

Future Internet Expert Workshop 15 March 2010, Boston

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Contents

1. Introduction.
2. Scenario overviews.
3. Scenario key discussion points.
4. Summary of potential 'desirable' and 'undesirable' scenario features.
5. Future priorities.

Introduction

The goals of the workshop were to:

1. Compare four different scenarios, in terms of their social and economic impact in order to better understand which elements from each are the most desirable for a more sustainable (or otherwise better) world.
2. Understand how current technological, social and economic trends would lead to the different scenarios proposed.
3. Understand how policy options (e.g. network neutrality) impact the emergence of the different scenarios.
4. Articulate what the future priorities for ICT research in Internet architectures and infrastructures should be.

Scenario overviews

1. 'Smooth Trip': the knowledge-based Internet economy

- Omnipresent and pervasive Internet access.
- Education and health services key.
- Work and relationships increasingly conducted remotely.
- Digital divides slowly narrowed.
- Development incremental in response to commercial and public needs.
- Mobile technology, Internet of 'things' and environmental sensors.
- Strong consumer protection regulation, privacy and control.
- Some government restrictions on access in line with legal and cultural norms.
- Some businesses use increased controls to capture greater revenue share.

2. 'Going Green': the green Internet economy

- Internet is foundation of a sustainable society and an emerging green economy.
- Monitoring, controlling, adjustment, management, automation and substitution of carbon-intensive activities.
- ICTs become much more energy-efficient.
- ICTs key to disaster response and recovery.

- Home working becomes norm; telepresence replaces much business travel and some tourism.
- Social networking tools reduce social divisions within and between nations.
- Remote regions and developing countries highly connected as the basis for outsourcing of much information work.

3. 'Commercial Big Brother': the commercial and entertainment Internet economy

- Internet largely commercial channel for entertainment, retailing and advertising.
- High-speed access is built into the home only with government subsidy and removal of regulatory constraints, strengthening large ISP dominance.
- Immersive, interactive video content consumes most user time and bandwidth.
- Access mainly through DRM-heavy proprietary hardware.
- Merged ISPs/search engines/social networking sites offer walled gardens featuring high-quality access to video content and interactive services.
- Tacit cooperation between governments and providers to block controversial content.
- Users are intensively profiled to support targeted advertising, with no effective global privacy regulation.
- Security concerns used to justify lock-down of network.

4. 'e-Demos': the people centred Internet society

- Power progressively migrates to the people in a user-built 'Connected Society', based on collective and distributed generation and sharing of knowledge, which enables a collective "extended awareness" of any global and local issues.
- 'Prosumers' have a wide choice of net access, easily-programmable devices and tools to build shared secure environments for work and leisure.
- Strong political demand for user rights such as privacy, free expression, transparency, trust, fraud-resistance, consumer protection and fair, honest governance.
- Much stronger participation in online communities, also to build collective knowledge with wiki-style mechanisms.
- Freely sharing content is seen as beneficial for innovation and becomes the norm and not a law infringement to be punished – alternative economic models are developed to reward authors.
- Heavy demand in developing world for low-cost access devices leads to a global market of 10bn+ clients and peer production of many services.
- Low barriers to entry lead to a global online marketplace of billions of micro-enterprises.
- Infrastructure operators are regulated as public utilities.
- Security mechanisms collaborative rather than controlling.
- A messy and highly diverse society populates the 'managed chaos' of the Internet.

Scenario key discussion points

1. 'Smooth Trip': the knowledge-based Internet economy

Summary and general comments: This scenario would result from the current trend of rise of the knowledge-based internet economy, based on a mix of distributed participation and increasing commercial interests. Ideally, it was articulated as providing a smooth interoperable platform with a low cost to entry and easily accessible information and services. Key themes and associated issues that emerge in relation to this scenario are:

1) Policy development and implementation: Policy will have a large impact, both positive and negative, on what is available to users. In particular, policies dealing with *data protection*, *interoperability*, *IPR*, *transparency* were raised as important. Highlighted was the need to not simply copy policies from other regions (i.e. the U.S.) and to align policy with an understanding of what citizen/consumers want.

2) Open standards and access: General trend towards enhancing openness and access across people and devices. However, differences between what users want versus what businesses are willing to provide. This scenario requires a cultural willingness to share as well as the ability to filter information very effectively. Filtering becomes a key focus i.e. search engine technology.

3) Network neutrality: Seen as particularly relevant in enabling this scenario. However, it is not simply a matter of preserving network neutrality no matter what the implications (e.g. the potential damage to streaming traffic). Instead there is a need to maintain a level of neutrality but without strong enforcement or strong violation i.e. network neutrality stays the same but with some caveats, such as streaming.

4) Economic models and incentives: Economic models should remain as varied as possible in order to encourage innovation. There is a high degree of interaction between government and business, both large and small, with businesses having vested interest in government. Government and end-users both fund projects.

5) Security, privacy and control: Private commercial enterprises often responsible for security as part of the economic model— competition actually leads to more secure networks than the government's attempt to create privacy. There is a risk of a false sense of security, with tradeoffs taking place between security and anonymity. Due to the high reliance on data exchange, privacy and security issues are critical and, as a society, we become more vulnerable to cyber-crime.

6) Technological development: Developments in this scenario are based on the current architecture (rather than on clean-slate approaches), with incremental technologies and atomized self-interest. There is a risk of slow rates development and systemic technical problems in implementing new services (e.g. IPv6). Technology is developed collectively with everyone contributing a little bit to make up a larger whole and legacy systems supported. Mobile access becomes increasingly prominent as a means for accessing services and information.

7) Social inclusion and exclusion: Fear over the creation of new forms of inequality and a technical hierarchy of users that doesn't necessarily match up with the competence and skills that we have now. Issues of inclusion and exclusion not simply be linked to wealth and education (although these remain keys concerns), but there will be new forms of exclusion and the risk of forced inclusion. New forms of filtering and aggregation will emerge and alongside new forms of power and control mechanisms. Particular interest expressed in relation to aging population and developing nations.

2. 'Going Green': the green Internet economy

Summary and general comments: Questions were raised on how relevant this was to the Internet, as issues on the environment and climate change are much broader ones. Therefore, it was felt that this was not likely to be a default scenario, also because environmental concerns alone would not drive the future internet. However, this scenario was interesting to consider for the specificity of the green internet arguments, which would be a key part of any future scenario. Key themes and associated issues that emerge in relation to this scenario are:

1) Economic models and incentives: Reducing energy and natural resources consumption worldwide is clearly the main driver. However, various answers to the question of what would count as incentives emerged. On an individual level the primary incentive was seen as lowering energy bills. The importance of government involvement and its driving role were highlighted in relation to this. For example, energy efficient appliances would not have made it if not for government incentives. However, while on the one hand it was argued that government-centric economic models and incentives were critical for success of the green energy movement on the other it was argued that market forces need to be allowed to play a more active role and subsidies should be minimised. So while the rising cost of energy gives more incentive for companies to improve, subsidies may be needed to push people in a green direction. However, if energy becomes very expensive, little government motivation will be required and energy saving incentives will naturally emerge since energy is a scarce resource.

2) Energy consumption and sustainability: What actually counts as increased energy efficiency and sustainability is not always simple. Three main topics were discussed in relation to this. Firstly, where to source energy for computer data and processing i.e. Google's initiative to build server farms near sources of hydroelectric power. Secondly, sustainability issues around provision of power for increased computing services. Thirdly, questions around the disposal of technology and devices in a sustainable manner. In relation to the last of these it was suggested that end of life products could be recycled and secondary uses developed.

3) Culture norms and globalisation: Will the Internet in this context be national, global, or local? Understanding the complexity of the global adoption and control of Internet services were raised. While this scenario would speak to some audiences – e.g. Google spends more on power bills than on salaries and are putting money into alternative energy centres – some people do not believe in climate change. Businesses are moving data centres to cheaper countries, so globalisation not only has to be taken into consideration in relation to adoption but also management, control and regulation. It was felt it was unlikely that Internet services would replace travel unless government forces it.

4) Security, privacy and control: Privacy is affected in this model due to requirements for monitoring and gathering evidence against individuals. In order to monitor and hold people accountable for their energy use, data protection becomes an increasingly important concern.

5) Standards: Need standards to monitor consumption at a global level. Architectural choices, but not direct choices, e.g. gradual shift to low powered devices, Cloud services. NGN/clean slate not affected.

3. 'Commercial Big Brother': the commercial and entertainment Internet economy

Summary and general comments: It was felt this was the default scenario, the one that we are moving towards. Societal cost is distributed and the innovation in this model happens (and is funded) from those who are benefit the most. Key themes and associated issues that emerge in relation to this scenario are:

1) IPR: Copyright of content and surrounding legal issues are a huge concern here. There will be less and less control of data/information from the content creator, with the data collector or aggregator becoming stronger. In other words, the right to control will be on the side of the collector, e.g. Rupert Murdoch or music majors versus Google or authors. ISPs and telcos would also play a very strong role here (e.g. as for filtering and data inspection). There will be an enforcement and then expansion of the powers of intellectual property, with the clear objective of maximising revenues, with messy legal situations due to cultural differences in data handling, copyright laws, and questions on intermediary liability. IPR takes an increasingly important role. NGN architectures would provide the technological enablers for this stricter IPR protection mechanisms. P2P sharing would become more strictly controlled, and copyright quarrels may be used to shut down websites.

2) Security, privacy and control: Security concerns ambivalent here. On the one hand security could be seen as a driver for this scenario, to increase trust in commercial transactions, on the other this could be based on a 'just trust me argument' with no truth in it, e.g. ATM fraud. Furthermore, this scenario is expected to be based on closed/proprietary standards, which have shown to have poorer security levels than open systems that are subject to broader public scrutiny. The right to control is on the side of the collector with the data subject not having any right, which would pose concerns for privacy. Concerns about the data hosting i.e. threat of release of data due to moving the data to less secure places. Difficulties in terms of getting through the legal system of the country and then physically getting the judgment implemented and exercised. Reputation doesn't register as of crucial significance here as users don't play any active role.

3) Economics models and incentives: The economic industrial interests are the main drivers for this scenario. Economic models such as bundled services will influence uptake and use. Services with one single provider will reduce the cost and as a result affect what is provided. For example, the Google scenario, the advertising model that seems free, but is commercially paid for. Strong revenues for companies, but little for the state in this scenario. No incentives are needed as the scenario is industry-driven, and regulations or network neutrality considerations are seen just as a burden. Competing commercial interests would lead to a fragmentation of the Internet into multiple sub-internets. This may lead to closed architecture of the internet (e.g. apple ecosystem) and there is a risk that these emerging internets end up competing with each other.

4) Standards: There is a link between standards and control, but not an obvious or causal one. Some argue that open standards are counter to what big brother wants and others that open standards *are* what big brother wants. While closed standards *support 'big brother'*, open standards do not necessarily work against it. If my ISP controls my service it doesn't matter if there are open standards, they can just block access to websites, but having open standards lets users choose. Need standards on control and standards on power. Standards can become a source of economic advantage; if a standard (which can be initially claimed to be "open") is patented and it becomes widely adopted, then you have a commercial advantage

6) Energy consumption: In this scenario more is better and energy consumption could increase e.g. bigger screens or bigger data centres. However, 'going green' could become a competitive advantage.

4. “e-Demos”: the people centred Internet economy

Summary and general comments: More research is needed to understand this scenario and it was felt that this has major dependencies on the other three scenarios. It was seen as the scenario that was most favourable to user rights and the one with the least government intervention or industrial interference. Key themes and associated issues that emerge in relation to this scenario are:

1) Economics models and incentives: There is no clear source of funding, but it is not likely that this will require high capitalisation (i.e. communication meshes that don't involve large capital investment), resulting in a distributed and fragmented funding model. This scenario accommodates innovation at any level and will play out when disruptive innovations are allowed to grow. Hence, innovative and associated compensation for the community is a major motivation. Online reputation, a basic element of social networks, becomes a driving force on individual and organisational levels.

2) IPR: Will be a commons based model with less or no protection and more incentives for sharing information. Alternative economic models will emerge to remunerate and incentivise authorship, while leaving content fruition a free for all in order to reduce divides and spur innovation, e.g. from SMEs.

3) Standards Interoperability: Interoperability on different levels would be highly desirable so that groups can form and create their own networks, but still share technology and applications. Therefore, if you want to create an environment where people can share things in this scenario, you would need some standard. Network neutrality is seen as very important. Open source standards are seen as a natural solution in this scenario. As users become significant creators in this scenario bandwidth is bi-directional and standards will need to reflect this.

4) Key role players: This scenario creates interesting relations between various players. What will be the role of open source community? Government? Businesses? User/ creators? Citizens? Governance schemes?

5) Cultural norms and globalisation: The strong collaboration between people envisaged in this scenario would ease tensions between global and local services, in which different cultures affect services. Effective support for allowing different cultures to dialogue is crucial for the emergence of this scenario. But what language(s) and technology(s) will be used? For example, the Korean network is strong and independent but their technology is common to the US.

6) Security, privacy and control: it was argued that privacy is more important than security in this scenario, which is based on mutual trust, but not naively. Security is enforced by distributed mechanisms and by a kind of "online social control" exerted by all the other users.

7) Network Neutrality: neutrality of the network at all levels is a key element in this scenario, where no operator or user should be favoured against any other.

Summary of key parameters

	1. Smooth Trip	2. Going Green	3. Commercial Big Brother	4. e-Demos
Internet infrastructure	Based on current architectural principles	Real-time, data driven, mesh, cloud services	Vertically integrated	Ad hoc/mesh, data/user driven
Technological developments	Mobility based No change in archit. Principles Interoperability	Sensors Distributed network control	Streaming requires NGN or "clean slate" Walled gardens, specialized nets	Distributed control Online Reputation, Viral adoption Generalized wiki
Security, Privacy and Control	Security from competing private efforts Tradeoffs with anonymity	Sensitive to privacy, data protection	Strong Security, either real or apparent Power to data collectors	Privacy and identity more important than security
Economic models	As varied as possible. Work process evolution. Government and business support.	Natural resources consumption. May need incentives	Entertainment Driven by profits from industry, content and network providers	Distributed, user generated Innovation from the bottom
Social aspects	Social inequality	Globalisation key	No social drive	Main social drive
Policy	Data protection Moderate IPR Transparency	Energy, Environment	Strong IPR protection	No IPR protection Open standards Interconnection
Standards	Some tension between open and industrial standards Filter / search technologies key	Need global standards	Competing closed standards may prevail Open standards acceptable	Open or Open source standards Multi-cultural support
Network Neutrality	Important but not strongly enforced		Ignored, just a burden	Key element to enforce

Future Priorities: retrospective, prospective and prescriptive

Retrospective and prospective: views on scenarios and questions to be answered

Although there was strong agreement that the status quo leans towards scenario three, its relationship to scenario one was questioned. More needs to be known on what the distinction between these are, what are the crucial similarities and differences to be taken into consideration?

The interconnections between these scenarios are not mutually exclusive and their interaction and relationships need to be understood. Will not be an either or situation, but one may emerge as dominant. It was felt that although scenario three *will happen*, more can be done by governments to encourage the other scenarios. Scenario two is congruent with three, but different industries are in control. Scenario four has commonalities with scenario one, but with less control from industries or governments. In each case a clear understanding needs to be developed of where the money will come from and where will it go need to be answered.

The rise of mobility was seen as a trend of continuing importance, especially in developing countries as were debates and controversies on different IPR regimes. Security and privacy continue as concerns, but responsibility shifts to different players in the different scenarios.

Standards and net neutrality were key elements and different types and practices of standardisation were discussed:

1. ISO- styled standardization: very heavy-handed, but has social aspect.
2. IETF – global and motivated by desire to keep the internet running as it always has and is a place where some consensus will be drawn based between ISO and IEEE.
3. IEEE standards – opposite of ISO and purely technical.
4. Web consortium becoming even more important since they're high level.

Prescriptive: recommendations on things to be done (in random order)

- It is essential to build in privacy and security from the outset- scenarios reflect different models of security and privacy
- Need to develop new principles to measure and evaluate choices beyond simply the monetary metric, considering concrete measures of social-ethical aspects such as reputation, trust , environment etc.
- In order to resist private interests and come up with more independent research, we need an institutional buffer. This implies a need for government-funded research, or some other mechanism that is interested in the public good. Set up institution(s) that aim for public goals. Even the NSF isn't enough. NSF is interested in pure research and not necessarily public good research.
- Some thoughts on this:
 - Maybe research should be more like an open-source project. That once it's out there, it can be continued.
 - Develop good testbeds that showcase real problems so that users can exploit them to create solutions.
 - Move research up the protocol stack to higher levels.

- More research should be done on usability. Make things easy for users to adopt and use.
- Better models of how users use and interact with systems. HCI is not effectively translated (as of now) into actual systems. Modelling done to understand better how users conceive systems and how they interact with them.
- Empower users, e.g. Rockstar development models – Linux, inspires innovation
- Government should advocate for research in the public interest and not research for pure industrial interests.
- Not to have a fear of failure in research initiatives. Expect failure in the research. High risk must be there, which means failure is likely.
- Do multidisciplinary research. One discipline might take the lead role and other roles are support.
- Build architectures that maintain flexibility to move amongst the scenarios. Allow innovation in the architecture. Different circumstances may require different scenarios.
- Develop traffic management standards and initiatives. EU set basic standards for basic levels of service and transparency in network neutrality.
- Intellectual property rights – do not give enforcement agencies too much power (e.g. invading people's possessions just to look for copyrighted material).
- Make incremental changes as opposed to clean slate approaches whose long-term consequences are hard to predict.
- Do not duplicate work industry is doing.
- Research into the 'mechanics' of information: ways to think about and organise information, privacy, security, reputation etc.