists and scientists: the EC needs to engage directly with those building, those studying and those using the Internet to inform strategic thinking. With the publication of Horizon2020, this may well offer the bridge between the over-arching concerns and dictates of the Digital Agenda and the technologies ("Excellent Science") that are intended to improve European society ("Better Society").

The SESERV Brussels workshop brought all of these issues together, including reasons not to legislate for net neutrality and more significantly perhaps: the need to define trust mechanisms[158], how usage patterns are changing[161] along with the pervasiveness of Internet use especially via mobile devices,[136] and the importance of gaming.[146,147]

RECOMMENDATION 20
Research and innovation directions do include issues which have been identified as strategic. It is time to start to incorporate the findings of current projects in shaping what should be the focus in Horizon2020 and beyond, as well as the mid-term review of the DAE. For the "Better Society" arm of Horizon2020, how users actually use services and applications, as well as what that will do to the infrastructure needs to be examined carefully. Without user involvement, though, there is no empirical evidence of what really happens in the Internet.

6.2.7 Pillar 6: Digital Literacy, Skills and Inclusion

Table 13: Digital Agenda Pillar 6 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	12		Recognising that there is an unacceptable "digital divide", this pillar targets the assessment and maintenance of the appropriate skills to allow all to benefit from the digital world.
Complete	3	3	
On-track	6	6	
Delayed	3	3	

Focus for the next 12-24 Months, with expectations on the European Parliament as well as Member States:

- *Proposals for digital competencies*: identify what skills are available and what needs to be done to support others

[166] http://www.seserv.org/panel/videos-interviews

- *Online interactive education platform*: to provide materials about new media technologies and literacy
- *Evaluation of accessibility*: the Commission will review public websites and supporting legislation to ensure that all sites are accessible to all

Relevant SESERV Themes: The SESERV Oxford workshop highlighted a number of blockers to progress, including the lack of a common understanding, and even vocabulary for exchange; there was a tendency for the adoption of polarised views in discussion. The SESERV Athens workshop highlighted such disparities even further: network and infrastructure providers barely aware of end-user expectations from the services they use. Once more, engaging with all stakeholders would bring benefits in understanding how the FI is likely to be used; and subsequently, what the likely effects are in the infrastructure and processes needed to support it. The Athens workshop also brought a number of factors: savvy users *are* important and need to be listened[163], they are ignored at the operator's peril; and even the average user is well aware of the QoE effects of traffic shaping [A Cooper].[162]

Further, the SESERV Oxford workshop revealed suspicion attaching to the IoT; yet in Brussels, the extent to which the Internet is moving towards a mobile environment with more mobile and sensor devices than anything else was revealed.[136] the SESERV Oxford workshop also revealed to a significant desire to be involved in the shaping and management of online communities by participants within that community, echoed indirectly by the gaming community.[163,147] Finally, the skill gained through experience not explicit training (as in the case of SNS activity) may not equip users to appreciate fully what is important for their own protection, though gaining experience and skill improves levels of trust.[167] It is time to look to how to build and maintain trust.[158]

RECOMMENDATION 21
Providing appropriate support and education to increase digital awareness will enable users to make appropriate and informed decisions about security and risk, increasing their levels of trust. In addition to user involvement, it is important though to introduce ethics into the development of infrastructures. Once more, though, it's important to look at what users are actually doing, and their expectations; they are becoming increasingly sophisticated in what they do and what they demand.

At the same time, the SESERV Brussels workshop made the point very forcibly that users now have high expectations from the infrastructures,[135,136] and are driving innovation[135] making ICT services much more an *appstore*-type[136] commodity rather than something developed by traditional software houses.

[167] Dutton, W.H. and Shepherd, A. (2003) "Trust in the Internet: The Social Dynamics of Experience Technology", The Oxford Internet Institute, available from: http://www.oii.ox.ac.uk/resources/publications/RR3.pdf

6.2.8 Pillar 7[168]: ICT-enable Benefits for EU Society

Table 14: Digital Agenda Pillar 7 Status

	Status		Description
	Dec 2011	**June 2012**	
Total Actions	28		This pillar focuses on specific societal challenges – the environment, an ageing population, efficient health and public services – on the basis that ICT has significant potential to affect and benefit everyday life.
Complete	5	8	
On-track	15[169]	10	
Delayed	8	8	
At-risk	0	1	

Focus for the next 12-24 Months, with expectations on the European Parliament as well as Member States:

- *ICT for sustainability:* recognising that the benefits of ICT come at a cost – higher energy consumption – there needs to be a focus on common measurement methods as well as the exploration of smart grids for energy
- *eHealth:* including extending access to online medical services, establishing a minimum set of patient data and introducing standard practices and so forth
- *Cultural and creative industries:* promoting online access to European culture
- *eGovernment:* promoting access to state information, as well as of the recognition of e-identification and e-authentication
- *Intelligent transport:* focused overall on better and more efficient transport, with single and unified solutions for air and maritime travel.

Relevant SESERV Themes: There are a number of disparate factors to be considered in relation to this final[168] pillar. The SESERV Athens workshop highlighted the need to optimise resource utilisation, not just expect continued growth: capacity is not the answer. This feeds directly into the focus on the sustainable use of ICT resource, which may be compromised still further by the exponential growth in network bandwidth consumed by the services of media providers.[170]

But in addition, there is a need to consider how resource is used. During the 4th FI Cluster Workshop, the scene was set against Ehrlich's original assertion that exponential economic growth is not possible because of the ecological constraints of the planet. Energy efficiency driven by a desire to reduce costs and increase profit is not the right focus: supply is limited and this should dictate how energy is exploited, not simple economics.[171] There is a clear need to identify and understand the concerns if some level of sustained growth – an appropriate goal given the importance the FI will play – is to be envisaged. There is a way to go, therefore, in recognising an urgent need for efficient use

[168] There is an 8th pillar dealing with International Aspects of all of the other pillars. This is not specifically reviewed or summarised here. Of the four actions, one has been completed and the others are on track.
[169] 1 is reported as partially complete, and has therefore been assigned to "On Track" in the summary table here.
[170] http://www.theatlanticwire.com/technology/2011/10/netflix-consumes-third-americas-Internet-bandwidth/44264/
[171] http://www.seserv.org/fise-conversation/supermarketstyleenergysavingbuyonegetone50off

of scarce resource, whilst at the same time trying to understand the context in which and how individuals really use those resources.

In Brussels, though, the point was made that traffic management may indeed to become necessary to prioritise eHealth and eCommerce over leisure and entertainment, not least in times of crisis.[161] But as has been stated throughout the discussion here, not all activity is necessarily "cultural": gaming is highly significant not only in its effects on the network,[146] but also as a source itself for socially beneficial research.[147] What is more, the current trend to generate and exchange personal content which may become viral[172] can have a significant effect on network usage: it may not be cultural heritage that end-users are after, but rather memes and user-generated content.

RECOMMENDATION 22
There is an urgent need to review actual usage alongside the focus on the optimisation of resource exploitation. Individual users develop their own concepts of what they are prepared to share and how it should be protected. Usage projections suggest that they are rapidly becoming a concern if not completely unsustainable. It is unwise though to try to fix what is worthwhile (or "cultural") and what is not.

[172] http://www.weeklystandard.com/author/matt-labash

6.3 Digital Agenda for Europe Scorecard

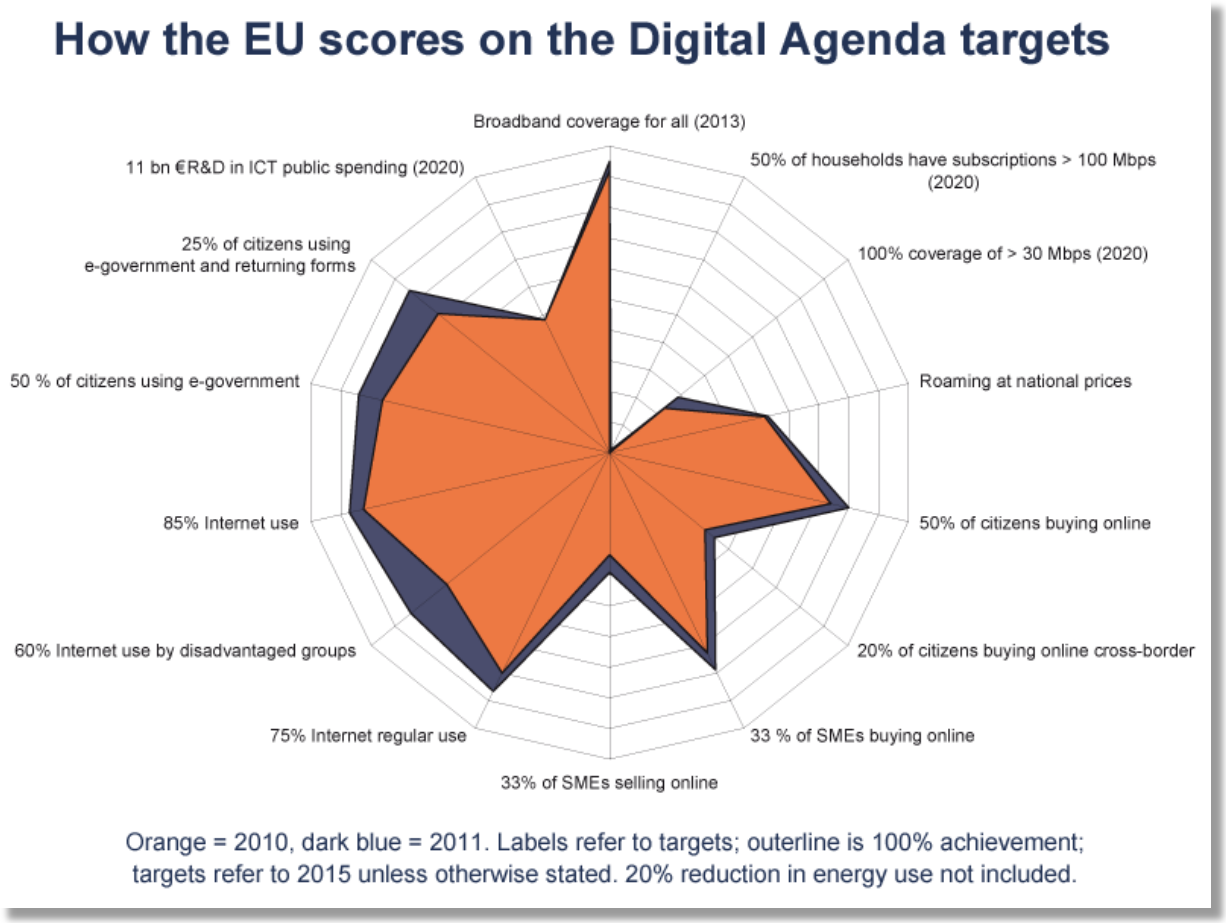

Figure 9: Digital Agenda Targets

(Source: Digital Agenda for Europe 2020 Scorecard[173])

By way of summary, the figure above (from the Digital Agenda site) provides an indication of how trends and behaviours are tracking against the Commission's stated target. Refer to the bottom label on how to interpret the radar chart.

The main area of improvement – moving towards the overall target on the outside of the radar chart – is really Internet usage: more SME's buying and selling online; more disadvantaged users online; more citizen engagement online; and so forth. In the light of the SESERV Athens workshop, this highlights the need for more careful traffic management and monitoring. But as the SESERV Brussels workshop pointed out, end-user usage needs to be taken into account: they are driving innovation, but for leisure-type activities, not just eGovernment and eCommerce.

Of the seven pillars, between December 2011 and May 2011, 2, 4, 5 and 6 show no change in status; the other three pillars (1, 3 and 7) have made some progress. Overall, there were some 25% of actions completed in December, and this has now risen to some 33%.

[173] http://ec.europa.eu/information_society/digital-agenda/scoreboard/index_en.htm

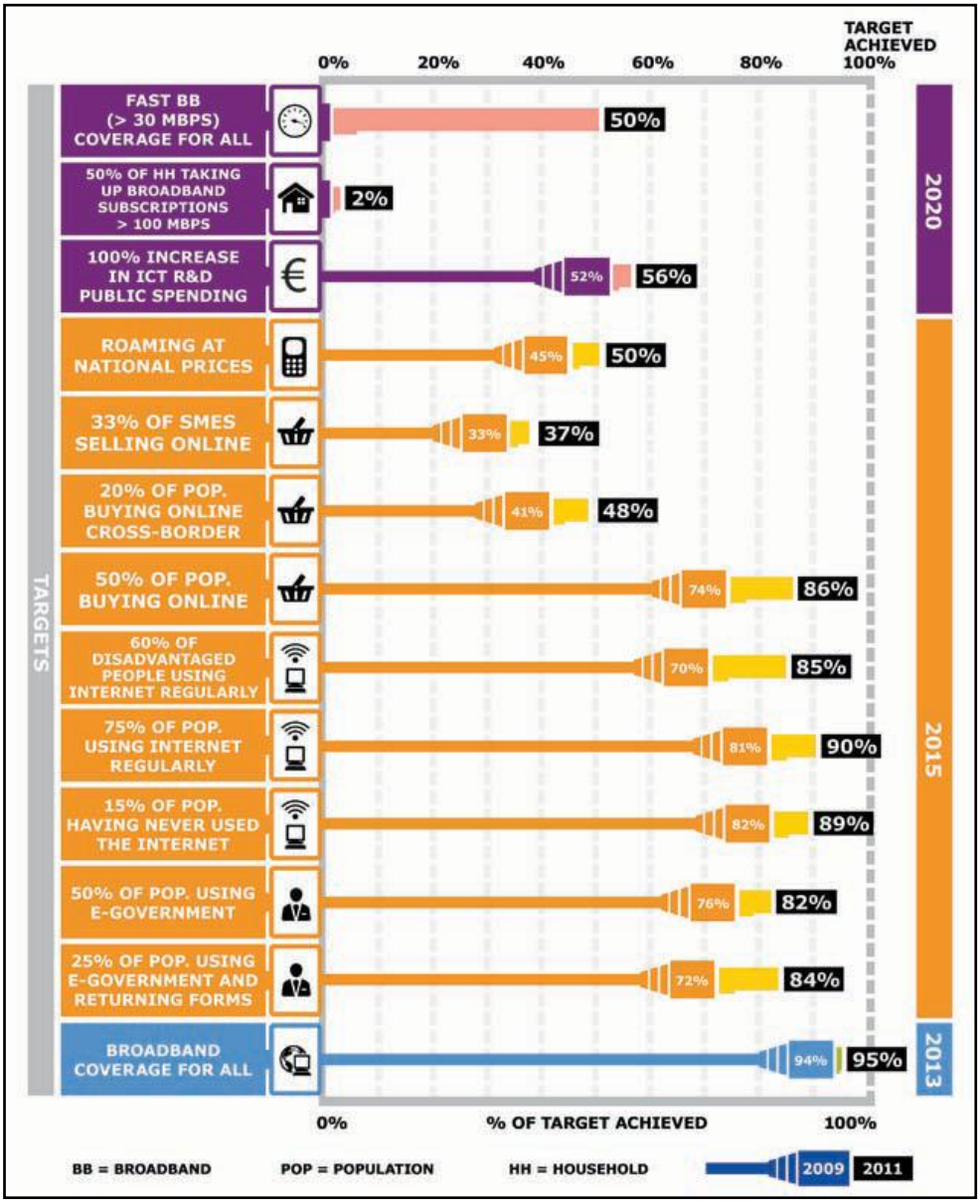

Figure 10: Progress Between 2009 and 2011 Towards the DAE Targets

6.3.1 Internet Usage

Table 15: Internet Usage by Country[174]

EU Member	Country	Population, 2011	Internet Users (12/2011)	Penetration	Facebook users (03/2012)
N	Iceland	311,058	**304,129**	97.80%	67.58%
N	Norway	4,691,849	**4,560,572**	97.20%	54.60%
Y	Sweden	9,088,728	**8,441,718**	92.90%	49.73%
Y	Netherlands	16,847,007	**15,071,191**	89.50%	34.19%
Y	Denmark	5,529,888	**4,923,824**	89.00%	51.27%

[174] All figures from http://www.Internetworldstats.com/stats4.htm; individual data are ordered by penetration.

EU MEMBER	COUNTRY	POPULATION, 2011	INTERNET USERS (12/2011)	PENETRATION	FACEBOOK USERS (03/2012)
Y	Finland	5,259,250	**4,661,265**	88.60%	39.53%
N	Switzerland	7,639,961	**6,430,363**	84.20%	35.70%
Y	UK	62,698,362	**52,731,209**	84.10%	48.60%
Y	Germany	81,471,834	**67,364,898**	82.70%	27.15%
Y	Belgium	10,431,477	**8,489,901**	81.40%	44.43%
Y	Slovakia	5,477,038	**4,337,868**	79.20%	34.49%
Y	Estonia	1,282,963	**993,785**	77.50%	34.89%
Y	France	65,102,719	**50,290,226**	77.20%	36.17%
Y	Austria	8,217,280	**6,143,600**	74.80%	33.67%
Y	Slovenia	2,000,092	**1,420,776**	71.00%	33.53%
Y	Czech Republic	10,190,213	**7,220,732**	70.90%	34.37%
Y	Ireland	4,670,976	**3,122,358**	66.80%	44.83%
Y	Spain	46,754,784	**30,654,678**	65.60%	33.54%
Y	Hungary	9,976,062	**6,516,627**	65.30%	37.60%
Y	Malta	408,333	**262,404**	64.30%	47.01%
Y	Poland	38,441,588	**23,852,486**	62.00%	19.57%
N	Croatia	4,483,804	**2,656,089**	59.20%	32.39%
Y	Italy	61,016,804	**35,800,000**	58.70%	34.24%
N	Serbia	7,310,555	**4,107,000**	56.20%	43.41%
Y	Cyprus	1,120,489	**584,863**	52.20%	49.43%
Y	Portugal	10,760,305	**5,455,217**	50.70%	38.79%
Y	Bulgaria	7,093,635	**3,464,287**	48.80%	33.65%
Y	Greece	10,760,136	**5,043,550**	46.90%	33.10%
N	Belarus	9,577,552	**4,436,800**	46.30%	4.27%
N	Russia	138,739,892	**61,472,011**	44.30%	3.77%
N	Bosnia-Herzegovina	4,622,163	**1,955,277**	42.30%	27.45%
Y	Romania	21,904,551	**8,578,484**	39.20%	19.00%
N	Ukraine	45,134,707	**15,300,000**	33.90%	3.74%
	TOTAL	719,016,055	456,648,188	63.51%	26.28%
	EU Members	496,504,514	355,425,947	71.59%	34.28%[175]

[175] Van Bellegham quotes an overall social networking figure at 73% in Europe, taking account of other sites such as Vkontakte in Eastern Europe. (September 2011: http://blog.insites.eu/2011/09/14/347-million-europeans-use-social-networks-results-of-a-global-social-media-study/)

6.4 Conclusion

In this brief summary, the 2011 status of the Digital Agenda for Europe along with the recent May 2012 update has been reviewed against a background of the findings of activities in the SESERV project, including the three workshops in Oxford (June 2011), Athens (January 2012) and Brussels (May 2012), video interviews, surveys to the FI community and specific focus groups. Individual indicators focus on the achievement of specific goals related more to coverage, governance and regulation than to usage. This looks like a significant shortcoming: both the societal and economic strands of SESERV indicate

1. usage tends to be creative and may, if left unchecked, compromise existing infrastructures
2. regulation does not necessarily meet user expectations or requirements;
3. users will often judge for themselves how to engage online, though
4. increased skill and experience can help to foster and improve trust in the online environment
5. resource is scarce and needs to be used more optimally, therefore
6. blanket investment to increase capacity is short-sighted and ultimately counter-productive

In moving forward, there needs to be more inclusion of users, not least those with experience of using and exploiting online services and applications, in the heart of strategic discussions. Just as the SESERV workshops have discovered, online communities are becoming a significant force, crying out for involvement in the development and management of their own communities. It is therefore perhaps time that EU citizens should be engaged directly by policy-makers in shaping the strategy for the Future Internet, voicing what they expect and need, as well as describing how they use the current Internet.

7 Discussion and Recommendations

In this report, a wide variety of issues have been discussed related to the socio-economic issues relevant to Future Internet projects. A series of recommendations has been offered which is based on the consultations with the FISE community over the last two years. These recommendations are not meant to be exhaustive since SESERV was not a research project, but a coordination and support action. Thus, these recommendations are ones which we make in support of the community of the Future Internet, based on what they have told us are priorities. Each of these recommendations are detailed in the report (on the page listed), but it is worthwhile to briefly revisit them here as a group.

In this section the 22 recommendations from throughout the report have been regrouped into several top-level themes to show how they are related to each other in the FI Ecosystem. (Note that several recommendations appear in more than one grouping).

7.1 Research Project Design / Project Development

Several of the recommendations from throughout this report focus on allowing time for different disciplines to mesh during projects, to set an appropriate pace, to have flexibility in organizational structures and funding, and to consider issues of sustainability.

RECOMMENDATION 1 Demand clear time in first months of projects allocated for conversation between partners from different disciplines to accomplish true multidisciplinary collaboration and dedicate resources to this.	p. 19
RECOMMENDATION 2 Do not concentrate too much on having fast-moving goals in the first stage of projects; allow for additional iterations. Do not initially evaluate the project solely on 'fast activity' or 'product output', but on other indicators such as uptake or usability.	p. 21
RECOMMENDATION 4 Create flexible structures and funding incentives to facilitate multidisciplinary teams coming together for a problem focused effort or an area study, such as promoting projects which specifically include stakeholders from all appropriate areas.	p. 23
RECOMMENDATION 7 Fund longer projects, or fund second rounds/follow-ups. There needs to be a mechanism or funding model to go from a technical proof of concept through to a real product, with the kind of iterative development/release cycles often found in mainstream, commercial technology developers.	p. 31
RECOMMENDATION 8 Provide funding for a 'champion' after the project has ended to stay engaged with the community to create continuation. Alternatively, find caretakers in communities and support them with funding and time. Let the users 'take-over' and make the process bottom-up with some help.	p. 32

These recommendations are aimed primarily at a mix of technology developers (1, 2, 4), funding bodies (7, 8), project managers (1, 2, 4, 8), although there are also points aimed at communities of technology users/participants (8). Some of these recommendations are difficult to implement in current conditions of tight budgets and funding austerity (such as

allowing extra start-up time for projects or to provide support beyond the end of a project), but the evidence seems clear that, particularly in the case of the up-front investments, small amounts of extra time and resources can greatly increase the likelihood of overall project success, thus protecting the investment in the project.

7.2 Users/Participants Experiences and Perspectives

The next set of recommendations has to do with one of the major themes of SESERV: the importance of considering the centrality of the Internet participant (i.e. 'user') in successful Future Internet technologies. The importance of understanding the people who will make use of technology and leverage technologies for new uses was a consistent theme throughout the project. At all the workshops and FIA events, at all the focus groups, and in many of the documents and video interviews posted online, the 'user' has a concept underlies much of the current thinking across the board. The challenge, however, is to move beyond the idea of the 'user' as problem or barrier, and instead to consider the people who participate in using technology as key stakeholders in the design of the Future Internet.

RECOMMENDATION 6 Continue to support technology projects which involve skilled user experience (UX) design and user-oriented researchers as a core part of multidisciplinary teams.	p. 31
RECOMMENDATION 9 Don't let the ease of collecting user data be done to such an extent as to let the user feel under surveillance or under threat (or more simply put off).	p. 34
RECOMMENDATION 11 Create better methods for informing users what their data is worth, and what they are getting in exchange for sharing it (and what the consequences of using services is).	p. 35
RECOMMENDATION 13 Look at what users actually do, how they interact and what they expect. Users need to be included, not only as significant FI stakeholders, but also because without user-involvement, there can be no empirics and therefore no science.	p. 42
RECOMMENDATION 15 QoE not QoS is what matters; privacy and trust are concepts that end-users are better qualified to determine. Look at what users actually want and the form of the data they use, not the content of the data itself. It's user experience that matters, not what technology is used to deliver what data.	p. 45
RECOMMENDATION 20 Research and innovation directions do include issues which have been identified as strategic. It is time to start to incorporate the findings of current projects in shaping what should be the focus in Horizon2020 and beyond, as well as the mid-term review of the DAE. For the "Better Society" arm of Horizon2020, how users actually use services and applications, as well as what that will do to the infrastructure needs to be examined carefully. Without user involvement, though, there is no empirical evidence of what really happens in the Internet.	p. 70

This group of recommendations is of potential interest to technology developers (6, 9, 11, 13, 15) and project managers (6, 13). Funding bodies (6, 20) have a role to play in supporting projects with a user focus, and governments (9, 11, 20) have a key role to play

in developing regulations and frameworks that support users as key stakeholders in the Future Internet. Citizens and civic society advocates (9, 11, 20) also have a role to play here in advancing the conversation. Technology providers and businesses (9, 11, 15) are also important, since they provide the networks and systems that will implement strategies and policies affecting users and uses.

7.3 Internet Data

Data is a key source of business value, especially in the current age of big data analytics, and data about users and uses is both a source of business value and of potential problem if data security is allowed to be compromised or data is used for purposes which are considered unacceptable. Also, the volume of data flowing over the network is the source of many of the contentions and tussles discussed in great detail in D2.2. From the social point of view, understanding how data is being used and how better experience is being delivered are key issues.

RECOMMENDATION 10 p. 35
Increase transparency about how data is being used, and make understandable and clear choices available to the public (e.g. simple frameworks more like Creative Commons rather than 10-page legal documents).
RECOMMENDATION 12 p. 40
Understanding the forms *and* uses of data is often more important than just understanding the size or structure of the data itself. The static aspects of data management (storage and search/retrieval) are relatively easy to manage; the dynamic aspects (data transmission to support particular real or perceived Quality of Experience) are where the real problems lie.

These recommendations are of particular interest to citizens and civic society advocates (10), technology providers (10, 12), and businesses (10, 12).

7.4 Regulation and Public Policy

The importance of taking social issues into account when deciding public policy and setting regulatory frameworks into motion cannot be underestimated. At the moment, different stakeholders often only have a limited understanding of the goals and limitations of other stakeholders, which impedes successful policy and regulation. For instance, the user view of network congestion (which might be seen simply as an annoyance) is very different from the ISP view of network congestion (for whom it is a core business challenge), but unless these two parties are both part of discussions on how to regulate congestion and set policy to increase network usage, the resulting regulations are more likely to reach sub-optimal results.

RECOMMENDATION 16 p. 64
Focusing on commercially-based cross-border content is not enough. Much of the content currently being shared is of little commercial value but is straining the network. The debate over net neutrality should take into account both commercial and social factors. The Digital Agenda would do well to look to users and how they use content to be able to define urgently needed regulation in this area.

RECOMMENDATION 17 p. 65 It is vital to involve all interested parties – paying special attention to the changing nature of the FI ecosystem and associated stakeholders. The FI will become more and more IoT-like, built on cloud-like shared facilities. Legislation and regulation need to keep pace with the ever-increasing pace of user-driven change. A common language and terminology to facilitate multi-disciplinary debate will be key.
RECOMMENDATION 19 p. 69 Investment in infrastructure is not enough, and may not even keep pace with projected traffic. There is already a need to optimise usage rather than let traffic spiral out of control. Further, rural and last-mile provision may need careful monitoring by suitably empowered industry watchdogs to ensure end-to-end QoS irrespective of user type. Ultimately, though, the business model around the "virtuous cycle" may well need revision.
RECOMMENDATION 20 p. 70 Research and innovation directions do include issues which have been identified as strategic. It is time to start to incorporate the findings of current projects in shaping what should be the focus in Horizon2020 and beyond, as well as the mid-term review of the DAE. For the "Better Society" arm of Horizon2020, how users actually use services and applications, as well as what that will do to the infrastructure needs to be examined carefully. Without user involvement, though, there is no empirical evidence of what really happens in the Internet.
RECOMMENDATION 22 p. 73 There is an urgent need to review actual usage alongside the focus on the optimisation of resource exploitation. Individual users develop their own concepts of what they are prepared to share and how it should be protected. Usage projections suggest that they are rapidly becoming a concern if not completely unsustainable. It is unwise though to try to fix what is worthwhile (or "cultural") and what is not.

Stakeholders from across the board have an interest in the regulatory and public policy aspects of the Future Internet, but engaging them all in the debate can be a challenge. Governments and regulatory bodies are interested in all of these issues (16, 17, 19, 20, 22), but these are also of central concern to users (16, 17, 22), technology providers (17, 19, 22), and content businesses (16, 22).

7.5 Transparency and Trust

Trust (and the transparency which underpins and inspires trust) has been a common theme of discussions about networking technology for decades, yet it remains the source of ongoing challenges for the Future Internet. Ranging from trust within development teams to public trust in the network, these recommendations reflect the position taken by IBM's Hartman[8] during the SESERV workshop in Brussels: that trust is asymmetrical and fragile – it takes a long time to build, a moment to break, and is hard or even impossible to repair.

RECOMMENDATION 5 p. 24 Create teams built on mutual trust by establishing expertise, managing expectations from different partners, and establishing boundaries of which aspects of the project are open to change, and which are fixed.

RECOMMENDATION 10 Increase transparency about how data is being used, and make understandable and clear choices available to the public (e.g. simple frameworks more like Creative Commons rather than 10-page legal documents).	p. 35
RECOMMENDATION 14 There need to be transparent technologies and new business models to ensure all stakeholders in the network are treated fairly in the context of user expectation that the technology is transparent and QoE is the most important factor.	p. 44
RECOMMENDATION 18 More direct involvement of end-users in the design and validation of trust and security issues, along with some flexibility in allowing users to set their own boundaries. Access to appropriate risk and security expertise should be provided, including ensuring sufficient resource is available to handle alerts and attacks. Some incentives may be required as we begin to understand how to maintain and restore trust. Ultimately though transparency rather than legislation is needed above all.	p. 67

Trust in the Future Internet involves all stakeholders at some level, but the recommendations here will be of particular interest to project managers (5, 18), governments and regulatory bodies (10, 18), businesses (10, 14), technology developers (5, 18), and technology providers (10, 14, 18).

7.6 Citizenship, Awareness, and Education

The final group of recommendations relates to the public at large, and the responsibility of more members of the public to become *knowledgeable* stakeholders in the Future Internet conversation. Whether that involves students becoming trained in how to bridge the gaps between technology developers and social expertise, or end-users becoming better educated consumers of how their data is being used and what risks that entails, more people need to make the move from being passive 'users' into active participants in the Future Internet ecosystem.

RECOMMENDATION 3 Target training at identifying students with skills that can be developed to become 'bridgers' and tie this to the economic benefit of this for both the individuals and for society.	p. 22
RECOMMENDATION 11 Create better methods for informing users what their data is worth, and what they are getting in exchange for sharing it (and what the consequences of using services is).	p. 35
RECOMMENDATION 21 Providing appropriate support and education to increase digital awareness will enable users to make appropriate and informed decisions about security and risk, increasing their levels of trust. In addition to user involvement, it is important though to introduce ethics into the development of infrastructures. Once more, though, it's important to look at what users are actually doing, and their expectations; they are becoming increasingly sophisticated in what they do and what they demand.	p. 71

These recommendations are all of interest to citizens and technology users (3, 11, 21). In addition, funding bodies can prioritize support for new training schemes (3), which may

involve embedding students with technology developers and providers. Businesses, governments, and civic society advocates all have a role to play here as well, particularly with regard to providing clearer information to the Internet-using public (11, 21).

7.7 Conclusion

Throughout this report, we have presented a wide range of evidence gathered from stakeholders in the Future Internet ecosystem. This is not meant to be an exhaustive exercise, as SESERV was a coordination and support action, not a research project. However, in the course of supporting the socio-economic community interested in the Future Internet, we have found many patterns consistent across the stakeholders: the importance of understanding the social implications of technology and the role people have in using it; the difficulties of multidisciplinary collaboration; and the challenges of getting stakeholders from one domain to cross over into other domains to share knowledge and expertise.

Even with these challenges, however, there are many causes for optimism. The many speakers and participants at the SESERV events over the last two years showed an enthusiasm for tackling the social and economic issues that arise from the choices made in designing the technological configurations for the Future Internet. The SESERV participants showed that there is need to continue to have opportunities to bring socio-economic concerns to the forefront of the FI community, and equally the need to share the FI story with a broader range of audiences outside the FIA, including the Digital Agenda Assembly, the social science research community, and the parts of the Internet business community which is creating content that will be transported over the network technologies being designed by FI projects.

The recommendations in this report are suggestions for further conversation that we hope will be taken up by the FISE community and beyond. None are the final statement on the issues raised, but are intended to stimulate thought and conversation in the coming years as the Future Internet continues to develop. Done right, this Future Internet will support important social values, economic development, personal growth, and fundamental human needs and rights, a goal all SESERV participants shared even when their ideas for how to reach that lofty goal were in disagreement. The next steps are as important as the previous ones – and this project has given us cause for optimism that the groundwork is in place to build a Future Internet with a solid socio-economic base grounding it.

Appendix I: FIA Chapter

This following WP3 chapter was included in the 2012 FIA book, and was identified as one of the three best chapters in the volume, and selected for presentation at the FIA-Aalborg meeting. Anne-Marie Oostveen presented the paper in Aalborg.

Oostveen, A., Hjorth, I., Pickering, B., Boniface, M., Meyer, E.T., Cobo, C., Schroeder, R. (2012). Cross-Disciplinary Lessons for the Future Internet. In F. Alvarez et al. (eds.), *Future Internet – From Technical Promises to Reality.* Lecture Notes in Computer Science (LNCS) 7281. London: Springer, pp. 42-54.

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Cross-Disciplinary Lessons for the Future Internet

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Abstract. There are many societal concerns that emerge as a consequence of Future Internet research and development. An online survey identified six key social and economic issues deemed most relevant by 98 representatives from FP7 Challenge 1 projects. During a workshop organized by the SESERV project, experts in Future Internet technology engaged with social scientists (including economists), policy experts and other stakeholders in analysing the socio-economic barriers and challenges that affect the Future Internet, and conversely, how the Future Internet will affect society, government, and business. The workshop aimed *to bridge the gap* between those *who study* and *those who build* the Internet. This chapter describes the socio-economic barriers related to the Future Internet as seen by the Future Internet community itself and presents suggested resolutions to these challenges. It also investigates how relevant the EU Digital Agenda is to Future Internet technologists.

Keywords: Future Internet, Socio-Economics, Digital Agenda, Users, SESERV.

1 Introduction

It is clear that the Internet has become an essential part of the infrastructure of modern life. Relationships are managed using new online media, commerce increasingly takes place online, governments use the Internet to consult citizens, media content has moved online, television and entertainment are being delivered via the Internet, and policy makers engage the public online via programs such as Digital Britain [1], the European Digital Agenda [2], and other worldwide initiatives. One focus area is the future of the Internet itself, and how the Future Internet, as it is called, will be developed either as a logical extension of what is in place now, or as something completely different [3].

At the same time the Internet is evolving, both as a technical piece of engineering and as a social and economic platform. Yet it is not clear how to balance competing interests when technical, societal, economic and regulatory concerns come into conflict. One point of view is that technology developers should be allowed to develop innovative technologies with little oversight and regulation so as not to stifle creativity. In this view, social and regulatory concerns can be dealt with as they arise as a result of use. A different viewpoint is that any future Internet must be designed with social and economic concerns at the centre, so that technology supports shared values, enhances inclusion, protects privacy, and supports democratic goals.

Innovation is often serendipitous [4]; for maximum benefit, the complex interactions and even antagonisms between society and the technologists need to be nurtured in a suitable and enabling environment. Thus social (what are the pressing needs of users), legal (what are the norms that ought to be upheld) and technical (what is currently possible) perspectives inevitably intertwine, even as there needs to be an awareness of the choices that can be made. Understanding the interactions between technologists, society, legislation and regulation is therefore central to shaping the Future Internet and the applications and services that are emerging with it [5; 6]. In this chapter we will investigate the societal aspects of the Future Internet through the lens of the perspectives of social scientists, policy makers and technologists involved in EC projects within ICT Challenge 1 who are responsible for making the Future Internet a reality.

How the Internet pervades our lives, professionally, commercially, politically and within the context of our leisure activities is an important question for Europe and beyond. Boosting the EU's research and development efforts is a key element of the *Digital Agenda* for Europe [2]. EU-funded research aims to make the Internet of the future a dynamic place for innovation, growth and jobs. The European Commission is currently reviewing the progress of some 140 "Future Internet" research projects which it supports. Given the relevance of some of the planned actions in the Digital Agenda for the workshop participants and their proximity to several themes included in the programme, it was considered important to learn more about their familiarity with this EU instrument and also to understand the value it provides to their current activities. Therefore ten workshop participants were interviewed on this topic.

The purpose of this article is to discuss societal issues which affect the development and success of Future Internet technologies based on the collective thoughts and views of social scientists and technologists working on Future

Internet research in EC Challenge 1 and beyond. The specific socio-economic topics discussed during the workshop 'The Future Internet: The Social Nature of Technical Choices' organized by the SESERV consortium[176] were based on the results of an online survey circulated among the Future Internet community. The structure of this chapter is as follows: in Section 2 we discuss the socio-economic topics that emerged via representatives of Future Internet projects and how these relate to the challenges and barriers they face in their development work. Drawing on these discussions, we identify eight cross-cutting strategies that provide potential resolutions to these socio-economic challenges and barriers (Section 3). Finally, in Section 4 we identify how relevant the EU Digital Agenda is to the Future Internet technologists and examine the value of this EU instrument for the project they are involved in.

2 Societal Concerns and Challenges

The Future Internet Ecosystem is now a complex and dynamic socio-economic space. In 2010, the Internet Society defined something it called an 'Internet Ecosystem' [7]. The stakeholders in this exercise came from a traditional infrastructure perspective. In recent years, however, the rapid convergence of technologies has increased the scope of stakeholder engagement with the Internet way beyond what was originally envisaged and described by the Internet Society. The European Future Internet initiative has been at the forefront of such developments both within the core ICT programme and the Future Internet Public Private Partnership (FI-PPP) initiative [8]. Thus a number of different models have been proposed for who the stakeholders might be within a Future Internet ecosystem. In these new models we see a significant increase in the diversity of roles; an increased emphasis on users in addition to previous infrastructure; and a blurring of roles between major market players [9]. The concerns of the Internet have moved from structures purely targeting transport and delivery of data - to socio-economic structures supporting exchange of information and knowledge according to the values of individuals and communities.

Figure 1: The Future Internet Ecosystem [9]

Many societal concerns emerge as a consequence of Future Internet research and development. Relating these specifically to the Future Internet ecosystem rather than to more general societal issues is essential for engaging Challenge 1 projects in debate. Two recent reports, *Social Impact of ICT Studies* [10] and *Towards a Future Internet* [11] were used to identify 16 societal concerns (via content analysis of both documents) for the Future Internet that raise significant technical, commercial and regulatory challenges (Table 1):

Table 1: Societal Concerns for the Future Internet

[176] SESERV (Socio-Economic Services for European Research Projects). See http://www.seserv.org

▪ Regulation	▪ E-democracy
▪ Privacy	▪ Digital Citizenship
▪ Online Identity	▪ Digital Inclusion
▪ Green Issues	▪ Online Communities
▪ Security of Communications	▪ Internet of Things
▪ Content Regulation	▪ Consumers and Suppliers
▪ Cloud Computing	▪ Distributed Knowledge
▪ Trust	▪ Cybercrime and Cyberlaw

Through an online survey, 98 representatives from FP7 Challenge 1 projects rated the relevance of the above listed socio-economic topics for the technology they are developing, or research they are undertaking on a subjective scale from "Not Relevant" through to "Absolutely relevant, a key issue". The following six key social and economic issues were identified as being of most interest to Challenge 1 project members: *Privacy and Data Protection* including user data, file-sharing control, selling of personal information; *Online Identity* including anonymity, digital presence, rights to delete information; *Security of Communications* including legal implications*; Online Communities* including social networks, virtual relationships; *Internet of Things* and the connections between people and devices; and *Cloud Computing* including the risks and benefits of virtual access to information. Some topics - like Green Internet and Cybercrime, as well as Digital Inclusion - seemed to be disregarded by all projects. Others, like Content Regulation, are regarded as important to only a few [12].

During the workshop and seminar held at the University of Oxford in June 2011, experts in Future Internet technology engaged with researchers such as social scientists (including economists), policy experts and other stakeholders to explore the socio-economic aspects of the Future Internet, and conversely how the Future Internet will affect society, government, and business [13].The workshop aimed *to bridge the gap* between *those who study* and *those who build* the Internet. Special break-out sessions on each of the six key social and economic issues were organized to facilitate a more focused discussion between the 69 participants. The next sections give a summary of the societal concerns and challenges discussed in the 1.5 hour break-out sessions.

2.1 Privacy and data protection

As the Internet becomes more integral to the way we live our daily lives, end-users are becoming increasingly aware of the dangers of making too much information available publicly [14]. People's careers and personal lives can be severely affected if they do not consider carefully what information (including multimedia – photos, videos etc.) they disclose online. Certainly there is a trend towards increased privacy awareness. But while attitudes towards privacy are changing significantly – for many, the level of privacy concern is decreasing. This raises some interesting questions about the role of future research into privacy and privacy-enhancing technologies.

The low-point for privacy was reached in the first decade of the millennium. The enthusiasm of users for Internet applications (Web search, Web publishing, social networking, etc), combined with a neglect for basic security by the application operators led to a free-for-all. The abuses at this point fell into two main classes. First of all, users found that information about their activities in one context (e.g., social life) was publicly accessible and could be used against them in another context (e.g., professional life). And secondly, users found that even information that was supposedly confidential (e.g., between themselves and the service provider) or restricted (e.g., to a select group of friends) could be viewed and sold for commercial gain.

Uncovering supposedly confidential data involved some modest effort, so typically the victims of confidential data disclosure were persons of some notoriety. For most users, the main concern was the extent to which they were making information public. People are now addressing this concern by allowing less of their content to be published for anyone to see. This improvement in general awareness will make Future Internet applications safer (e.g., customers and regulators will demand that smart grids and location-aware services protect user privacy).

However, while this low point may have passed, privacy is still heavily compromised by a lack of deeper awareness as much as by technical or cost issues. Users supply huge amounts of personal information to service providers with every post, query or click in applications like Google Search, Facebook, and Twitter. Users benefit from this data exchange because they can use search technology, social networks and the like without charge. Yet the relationship between citizens and service providers is highly asymmetric, and the resulting loss of privacy for users and bystanders is profound. The providers of these services exploit this content in a wide variety of ways: to attract a larger audience share since those who provide data may themselves become users; to classify users based on their personal data (profiles and traces), allowing personal characteristics to be extracted and used to 'improve' the service; to classify and index data (including personal relationship data) which allows the service to be further enhanced; to create personalised advertising; and to provide information to other organizations including businesses and governments, for payment and/or to meet legal obligations.

The most successful Social Network Sites or online retailers (such as Amazon.com) are now among the largest and most profitable businesses on the planet. Yet they typically accept no responsibility for user-generated content, leaving the users to bear any liabilities[177]. Users can publish sensitive, sometimes scandalous information about third parties or each other, which is propagated freely by the service provider, often attracting large audiences. The victims have no protection and very limited recourse. They can ask the service provider to remove the offending content (after the damage is done), or they can sue the user who posted it (if the service provider reveals their real identity, and that user falls under a jurisdiction to which the victim has access).

The trend is towards an increase in asymmetry as service providers improve their exploitation and find new opportunities to capture personal data from their users. Personal data is increasingly available to the service provider and (if it serves their purpose) to other users, commercial customers and government agencies. Freedom of choice is being eroded as the services provided (Web searches, online shopping, etc) are increasingly filtered based on the provider's analysis of user preferences. The risks from widespread disclosure - should the provider be hacked or forced by government agencies to release information - are growing ever greater. European privacy regulations provide little protection due to technical and jurisdictional limitations and this may make it harder for European service providers to innovate and compete in a global market.

Privacy clearly goes hand-in-hand with issues of security and trust. It is reasonable, therefore, to expect appropriate technical and procedural protection in support of users once they are online. To some degree, users may have unrealistic and exaggerated expectations of such technical provision for privacy. However, it is equally true that users themselves should be able to make appropriate judgements about suitable protection and data management. Thus the blanket application of regulation is neither appropriate nor necessary. Instead, examining how users behave and *wish* to behave may help determine what is really required.

2.2 Online Identity

Online identity is closely and inextricably related to issues and relationships between data, privacy and rights (including, though not limited to, digital rights). The concern today has switched to the more fundamental question of how identity is to be understood within the context of (user) interactions in different socio-technical environments. It thus becomes necessary to examine the relationships between data (all data/private data) and identity.

Identity is not easy to define, and current definitions diverge. Still, some common baselines and vocabularies are needed to enable a multidisciplinary discussion of identity. Society conceives identity as stable: identity in terms such as surname and passport and the like is assumed stable by policy-makers and in terms of social norms. Yet, in scholarly discourses and research on identity, identity is often characterised as inherently dynamic (changing over time and context). In addition, individuals might very well experience their identity as fluid or develop multiple identities [15]. This clash between these two opposing stances is currently not sufficiently addressed.

This gives rise to a number of socio-technical challenges. First, there is a need for developing tools for managing online identity, including multi-scale filtering of content. End-users could benefit from having a set of tools to assist in the management of their online identities across platforms. As applications are increasingly tied to each other, users need assistance in understanding the implications of these connections for the sharing of their data and of their identity/-ies. Designing tools that enable multi-scale filtering of content by users (e.g. by giving more control of what information is accessible to whom) is an immediate challenge to be addressed.

Secondly, in an online/networked environment, users leave digital footprints behind. These footprints are data that can be harnessed or misused by third parties. In addition, more sophisticated methods for analysing large-scale data from, for example, archived system logs, mobile phone usage, and other online interactions make it possible to identify individuals based on their preferences, patterns and social networks. This places an increased onus on developers, legislators, third parties and researchers to disclose the degree to which data reveal identity. A further challenge is to find ways to anonymize individuals – both their data and identity – as well as to cater for justified tracking (mobile phone use and associated billing).

Thirdly, currently anonymity cannot really be guaranteed online and individual users can, with some effort, almost always be identified. Hence it is important to determine which levels of anonymity should be allowed under which circumstances and in which contexts. This also raises the question whether anonymity should form part of a more general set of digital rights. Extending these points, one challenge then is to develop features that allow for increasing levels of transparency for end-users whereby individual users are made aware of the level of, or lack of, anonymity that systems allow for.

[177] Though this is not always the case, e.g. Italian law puts the onus on the service provider.

Finally, the right of an individual to disappear poses specific problems: this is not a question of legislation in the sense that legal protection can be provided both for victims and perpetrators. Instead, this relates directly to the interplay between an individual's rights and those of the community. The question is whether there are occasions or events so significant or horrific that they should never been removed; when an individual's identity online cannot be "protected" for the common good.

2.3 Security of Communications

Security of communications is neither about privacy nor data protection and management in the face of any new invasion of privacy, nor about forms of identity and anonymity in the digital context. Instead, it is about managing the risks to the smooth functioning of business and of critical and non-critical infrastructures, to financial stability, and to personal security and trust. Security in this context, therefore, is about risk management.

Cloud computing is a fundamental component within the Future Internet ecosystem, with clouds providing their customers with instant access to large-scale data storage and processing facilities. While cloud computing could provide access to vast resources, clouds raise concerns about the risks they pose to users and societies. For instance, what if cloud providers or their customers were malicious? Protecting the data is another issue. When we look at the security challenges, we are – by default – getting into the problem of data protection. If we cannot protect the data, how can we guarantee that the services can be protected?

For cloud computing there are significant non-technical issues and challenges. Who is (or should be) responsible for meeting the security threats of clouds? The operator of the cloud? The developer of applications that access and use them? The customer for those applications? The bystanders affected by them (e.g., the victims)? Social or governmental agents (e.g., police, social networks)? And in such cases, how can responsibility be attributed? Do you impose responsibility by regulation, or self-regulation by market actors? There are also concerns arising from how the responsibility to protect from security risks is assigned. One extreme scenario could be that the cloud provider becomes the key party responsible for the cloud. Yet this could have worrying implications for the degree of freedom of users. In contrast, the implications of having little or no regulation could be risky in possibly preventing parts of the innovation. Will the responsibility and potential liability deter anyone from offering innovative Future Internet services? Will the potential impact lead society to make laws to prevent these innovations? And how will such laws be handled across national borders? There are no easy and general solutions. Aligning legal measures between countries is of particular importance here: if service providers are unable to do this, they may not be able to operate across borders. At the moment no cloud providers explicitly accept responsibility.

Security can be addressed via technical requirements, but the more difficult emerging challenges are socio-economic: what are the obligations of those who did not expect to be supporting these services? Access to risk expertise and managing risk are essential. A cloud provider has a team of security analysts or information security analysts, and large corporations employ legal services firms. Others, however, may not have access to risk experts or be able to cope with security threats. Most medium and small scale companies cannot afford to hire technical risk analysts in addition to lawyers and other experts. Similarly, domestic users will for the most part have to trust the information they are provided with.

The problem with legislation as a solution is that cloud providers typically do not operate in a specific country and different countries have different laws. Also even though they have to comply with existing EU legislation concerning storage and privacy, the nature of the cloud brings new risks. Many SMEs are thinking of moving their regular ICT needs into a cloud and for a smaller company, it could be better *not* to have many policies and regulations, especially as they often lag behind innovations. Service providers could be compelled to manage the risks, and customers need to trust the infrastructure provider. But if users feel they are being closely monitored, they might not feel comfortable with the service.

One possible solution would be to leave security to the market, with customers avoiding services that they find too risky. But the *laissez-faire* of a completely free market is not enough to manage security risks. There is a need for regulation, and one simple approach could be to force cloud service providers to publish statistics about the health of their activities and their monthly attacks. On that basis, a government authority or a third party could check these. Yet information about security is also very sensitive, which means that service providers might not be willing to reveal these data. Hence there is a need for transparent metrics for comparing 'trustworthiness' and auditing standards to ensure that what service providers publish is credible.

2.4 Internet of Things

Definitions of the Internet of Things vary. At a minimum, the Internet of Things can be thought of as including all manner of mobile devices, including telephones, PDAs and sensors and equipping them with "intelligent" and large-scale data analytics. The key ingredient is the seamless interaction between different systems: Internet of Things technologies are bringing data together to create new services. The promise of the Internet of Things is to use online

technology combined with sensors which might automate the surveillance and management of the more mundane aspects of life (food purchases which are linked to fridge monitors; automation in the home; and so forth). But these social benefits could be outweighed by unresolved issues around trust. However, trust in this context extends beyond specific concerns about security and data protection; and there is now a decided interest in involving users in the design and development of applications with an awareness of ethical implications.

Many barriers have been identified for the adoption of Internet of Things within the Future Internet ecosystem. First, participants indicated that the currently used definitions are too abstract and hard to grasp. They are too academic and do not focus enough on design and applications. This is partly due to the lack of interaction between the actors in the design and applications domains. Furthermore, multi-device Internet of Things interaction does not have a well-developed vocabulary, and it is therefore difficult to facilitate effective discussions about the design of the Internet of Things. Currently, design development is characterised by 'doing' rather than by reflexivity and deliberations about design. Another barrier is that the general public perceives Internet of Things in terms of Big Brother: 'Smart' applications tend to be received with scepticism by the general public. One example is the 'smart' bins in London that were provided with sensors [16]. These were quickly labelled 'spy'-bins. Technologies are framed as having autonomous forces. In popular discourses, technologies are often being described as independent and intelligent agents acting autonomously and people as being 'affected' passively. Changing this attitude and the underlying technologically deterministic view would help to inform design.

Internet of Things technologies are predominantly designed for domestic purposes, such as the interactive 'intelligent' Internet fridge. Yet there is a lack of creativity in that new applications should be implemented in existing infrastructures such as transport systems and health applications to make these environments more intelligent. Additional challenges concern data: these new technologies generate vast amounts of data. Individual systems, however, are not able to harness the data because there is no common agreement on what to do with it. This generates the need for an 'intermediate' level of technology to help understand data on individual system levels. At the same time, the challenge is to design tools that can harness the generated data independent of the tool itself. A further difficulty lies in determining boundaries between public and private data. One example is the 'passive' monitoring of mobile phones: Walking around with mobile phones switched on, users can be tracked at all times. But where are the boundaries between, for instance, public and private spaces, or public spaces and consumer goods? There is a need for transparency here, and advantages and disadvantages (e.g. spam risks) need to be weighed against each other. Users could, for example, be presented with different levels of 'sign-off' options. Privacy concerns need to be balanced here against the possibility of generating moral panics, which can only be avoided with greater awareness. And it is vital to provide opportunities for 'offline' access to services for users who do not use online technologies. 'Opting out' currently penalizes people, which should not be the case.

Finally, as ever, there may be unintended consequences. An example from the health sector: Some elderly people have sensors implemented in their homes, measuring levels of moisture. While such sensors can help alert carers, they might also result in new practices, in which human expertise is replaced by automated sensor-network data analysis. These need to be taken into account.

2.5 Online Communities

Social media has grown rapidly – today nearly 4 in 5 active Internet users visit social networks and blogs [17]. One in every five minutes of time online is now being spent on social networking sites, up from a mere 6% in early 2007. Social networking sites reach 82 percent of the world's online population, representing 1.2 billion users around the world [18]. Online communities centre on how users interact with and exploit the range of social networking applications (e.g., government, leisure and work). Most social networks aim to increase participation and maintain their user communities. A critical success factor here is to maximise activity, which is largely achieved irrespective of the purpose of the communication between individuals. However, it is also necessary to comply with data protection legislation and this is also a legal requirement for European providers in relation to responsibilities and individual actions (e.g. consent). Herein lies a contradiction: Privacy compliance, often promoted as a means to increase trust and hence participation, can also act as an inhibiter to greater activity and participation. Individuals use social networking sites because their perception of risk is considered low enough for participation, yet the perception of and appetite for risk dictates levels of participation almost regardless of associated regulation.

This leads to an interesting challenge for European service providers and research projects: How to strike the balance between participation and privacy - if it is desirable to monitor and mine data - without violating a citizen's right to privacy. Architectures that facilitate communication between individuals irrespective of purpose have been an important source of innovation for the Internet. It is unlikely that the successful paradigms of the last decade, social networking and clouds, would have prospered if they had had to take compliance to the European regulatory environment into account from the start. Each new paradigm has focused on promoting the benefits and opted for weak privacy positions. The try-it-and-see approach has allowed for a privacy balance to evolve over time as participants

explored their preferences rather than having them analysed in advance by security experts. Social networking has in fact been a large experiment in people's appetite for privacy.

New key technologies relating to online communities can be understood in the context of social media such as micro-blogging and social network sites: An application like Path (for iPhone), for example, introduces the idea of limited friendship networks based on the Dunbar[178] number. Thus, the application is about enabling users to better control what information is shared with online social networks. Other key new technologies include the live synchronization of social networking content to multiple networks, in particular user profiles.

Online Communities highlight the basic dichotomy: is it technology or society which shapes the ICT future? The answer for now at least is that there is a real need to back off from technology for technology's sake and begin to take seriously *how* communities are formed and *what* they do online. This would not only move the focus towards societal behaviours and away from technology, but also require appropriately skilled cross-disciplinary researchers with an understanding of these communities as well as the success factors that underpin healthy and vibrant online communities.

A particular challenge for online communities is the linking of systems while maintaining user control and user-centredness. User-centric platform-bridging applications with transparent filtering options can be developed to synchronize content across platforms and networks. Here users should be able to manage and control their information sharing easily with the online communities in which they take part. A further challenge is better tools for managing online communities. Examples are tools for managing smaller community hubs that mirror the theoretical cognitive limit for social relationships (c.f. Dunbar's number). Another example is awareness of the limitations and strengths of smaller online communities (e.g., less information is accessible). Further, there are privacy concerns over sharing information and publishing content online, and perhaps more and smaller online communities could be one way of handling privacy issues. The right to be forgotten (have online content permanently deleted) is also a possibility, though, as stated previously, it would not necessarily include acts in the public sphere such as a right to allow actors/entities to delete information about having committed crimes against humanity: this is a prime example of community interest influencing or overriding generic legislative constraint.

Finally, users make innovative and creative use of systems and applications in the development of online communities, and one challenge is to facilitate structures for translating the creativity of users to improve these systems. Technologies are not the only drivers in the development of new types of online communities where different community structures may be required for sharing or co-creating content. There is a need to balance bottom-up and top-down technology development, and to involve the community members in the development of those communities.

2.6 Cloud Computing

Just as energy production benefits from economies of scale when consumers transfer responsibility of energy production to an electrical grid for centralised production, so those needing ICT resources benefit from a move away from individual and fixed investment in local resources to exploiting cloud facilities. Clouds provide economies of scale and optimise resource use across multiple users and applications, and Europe could gain significantly from the resulting new business opportunities. It is claimed that the EU lags behind the rest of the world when it comes to cloud computing, but there is also enormous potential, not least because much of European enterprise is SME based for whom investment in large and under-used ICT equipment may not be economic. Early end-user engagement is critical to direct investment and design. At the same time, of course, issues of trust and security cannot be overlooked and these need to be tackled alongside interoperability and portability.

There are a number of barriers to the adoption of cloud computing within the Future Internet ecosystem. One significant barrier is the lack of a global legal framework. The global nature of cloud computing (often with distributed assets) requires consistency in laws across jurisdictions (e.g. to notify data access breaches). International coordination is important here but also bottom-up feedback from users. Definitions also pose problems with clouds: some definitions refer strictly to infrastructure design while others are broad enough to encompass nearly all online activity. At a minimum, cloud computing is the ability to provide a service on top of which users can create their own solutions. Another barrier is that EU discourse focuses on risks and less on benefits, especially economic ones. Furthermore, the EU is at times slow in adopting or focusing on new technologies, with the prolonged emphasis on grid computing instead of cloud computing a good example.

User concerns relate largely to control. Participants agreed, for instance, that there is a need for more transparency and user control. Contracts vary greatly between different providers and often do not allow users control over where

[178] The number of people we are able to maintain active social relationships with proposed by R. Dunbar [19].

their data is stored. In addition, many companies run services on a third company's cloud infrastructure. This may not be clear to the end-user who doesn't deal directly with the cloud provider and yet relies upon the provider to secure the data and provide the actual service. Security in general is a concern; however, the perception of security by users is tightly linked to questions of transparency. Further, designing for interoperability and portability while allowing customization is a potential concern. Portability will allow users to move from one cloud provider to another and avoid platform lock-in. The user can thus benefit from the infrastructure without knowing the underlying technology in detail. Finally, privacy concerns were raised by participants: Cloud providers can potentially gain a large amount of meta-data about the activities, locations, and contents of user interactions with their services, and greater disclosure about what data is collected and how it is handled would be appreciated.

3 Cross-Cutting Resolutions to Socio-Economic Challenges

The discussions in Section 2 yielded recurring strategies which, as we shall now see, provide eight cross-cutting resolutions to the socio-economic challenges identified.

3.1 Call for Increased Transparency

A dominant trend across all the discussions was a call for increased transparency on all levels for end-users of networked ICTs. Systems and applications should offer end-users tools that allow for the filtering of information and sharing of content in order to ensure that end-users know exactly who has access to, for example, the contents of their online social network. Advanced transparent filtering options are becoming increasingly critical as more and more online networks are being synchronized, as are tools that assist users in managing their various online communities.

Transparency also relates to ISPs and data storage, particularly with the move towards cloud-based services. As mentioned, many companies run services on 3rd party infrastructure which is not sufficiently transparent to end-users. To make security risks more transparent for end-users, providers could, for example, publish monthly statistics on attacks. End-users should also be able to easily identify where and how their data is stored and also how their data is or will be used.

3.2 Call for More User-Centricity and Control

Discussions converged on a call for more user-centricity and control. A prominent theme here was the need for increased user-centricity in the design of applications. Going further, users could be allowed some means of influencing applications/systems on an ongoing basis; creative uses could feed back into systems to improve them and innovate further.

A common theme here is the latent scope for much more user control. Control is particularly evident in the context of opt-out options: users should be able, in a more granular manner, to opt out of services or elements of services. Additionally, a range of different choices for how user data is stored could be offered (e.g. a server's geographic location). Finally, users should have better ways of assessing and controlling their security risks and risk management.

3.3 Continuing Need for Further Multi-disciplinary Bridging

Without exception the discussions called for greater multi-disciplinarity and bridging across sectors. While it is easy to call for knowledge-exchange, dialogue and collaboration across and beyond academic fields, industry, developers, designers and users, the discussion also identified gaps, for example, between privacy researchers and Internet of Things engineers, or between eHealth practitioners and IT suppliers.

Potential ways to ensure further multi-disciplinary bridging is to create frameworks for knowledge exchange between users, developers, regulators and researchers. Another way to avoid 'siloization' or 'pillarization' is to facilitate connections between, for example, technical and legal analysts to develop a better understanding of risks. The expertise of different communities should bring a range of diverse human resources into all - including early - stages of technology development and design, and these will only come about via multi-disciplinary engagement and institutions such as research centres.

3.4 Striking a Balance between Extremes in Debates and Design

A cross-cutting theme that emerged across several discussions (including Online Identity; Online Communities; Internet of Things; and Privacy) was a call for more balanced approaches in design avoiding dichotomized thinking. In terms of identity, for example, it was argued that there is a need to balance the viewpoints of identity as either singular and stable (e.g. passport) or multiplex and completely fluid and dynamic. How identity is perceived, of course, has consequences for system design, and so there is a need for more nuanced views and multi-disciplinary insights, which include an acknowledgement of identity as existing on a continuum from stable to dynamic.

Similarly with respect to design, there is a need for balanced approaches which include bottom-up and top-down innovation, as when new forms of communities emerge that are potential drivers of technology development.

Elsewhere, eHealth privacy practices and perceptions suggest another balance to strike: As far as patient records go, for example, it might be beneficial to seek a middle ground that allows proportionate access rather than relying on either *laissez-faire* approaches or over-formalization (extreme regulation) of access, as is arguably currently the case.

Discourses on privacy issues tend to lack balance, for example, between privacy concerns and the affordances of given technologies: the Internet of Things technologies, often perceived as 'big brother' surveillance, provide a good example.

3.5 Facilitating the Development of Digital Literacy

The need for greater digital and media literacy education was expressed across the sessions on Security, Privacy, Identity and Online Communities: The core concerns related to user ability to critically manage privacy and identity concerns. Arguably, digital literacy skills can equip users with more sophisticated tools for managing and understanding identity in online and hybrid contexts and thus solve some of the problems encountered with privacy concerns. Security risks could be managed better if best practice guidelines were available and there was more awareness. This theme points to some of the non-technical social barriers and challenges that need to be addressed alongside the design and development of socio-technical systems.

3.6 Addressing the Lack of Common Vocabularies and Definitions

Common vocabularies and better definitions (Identity; Internet of Things; Online Communities; Cloud Computing) have the potential to be enablers: In cloud computing, for example, current definitions are diverging: some refer exclusively to infrastructure, while others include social uses and online activities. For definitions of the Internet of Things the problem is that they are currently too academic, lack focus on design, and are therefore difficult to apply in technology development. For identity, there is a need for definitions that acknowledges that identity is closely related to questions of privacy, data and rights in digital contexts.

Common vocabularies can support the development of new technologies and ways of engaging with them, yet at present, these are lacking, for example, in the case of the multi-device Internet of Things. Likewise, a more advanced vocabulary is needed to describe, for example, the maintenance, structure, and scales of online communities. Seen in the light of the call for multi-disciplinary bridging and collaboration, there is a need for an adequate vocabulary and definitions that can be applied across sectors and contexts.

3.7 Need for Clarity about Digital Rights and Digital Choice

The discussions about Privacy, Internet of Things and Online Communities agreed on the need to clarify digital rights and digital choices: what levels of anonymity should be granted; and to whom and in which contexts? In the case of eHealth, for example, there is a need to balance an individual's right to anonymity against appropriate access to sufficient identifiers to detect and tackle emerging health issues.

Another question concerns the extent to which digital rights should include the right to be forgotten: to have information deleted. As we have seen, this right might not apply to information in the public sphere, as with content that has a historic or humanitarian value - holocaust-related information being one example. Digital choice can be exemplified in relation to the Internet of Things, where off-line alternatives should be available: Here digital choice relates to the right to not make use of technologies, without being penalized.

3.8 Enabling Global Regulatory Frameworks

Global regulatory frameworks are particularly pertinent to the discussions of Security, Online Communities and Cloud Computing. Suggestions here include consistency across jurisdictions for data breaches as well as for anonymity (conditional on domain, e.g. politically sensitive topics). Increased trans-national legislation could ensure that providers are not discouraged from operating in certain countries (for example if a particular country holds providers liable for IP infringement by users).

4 The Future Internet Community and the Digital Agenda

ICT is regarded as increasingly critical for the future growth and development of Europe. The *Europe 2020* [20] document outlines the main challenges and opportunities over the coming decade. Together with the *Digital Agenda* [2], these identify the immediate risks and challenges and outline appropriate coordination, including for the Future Internet. The overall aim of the Digital Agenda is to "deliver sustainable and social benefits from a digital single market based on fast and ultra fast Internet and interoperable applications".

At the centre of the Digital Agenda is an assumption about the mutual reinforcement between innovation in the ICT sector and consumption which, in turn drives technological improvement. This *virtuous cycle* runs something like this: if there are attractive services and content available online – and the content is assumed to be available uniformly across all member states – then this will motivate increased demand. More users will want to access the content and services,

and will be looking for more and improved content and services. Increased demand in turn provides the necessary financial basis for improvements in the supporting infrastructure with increased bandwidth and speeds. This investment in turn enables ever more sophisticated service and content generation and support, and so on.

Against this background, the Digital Agenda recognises some seven major challenges or *obstacles*: fragmented digital markets, lack of interoperability, rising cybercrime and low trust, lack of investment in networks, insufficient R&D, lack of skills, and fragmented answers to societal questions. These obstacles relate principally to infrastructure and commerce. Ultimately, the *virtuous cycle* can only operate if these obstacles are addressed effectively.

The discussion in the previous sections has highlighted that the Future Internet is of interest to many different stakeholders, and particularly the role of *users* in terms of improving technology design and alleviating fears around privacy and security risks. These social aspects should not be down-played in the Digital Agenda. Along the same lines, the focus on infrastructure and cross-border eCommerce fails to give a central place to end-users. The assumption of the *virtuous cycle* is that, given the right environment and the right content and services, end-users will participate - not least as consumers. If that is the case, considerable effort needs to be invested in understanding the *use* of services (for example, generating content), including the inhibitors to online activity.

The Digital Agenda needs to engage closely with the Future Internet community. Knowledge of the aims and relevance of the Digital Agenda is highly variable across many European ICT projects and actors. A number of informal interviews with participants in this community were conducted, and while these cannot be construed as representative, some common observations might be made: the projects in this community had little widespread understanding of the aims of the Digital Agenda. If familiar at all, the *Digital Agenda* tended to be seen as remote and irrelevant to the specific concerns within the projects themselves. Europe may set its agenda and indeed provide the appropriate motivation for technology research and advances, but its relevance and meaning for projects is unclear. There is also a perception that governments and the EU should not seek to micro-manage projects: if innovation is to deliver, a large amount of autonomy is required. Especially in discussions of the *Internet of Things*, it was argued that for designers and business developers, the Digital Agenda can be experienced as a restriction on new business plans and technology designs. This also affects the global competitiveness. Notwithstanding such views, there was a general consensus that the Digital Agenda is central to taking Europe forward technologically as well as socially: though the high level nature of the Agenda and the lack of global relevance beyond the EU may weaken it, as an instrument for future strategy, technologists and social scientists have much to contribute to the Digital Agenda and *vice versa*.

5 Conclusions

This chapter has presented the views of social scientists and technologists working on the Future Internet. The community has developed possible future strategies and priorities. The results represented a snapshot of the challenges facing those undertaking Future Internet research. There is no doubt that the Future Internet ecosystem is an increasingly rich, diverse and complex environment, and Challenge 1 projects are aware of key societal concerns and challenges, and of potential resolutions to address them. In contrast, the Digital Agenda is not well understood by technologists and there is a gap between a set of high level policies and incentives that are particularly focused on infrastructure and complex regulatory processes – as against the users and future uses of the technologies being developed. Regulations currently ignore some of the concerns of citizens and there is a disconnect insofar as, in discussions with Challenge 1 projects, it seems that not even the 'stakeholders' of the Future Internet are fully aware or interested in the Digital Agenda.

The EU Commission needs to find a way to update a Digital Agenda in response to the needs of a broad spectrum of people and communities rather than focusing only on big companies or governments. For instance, rural and remote regions, non-organized communities and even SMEs seem to be under-represented in this policy aimed at 2020. Put differently, different 'soft' design mechanisms may help the Digital Agenda to adapt to the social, political, educational, labour, and environmental needs of the community. If the Digital Agenda is not embedded in the principles of openness, adaptability, participation and transparency, it is hard to see how it will succeed. Supporting technologists in their understanding of the potential broader impacts of the Future Internet and its adoption through dialogue with social scientists must be central to this effort. To realise the benefits for the widest possible range of stakeholders, there will need to be increasing engagement between those that study and those that build the Future Internet.

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Appendix II: List of Focus Group Participants

This appendix is for internal EC review only, and not for circulation. Participants were promised anonymity in their answers. Two focus groups were held at the following locations:

1. Digital Social Research, A Forum for Policy and Practice,[179] Oxford, UK (13 Mar 2012). Topic: Multi-disciplinary collaboration.

Participants	Affiliation
Theresa Anderson[180]	University of Technology, Sydney, Australia
Judit Bar-Ilan[181]	Bar-Ilan University, Israel
Jeff Boase[182]	Ryerson University, Canada
Christine Borgman[183]	University of California, LA, USA
Cornelius Puschmann[184]	University of Düsseldorf, Germany
Diane Sonnewald[185]	University College Dublin, Ireland
Peter van den Besselaar[186]	VU-University, Amsterdam, The Netherlands

Facilitators	Affiliation
Eric Meyer (Lead facilitator)	Oxford Internet Institute, UK
Ralph Schroeder	Oxford Internet Institute, UK
Anne-Marie Oostveen	Oxford Internet Institute, UK
Cristobal Cobo	Oxford Internet Institute, UK

2. Future Internet Assembly meeting[187] in Aalborg, Denmark (10-11 May 2012). Topic: User-centricity.

Participants	Affiliation
Freek Bomhof[188]	TNO Delft, The Netherlands
Ingrid Moerman[189]	Ghent University
Magnus Erikkson[190]	IT University of Gothenburg
Peter Ljungstrand[191]	IT University of Gothenburg

Facilitator	Affiliation
Anne-Marie Oostveen (Lead)	Oxford Internet Institute, UK

[179] http://www.oii.ox.ac.uk/events/?id=487
[180] http://datasearch2.uts.edu.au/cpce/members/detail.cfm?StaffID=1659
[181] http://www.biu.ac.il/faculty/Judit/
[182] http://www.ryerson.ca/~jboase/
[183] http://polaris.gseis.ucla.edu/cborgman/Chriss_Site/Welcome.html
[184] http://ynada.com/
[185] http://www.ucd.ie/sils/staff/professordianehsonnenwald/
[186] http://www.vandenbesselaar.net/
[187] http://www.future-Internet.eu/home/future-Internet-assembly/aalborg-may-2012.html. Note that this session was in addition to the official FIA sessions to which SESERV contributed. WP3 and WP2 both contacted participants in advance and planned logistics for access to a small room suitable to hold the focus groups.
[188] http://twitter.com/freekbomhof/
[189] http://ibcn.intec.ugent.be/?q=members_ingridmoerman
[190] http://www.iis.gu.se/english/contact/more-about-magnus-eriksson/
[191] http://www.tii.se/node/2574