Towards a Future Internet

Delphi-based scenarios assessment of possible trajectories for a future internet

DELPHI SURVEY ROUND 2 RESULTS

SMART 2008/0049

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The Delphi Survey was implemented and analysed by Rafael Popper of Manchester Institute of Innovation Research
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<td>Simon Forge, Karmen Guevara, Lara Srivastava, Colin Blackman, Ian Miles and Rafael Popper (Survey Implementation and Analysis)</td>
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Towards a Future Internet Delphi

About the Delphi technique

Delphi is a well-established foresight technique that involves repeated polling of the knowledgeable individuals, feeding back (sometimes) anonymised responses from earlier rounds of polling, with the idea that this will allow for better judgements to be made without undue influence from forceful or high-status advocates. The technique was developed so as to circumvent “follow the leader” tendencies of face-to-face exchanges, and other problems such as the reluctance to discard previously stated opinions. Delphi surveys are usually conducted in two rounds. Delphi surveys are most often employed to elicit views as to whether and when particular developments may occur, but the technique can be used for any sort of opinion or information – such as the likelihood and desirability of specific outcomes, impacts of policies or technologies, scenarios, etc. Likewise, Delphi is frequently used with a focus on the dominant views that emerge, but the technique may be oriented more to delineating different points of view. Delphi surveys are often carried out online, and findings are used to prepare policy recommendations, action plans, roadmaps, etc.

About the Second Round

Here we present the findings for the second round of the Delphi Survey. A total of 110 experts took part in the study (see Appendix 6). In the second round of this Delphi survey we asked selected experts from the research/education, business and government sectors to analyse a series of scenarios. The scenarios are based on the Delphi First Round’s results plus inputs from (1) socio-economic research on trends that will impact the internet, as well as inputs from other related projects; and (2) a workshop on socio-economic human factors and psychological trends and forces in Brussels in September 2009. In total, four scenarios were presented for consideration and assessment of their likelihood and desirability.

- **Scenario 1**: *Smooth Trip: the knowledge-based internet economy*. The aim of the internet is to enable all facets of work as the foundation of a new era in the world’s development, a Knowledge Economy.

- **Scenario 2**: *Going Green: the green internet economy*. A hot, wet internet world. The global climate crisis has hit everyday life and can no longer be pushed aside. It has become so threatening that the internet is harnessed to help save the planet.

- **Scenario 3**: *Commercial Big Brother: a commercially controlled consumer world*. Also called: The internet becomes a purely commercial channel for entertainment, retail commerce and advertising – “we have ways of making you buy”. It has become so threatening that the internet is harnessed to help save the planet.

- **Scenario 4**: *Power to the People: emergence of the e-Demos*. Ordinary people take the helm. User and e-consumer rights rule, building their own environments and applications.
As highlighted in the “Towards a Future Internet: Interrelation between Technological, Social and Economic Trends” interim report¹:

These scenarios may seem to be extensions in particular directions but this is to make them identifiably different so that particular characteristics can be clearly seen, although overlaps may exist while combinations of several scenarios may be preferred.

Comparing scenarios, we can imagine a contrasting range of socio-economic forces, combined with politico-commercial and ecological pressures which will shape the internet in terms of uses and offerings, reflecting lifestyles with their economic and political contexts. For instance in Scenario 3, a compliant aging population, the jobless condition of a significant proportion of the rest of the population in Europe combined with the market power of the major players, turns the internet into an escapist channel for entertainment. Thus its prime function is easily served by large commercial interests and a laissez-faire political regime, so it becomes little more than a shopping channel with mundane entertainment programming.

These four scenarios explore a range of trust, security and privacy issues, which in all cases have been raised in comparison with today but by very different means. In the more optimistic scenarios, this has been combated by going to the root of the problem and changing how internet authentication, authorisation and access control works. In its turn, the internet shapes our global cultural norms. For instance, in the environmentally protective scenario, an eco-conscious internet culture arises, through social networking which enables people to feel a global inter-connectedness.

Key results of the Second Round

Overall, the Second Round of the Delphi show the following results:

- In terms of likelihood, the “Smooth Trip” scenario is considered as the most likely scenario with 67% likelihood. No other scenario managed to reach similar levels of likelihood.

- The second most likely scenario is “Commercial Big Brother” with 47% likelihood, followed by “Going Green” (33%) and “Power to the People” (23%).

- In terms of durability, “Power to the People” appears as the most desirable scenario (62%), in spite of being the less likely.

- The second most desirable scenario is “Smooth Trip” (56%), closely followed by “Going Green” (54%). “Commercial Big Brother” is the least desirable scenario (8%).

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<td>56% desirable</td>
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Key Delphi findings: Integrating 1\textsuperscript{st} and 2\textsuperscript{nd} Rounds results

The results of the second round of the Towards a Future Internet Delphi Survey are in line with the overall picture presented in the first round results. Although many of the features characterising the Internet of the future may be captured in the “Smooth Trip” scenario, some experts believe that we will possibly have some elements of more or less desirable scenarios, such as “Power to the People” and “Going Green”, for example.

Summary of key First Round Delphi results

The first of the two rounds of the Delphi examined the underlying needs for a future internet and current trends (see report at http://www.4-sight-group.org/oii/futureinternetdelphireport.pdf). The online survey generated opinions from some 235 experts on a wide variety of subjects concerned with the future use of the internet. The survey attempted to forecast lifestyle impacts, types of applications and degrees of dependence across a wide range of categories. The opening questions related to the significance of the internet for people’s lives. The frame of reference for respondents was the European Union.

On the whole, the first round of the Delphi survey confirmed the internet as an increasingly significant influence on daily life and lifestyle. Most believe that it will become indispensable for finding and maintaining employment, and represent the principal social interactive conduit for a majority across the globe.

Overall, experts believe that in 2020 the general usage of the Internet will become vital for the vast majority of people. It is expected that between 11-50% of a person’s day will be directly influenced by the Internet. The Internet will basically permeate most aspects of our lives. Today most of us use the Internet to retrieve or share information. However, by 2020 the Internet is expected to support all basic voice and data communications. It is also going to continue playing an important role in the promotion of social networks such as Facebook, LinkedIn, Twitter and the like. Entertainment and employment related services will also be widely accessible and used via the Internet. It will be a central pillar of basic communications and it will be the primary source of news and information. From its many possible uses, the interconnection of human, machines and sensors/tags is possibly perceived as too challenging to be achieved by 2020, probably a few years later. Overall, the socio-economic use of the Internet will without a doubt exceed the political usage. The majority of government services will use the Internet to interact with people. For instance, citizens will be able to access basic information or to engage in simple communications with government agencies. Detailed advice, however, will still be delivered via face-to-face interactions. Politicians and governments will seek to use the Internet to influence politics. Nowadays the Internet has proven quite a powerful tool to help campaign groups to coordinate supporters in specific political actions. Political parties will be fundraising, recruiting and interacting with their members through the Web. We may also see more widely use of online consultations on specific legislation or government polices. However, we may not see the Internet being used to organise e-referenda for direct democracy leading to legislation. Such an ambitious objective may never been achieved if we do not improve the security of the World Wide Web. Learning and education processes will also be impacted at most levels. Today the Internet has penetrated education mainly at the university level (both undergraduate and post-graduate). But, by 2020, vocational retraining, secondary education and long life learning will also be deeply influenced by the Internet. The impact on primary education remains to be seen. A few people even suggest that the Internet will never have a considerable effect on primary education.
In terms of business usage, there is a general perception that by 2020 the Internet will become vital for the vast majority of business functions. Today research and development, marketing and personal relations are heavily influenced by the Web, but the Internet will soon be as vital as electricity for most business activities, including operations, sales, management, human resources and finance. By 2020 there will also be considerable changes for the users for the Internet. On the one hand, social exclusion will be reduced with smaller gaps for the age, gender and able/disable divides. But, on the other hand, the geography divide may or may not be reduced and wealth and education level will remain important causes of the digital divide. Nevertheless, by 2020 the Internet use is expected to increase from the current 60% to 75% of the EU population. Turning now to the issues which may be more important for a "socially-positive" development of the Internet, by 2020 low cost and user-friendliness will be the most significant factors, followed closely by trust, security and secure applications, mobile access and open access. Developments such as open standards, network neutrality, multicultural/multilingual interfaces or collaborative tools seem to have lower levels of importance or impact for a "socially-positive" Internet.

By 2020 some functionality and human interface expectations will be met while others, unfortunately, will not be achieved. First, mobile Internet will be available throughout the EU. Second, most citizens will trust online transactions and financial services. Third, the Internet will not reach acceptable levels of privacy or crime prevention. Fourth, the Internet will not be secure and reliable enough for vital services in which lives could be lost by malware or malfunctioning, e.g. remote tele-surgery or air traffic control. Fifth, the average Internet use across the EU will exceed watching broadcast TV (including watching TV over the Internet as well as other hobbies, such as playing games, listening to music, among others). Closely related to this, we can find the expectations for the Internet to become the main TV channel by 2020. The Internet will quite probably be more user-friendly, and users will interact in ever more wide-ranging, refined and spontaneous ways. For example, image recognition and gesture detection (with machine vision) or multi-sense technologies may or may not become widely used. Other interface extensions may probably not be extensively used by 2020 but some segments of the user population may be able to test advanced prototype versions of natural language understanding for all EU languages (with interactive voice) or useful intelligence-interpretation interpolation. The widely use of 3D and holographic virtual presence is certainly not expected by 2020, any major developments in these areas will be received with great surprise by the community of users. What is obviously a not very encouraging message is that by 2020 the Internet will still remain vulnerable to critical failures and cyber-attacks.

Whether low cost Internet usage can contribute to bring the poor into the mainstream of the global economy remains to be seen. There are no clear prospects. The Internet may or may not contribute to lessen the exclusion gap mainly because access costs (even if they are very low) and complexity will be key contributors to the Digital Poverty in 2020. Of course, there will continue be new sociological and psychological behaviours as a result of Internet usage and penetration in society. Internet cultures will tend to be more creative and the Internet will form new adjunct to society with increased social interactions. Jobs and the economy are more likely to be dependent on the Internet by 2020.

The Internet will also play an important role in global issues. For this reason, there will be plenty of attempts to apply more political control to the Internet (globally and nationally). The current global and economic conditions will accelerate Internet usage in many areas and sectors with new actors trying to enter the game and conquer spaces while existing actors will try to maintain or improve their position. By 2020 the Internet may or may not challenge
capitalism and the corporate economy. There are strong conflicting views on whether the Internet will ever contribute to create a new form of 'capitalism', based more on individuals, SMEs and personal content thus leading to a form of post-corporate economy in which the larger organisations have less of a leverage of size. Similarly, there is no consensus on whether the Internet may or may not challenge the global balance in trade and power by 2020. What is clear is that governance structures will be needed for the Internet and that it will be politically difficult for the Internet governance to go to international actors, such as the United Nations.

With regards to the evolution of the Internet, we may or may not see revolutionary changes by 2020. The Internet will be mainly characterised as a convenience and lifestyle management tool for everyday life, on the one hand, and a safe utility for information, work and entertainment, on the other. A third feature, which is rapidly growing, is the role of the Internet as a social place where people can learn, discuss and form opinions. The idea of having multiple "Internets" with special attributes by usage (e.g. a secure e-commerce version, and/or a real-time safer/more resilient form for vital functions such as surgery, and/or a social networking Internet with privacy functions) does not seem to convince a considerable number of people, thus its realisation will certainly surprise many, perhaps not in a positive way. An alternative, apparently less conflictive and possible situation for 2020, would be to have an Internet with tiers of value and privacy/security. Given that tiering implies premium services against standard offerings, the key question here is: what does society gain with tiering? Is this going to reduce or increase exclusion or the digital divide between those with premium services and those with standard ones? Another possible situation for 2020 would be for user-generated content to become dominant, be it via broadcast (one-to-many push), or peer to peer, or via user-controlled pull. Equally feasible would be for the “Internet of things” – with billions of objects reachable through the Web – to become increasingly significant. As for the idea of the Internet of smart things, it certainly sounds catchy but the truth is that it is very unlikely, at least by 2020. Now, Internet services will quite probably not be mainly paid for by subscription and advertising by 2020, instead, new business models are expected to emerge and flourish. The Internet may also become more ‘intelligent’ and be able to understand users’ requirements with greater use of semantics, for example. Proposals of new business models charging for Internet applications which are "free" today will be controversial. In the same way, an Internet divided into paid-for and a few free services will be divisive. As mentioned in the discussion about future functionalities (above), the Internet will gradually evolve into the TV channel of choice, with a virtual VCR.

One of the interesting findings of the Delphi is that the promotion of e-literacy, the improvement of general levels of education and the reduction of poverty and social inequality appear as the most important drivers of success for the take up of the Internet by 2020. Naturally, the future development of the Internet could also be hampered or slowed down by a number of factors or inhibitors of success, such as: the growing uncertainty over the use of personal data and privacy concerns; the new and unexpected threats to Internet usage; the percentage (between 10-20%) of the population who categorically refuse to use the Internet as it is considered as an unnecessary imposition; and the fears that government interventions to neutralize cyber-crime may slow down future developments of the Internet. Furthermore, the inevitable dynamic of these and many other driving and inhibiting factors – not to mention surprises! – together with the speed of research, technology development and innovation (RTDI) in the area of information and communication technologies (ICT), will definitely shape for better or worse the expectations about usage, roles of users, functionalities, interfaces, governance schemes and evolutionary changes presented in the Delphi results.
Summary of key Second Round Delphi results

In the second round, experts were asked which of the four scenarios they thought was most likely to become reality, and also which of the scenarios they considered most desirable. In total 110 experts participated in the second round. The key findings of the Second Round are:

- In terms of likelihood, the “Smooth Trip” scenario is considered as the most likely scenario with 67% likelihood. No other scenario reached similar levels of likelihood.

- The second most likely scenario is “Commercial Big Brother” with 47% likelihood, followed by “Going Green” (33%) and “Power to the People” (23%).

- In terms of desirability, “Power to the People” appears as the most desirable scenario (62%), in spite of being the less likely.

- The second most desirable scenario is “Smooth Trip” (56%), closely followed by “Going Green” (54%). “Commercial Big Brother” is the least desirable scenario (8%).

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<td>EU (67 experts)</td>
<td>61% likely 48% desirable</td>
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<td>51% likely 7% desirable</td>
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<tr>
<td>Non-EU (43 experts)</td>
<td>75% likely 70% desirable</td>
<td>37% likely 51% desirable</td>
<td>43% likely 10% desirable</td>
<td>21% likely 57% desirable</td>
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In terms of perception of likelihood and desirability by type of stakeholder, government experts were even more convinced than the average that the Smooth Trip scenario was not only the most likely (75%) but also desirable (75%). Government experts also rated the Power to the People scenario as equally desirable (75%), but much less likely (25%). The views of experts from the research and education sector closely matched the average, while business experts rated the likelihood and desirability of the Smooth Trip scenario slightly less than the average. Compared to the group as a whole, business experts thought Power to the People was more likely and more desirable. Surprisingly, business experts thought Power to the People was more desirable than Smooth Trip.

Results were also analysed according to geographical location of experts – EV v non-EU. Mostly the opinions on likelihood and desirability are similar. However, non-EU experts thought that Smooth Trip was both more likely (75% v 61%) and more desirable (70% v 48%) than their EU counterparts. EU experts thought that Power to the People was the most desirable scenario (65%), but not very likely to become reality (23%).
Scenario 1: Smooth Trip

Theme: “Smooth Trip - The knowledge-based internet economy”. The aim of the internet is to enable all facets of work as the foundation of a new era in the world’s development, a Knowledge Economy.

Key Characteristics: Digital connection and interaction; global mobility via mobile handheld devices.

The internet forms a part of all jobs as well as providing the key economic factors of job search, enterprise investments, trading platform, financial transactions, etc. The Internet technology of today continues much the same, with one important difference - the mobile handset is the primary working interface. It therefore must provide the tools for e-working and e-education—with the majority of applications used via a mobile link. Improved radio coverage and quality makes it possible for users to work anywhere globally and from any device. There is strong support for education and career renewal with continual professional development through online teaching/virtual immersion and simulation of work practices. Gradually several different ‘internets’ emerge – e.g. one for financial transactions with heavy security and privacy, another for vocational education with wideband media and for general uses. The training/vocational element starts with assuring digital literacy. There are teaching bases – with ‘books’ that hold conversations on their subject. As it is designed for a mobile handset – we may expect quite different interfaces – largely spoken and/or gestural and touch e.g. GPS point, see and learn – an educational tool of the future.

General results

“Smooth Trip” scenario is 67% likely and 56% desirable

67% likelihood 18% uncertainty 16% unlikelihood

56% desirability 27% indifference 17% undesirability

110 experts
Results by type of stakeholders

Research/Education actors results show 70% likelihood and 56% desirability

Business actors results show 54% likelihood and 50% desirability

Government actors results show 75% likelihood and 75% desirability

68 experts

28 experts

12 experts
Results by region

“European Union experts” results show 61% likelihood and 48% desirability

61% likelihood
22% uncertainty
17% unlikelihood

48% desirability
32% indifference
20% undesirability

67 experts

“Non-EU experts” results show 75% likelihood and 70% desirability

75% likelihood
12% uncertainty
13% unlikelihood

70% desirability
18% indifference
12% undesirability

43 experts
Scenario 2: Going Green

Theme: “Going Green - the green internet economy”. A ‘hot, wet’ internet world. The global climate crisis has hit everyday life and can no longer be pushed aside. It has become so threatening that the internet is harnessed to help save the planet.

Key Characteristics: Monitor and control, environmental industries - Green technology.

The internet is the only global network capable of monitoring and controlling emissions and other pollution effects. Internet development is focussed on climate change and pollution, specifically to equip the planet with sensors as a way of measuring and combating climate change and pollution. There is a strong economic move also to invest in green technology generally – the environmental industries – including that for the internet’s own infrastructure as the largest electrical machine on the planet. An economic link to the lingering recession is an additional factor driving infrastructure projects with public spending, opening a new segment of industrial growth, in ‘green technology’. The internet has a major segment of real-time sensor networks, growing an ‘internet of things’ technology and orientation, for its large geography sensor networks including subsea networks.

General results

“Going Green” scenario is 33% likely and 54% desirable

33% likelihood
28% uncertainty
38% unlikelihood

54% desirability
26% indifference
20% undesirability

110 experts
Results by type of stakeholders

Research/Education actors results show 27% likelihood and 52% desirability

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68 experts

Business actors results show 38% likelihood and 54% desirability

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28 experts

Government actors results show 42% likelihood and 67% desirability

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12 experts
**Results by region**

“European Union experts” results show 30% likelihood and 56% desirability

![Bar chart](chart1.png)

- 30% likelihood
- 27% uncertainty
- 43% unlikelihood

67 experts

“Non-EU experts” results show 37% likelihood and 51% desirability

![Bar chart](chart2.png)

- 37% likelihood
- 30% uncertainty
- 33% unlikelihood

43 experts
Scenario 3: Commercial Big Brother

Theme: Also called: Commercial Big Brother: commercially controlled consumer world. The internet becomes a purely commercial channel for entertainment, retail commerce and advertising – “we have ways of making you buy”. It has become so threatening that the internet is harnessed to help save the planet.

Key Characteristics: Large, key players hold purse strings: laissez-faire governments, passive user initiatives. Privacy disappears.

The internet is mostly directed by the largest players in online sales of fast-moving consumer goods, advertising and media publishing. The internet is dependent on their funding. It is also driven by three ‘carrier’ infrastructure industries, who are the largest internet players - firstly, ISPs and search engines plus social networking sites all rolled into one; secondly fixed and mobile telecommunications incumbents globally – who branch out into being national ISP and media brokers to the main content providers, with their own ‘walled garden’ media products; and thirdly, the cloud computing service providers. It is based on the assumptions that generally governments take a laissez-faire attitude, and allow a perfectly commercial environment. User-originated initiatives on applications and content do not exist – except in limited fashion within the rules and platforms operated by the major players. Cyber security problems abound for the users but far less for the major players. Privacy becomes a commercial good.

General results

“Commercial Big Brother” is 47% likely and 8% desirable

47% likelihood
26% uncertainty
27% unlikelihood

8% desirability
9% indifference
73% undesirability

110 experts
### Results by type of stakeholders

#### Research/Education actors results show 50% likelihood and 5% desirability

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<tr>
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68 experts

#### Business actors results show 48% likelihood and 16% desirability

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28 experts

#### Government actors results show 34% likelihood and 8% desirability

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12 experts
### Results by region

“European Union experts” results show 51% likelihood and 7% desirability

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7% desirability
8% indifference
85% undesirability

67 experts

“Non-EU experts” results show 43% likelihood and 10% desirability

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10% desirability
12% indifference
78% undesirability

43 experts
Scenario 4: Power to the People

Theme: “Power to the People - Emergence of the e-Demos: Creative Chaotics". Ordinary people take the helm. User and e-consumer rights rule, building their own environments and applications.

Key Characteristics: Ad hoc user driven: governments, large corporations watch.

Cooperative solutions rule built by ordinary users helping each other - the internet advances in an ad hoc manner, as ordinary people have a wide choice of easy to use tools to build a set of cooperative and commercial spaces for their own use as a safe environment. They build a Digitally Connected Society (but not digitally controlled) from a grass roots level upwards. People take the initiative, but in no organised way to start with - they push back against the status quo and demand their own way for the internet, to close the digital divide with a more human-oriented engineering. Governments and large corporations are not the drivers, but the spectators to a newly shaped internet. Privacy problems abound but new ways of protecting privacy are soon found, for a safer online world, using separate divisions – with multiple internets effectively.

General results

“Power to the People” is 23% likely and 62% desirable

23% likelihood
39% uncertainty
38% unlikelihood

62% desirability
21% indifference
17% undesirability

110 experts
### Results by type of stakeholders

#### Research/Education actors results show 17% likelihood and 58% desirability

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68 experts

#### Business actors results show 36% likelihood and 64% desirability

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28 experts

#### Government actors results show 25% likelihood and 75% desirability

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12 experts
**Results by region**

“European Union experts” results show 23% likelihood and 65% desirability

23% likelihood  
47% uncertainty  
30% unlikelihood

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65% desirability  
17% indifference  
18% undesirability

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67 experts

“Non-EU experts” results show 21% likelihood and 57% desirability

21% likelihood  
29% uncertainty  
50% unlikelihood

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57% desirability  
26% indifference  
17% undesirability

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43 experts
Appendix 1: Comments about Scenario 1

Comments from Research/Education actors

1. The emergence of several different ‘internets’ makes this scenario slightly less desirable and likely, since this is a controversial issue that will require agreements of the public and private sectors, among other actors.

2. I believe that the Internet will provide all the above services. However, I disagree that the technology will continue to be the much the same.

3. How clean and sustainable these jobs (and the Internet) become is important.

4. I support the contention that mobile is a key growth platform for internet delivery and that there will be many more infrastructures and devices by which interaction takes place. Not so sure about the means of interfacing.

5. The growing popularity of locked-down devices like the iPhone and iPad threatens this future - as Zittrrain suggests. Also, where does the strong support for such education come from in this scenario? Corporations? It's possible, but I'm somewhat sceptical.

6. I have a different opinion about almost every aspect of this scenario. I think it over-emphasises training/education and under-emphasises social interaction. Similarly it under-emphasises physical goods, personal travel and human-delivered services. I believe that the mobile handset will become the key device for authentification and identification of individuals, but only the fallback device for human I/O, when the user cannot make opportunistic use of other internet-connected human I/O devices in their local environment (e.g. wall screens, active tabletops, sound systems). We may see different "internets" appearing, but these will be layered on a common physical infrastructure because the costs of doing otherwise will be prohibitive. Similarly there is no way that individuals will carry different devices connected to different internets - we will expect the geeks to find some way to effectively sandbox applications with different security requirements while appearing to use a single infrastructure. I think that the distinction between "digital" and non-digital will become less obvious as less important as computer interfaces adapt to more "natural" methods of human I/O. Paradoxically this may mean that the public need be less digitally literate than today.

7. Despite the reference to "heavy security and privacy" for the more "sensitive" internets, concerns about loss of control over transaction-generated-information make this imagined future a bit concerning. Keeping them "separate but equal" seems highly unlikely.

8. There are two main issues with this scenario: 1/ fracturing the Internet into several zones implies that the end-to-end principle ceases to be viable, which will restrict the potential for innovation that has developed in part as a result of its present design; and 2/ over the 2020-2030 time frame the radical shift of infrastructure to mobile will bring significant need for new investment both in infrastructure and new devices, with the potential for the developing countries to continue to be unable to keep up in what is certain to be an ever more important Internet world.

9. I'd be much likelier to find this scenario likely and desirable if the range of jobs to which it applied were qualified. I expect there still to be many jobs, especially but not only in the developing world, which are mainly about "moving matter around" (e.g. agriculture,
construction, personal care), and large workforces concerned with operational rather than management aspects.

10. While the mobile handset will be a key working interface, it will not be the "primary" one; people will work in a variety of venues with different devices. Mobile computing (via a handset, but also via tablets and laptops) will be important, but users will also have more capable devices with larger screens, faster wire/fibre connections, and more local processing power. It's not clear what's intended by the "different internets" ideas. I don't expect separate namespaces, or different infrastructures; however, there may be logical partitioning. "Natural interfaces" have been a mirage for decades, and I expect this to continue since their success rests largely on breakthroughs in AI.

11. The divergence into different networks will not take place: Security is not an argument for normal end users.

12. Would be nice to be able to see all four scenarios at once. First half is more likely than second half - how do I indicate that?

13. This is a very desirable scenario overall because it seems to provide universal service to all. But it fails to offer any meaningful privacy protection for users. However, perhaps privacy or the reasonable expectation of privacy is a thing of the past, if it ever really existed. The mentioned GPS component guarantees the immediate location of users, including democratic digital activists residing in authoritarian regimes who may wish to remain anonymous. Thus, such a scenario may prove to be an anti-democratic surveillance network for both governments and businesses attempting to hypodermically-target and sell or persuade citizens/customers ideas, life-styles, products, services, candidates and policies – especially targeted to an individual's predilections and past behaviour, using ever-sophisticated algorithms developed by 'The Numerati.' Who or what will police the global internet, how and under what authority? Will there be an effective international consumer's union, an international attorneys general's office, an international trade commission, an international privacy czar? If not, then is the internet environment about survival of the fittest, cavat emptor?

14. Integration will still lag considerably in underdeveloped countries. Both wireline and wireless will be used heavily. There will be a wide variety of applications and network qualities-of-service, but they will be offered over integrated networks rather than separate networks.

15. There is a great danger of severe social exclusion, for example of people with disabilities, people who speak smaller languages, people from poor communities. Unless the system is built with a greater emphasis on standards and access than has historically been the case I would be very worried. To take one example, most Africans still cannot access the net in their mother tongues. A lot of work is being done, in Africa, to remedy this, but this needs to be allowed access to the new platforms.

16. The shadow economy (black market) will grow equally and may derive some of its strengths from disconnectedness as well as alternative networks.

17. "Books" such as smart phone, smart book, and netbook will be the dominant devices for human to interface. Spoken and/or gestural may not be the mainstream interface. The touch and GPS could be the mainstream interface.

18. Agree with some but not others. Mobile most widely used yes, but kind of device may vary 'handset' seems unlikely as "preferred" option for most work and education, although may be so perforce depending on economic conditions. Don't kill the desktop.
yet, computation may be in the cloud, but interaction has to be with the person - maybe screens and keyboards that you plug a mobile device that is more about authentication than computation? Similarly for gesture speech - this will become common due to large level of illiteracy or non-Latin writing systems. However, keyboards so much faster and in some ways easier, so don't expect them to go in a hurry. Don’t forget it was writing and reading that brought us up form being savages, so don’t condemn us to digital savagery too quick ;-)  

19. New political forms will emerge from this scenario. In particular, the notions of sovereignty and authority are quickly evolving, which will provoke major crisis. It may also happen that the Internet splits in a secure and highly controlled part, for business and serious things, and a free part, for leisure.

20. Beware of the cost element of mobile devices

21. From the point of view of the GLOBAL economy, the Primary and Secondary sectors will remain very important. The Tertiary sector will continue to grow and this platform will support the development of the Internet. Certain economic, political and physical events could restrain the development of the global Internet.

22. I agree with a future development of e-working/e-education and emergence of different internets such as a financial Internet or a vocational education Internet. But I believe that fixed access would remain important, and that mobile access would not necessarily replace it as the main access technology as presented in this scenario.

23. Hesitation related to "all," in that there will still be physical work done in many contexts. A loose interpretation of "forms a part" allows for more remote but finite connections.

Comments from Business actors

1. The major issue is wireless/mobile capacity -- I don't see spectrum regulators changing the rules fast enough to keep pace with demand.

2. This scenario mixes a lot of different aspects, wow. I agree on the mobile aspects - actually I am sitting in a restaurant killing time taking this survey on my BB - but strongly disagree on the educational aspects (BS) and do not believe the segregation argument.

3. "The Internet technology of today continues much the same" is incoherent and incompatible assumption with "Gradually several different 'internets' emerge" Question of "desirability" is meaningless

4. Focus on finance & teaching is strange. The most important use of the Internet in terms of direct benefits and people usage will be consumption related, purchasing non-Internet goods and services, and Internet goods and services, including purchasing applications, e-content, off-site storage and cloud computing. Also, Internet security will become a v big deal with v large security attacks and breaches, in many cases by sovereign states engaging in warfare, but also by organized crime.

5. Mobility, the variety of the terminals, a very timely example of which is iPad, will be dramatically increased in a couple of forthcoming decades. How the computers communications means, devises and interfaces interact with human beings has a vast possibility for additional improvement and innovation and many of these are likely to be available practically. Regarding different internets, the communications which don't need to reach many destinations but rather need the prevention of intrusions from unexpected persons will need an isolated network. Physical isolation will stay more
reasonable than crypto technologies which are meant to be able to set up a secure virtual channel over public internet.

6. We may consider Internet as an access technology enabling any kind of interaction from any kind of devices (mobile devices are one of the access means). But the truth is not in the access but in the services as well as in applications and in contents. We may spend more time when running applications or viewing contents than when surfing on Internet. So Internet will grow as accesses grow as well as traffic grows (especially for video based contents).

7. This scenario assumes that the knowledge economy is primarily about the provision of tools. Such an assumption is questionable. Also, are we not supposed to be moving beyond the knowledge economy already?

8. This scenario appears the most likely of all four, although elements of the other scenarios are very probable. High volume broadband networks will enable a number of parallel data infrastructures to be run side to side. Smart metering applications help monitor traffic, consumption and allocation of resources as well as providing real time information for quality control and waste management. RFID integration in everyday objects will allow new personalised real-time services. Data protection, security and privacy will vary on the type of transaction (financial transactions are a good example). Rather than relying on a single mobile device, people will probably operate in a device independent surrounding in which they use any number of convergent devices. It appears realistic though that in general some kind of single mobile device will play a key role in identity-based services. Questions will arise concerning the concept of "net-neutrality", as certain types of real-time services could require higher priority data transport.

9. to achieve this goal, Internet has to remain neutral towards users and companies + governments are not supposed to be the only stakeholders of the game

10. I believe that the era of connection and global mobility via mobile handheld devices will not continue for ever, and certainly not until 2030. Tha waste of bandwidth will show shortly. The Internet is not designed for mobile handsets. In my opinion, it is not desirable that individual connections are given priority to business traffic necessary to companies.

11. Today, the Internet is too much of a tool to connect individuals (social networking sites) and let the people download entertainment items (music, videos), rather than targeting a key economic role to support companies. For example, e-government is too often portrayed as an e-administrative tool to help citizens for their routine duties (IDs, tax returns, driving licenses, tec).

12. In 2030 computers will be 600-1000 times faster, so miniaturised mobile devices will be quite possible. A big choice for the future is whether people will be immersed in a ubiquitous swarm out of their control or able to control and project their wishes to a "processor-sphere" through a User Agent. Vocational/training in digital literacy is determined by the political character of society, and it is charmingly naive to see it added to the scenario like an exogenous nice-to-have.

Comments from Government actors

1. The divergence into different networks will not take place: Security is not an argument for normal end users.
2. Diffusion rates of mobile applications have been in Canada slower due to mostly to cost and lack of competition. These issues will be more sorted out in 10 years but we will still face challenges.

3. I think that the prevalence of mobile handsets as the primary working interface will continue to be differentiated between developing countries (where it is stronger) and developed economies (where it is weaker. The use of the phrase "mobile handset" might be misleading here. Better to say "portable device" and you will be closer.
Appendix 2: Comments about Scenario 2

Comments from Research/Education actors

1. Monitoring and controlling industries is only one (perhaps too narrow) of the solutions to growing environmental problems such as climate change. However, the real power of “Going Green” would be through major behavioural changes coming from the bottom-up of society (with the help of new Green Social Networks, e.g. Greenbook, Linkedgreen, and the like). Such changes could include new consumption patterns, sustainable farming communities, new business models supporting local communities, etc.

2. Internet is a piece, but only a piece of the answer.

3. The internet does not do the monitoring - it only transfers information. Whilst remote monitoring is possible, it relies upon human intermediation to make decisions. This will not change - indeed, it may enable very centralised control of decisionmaking that increases vulnerability to capture by a small number of powerful vested interests - either benign or malignant. Ultimately, 'green' is like any other choice regarding the allocation of scarce resources. It makes sense only insofar as the benefits outweigh the costs, not as an objective in its own right.

4. I don't see the internet as integral here - global sensor monitoring networks could be setup independent of the internet, and for security purposes probably should be. Yes, it would be useful to aggregate this data, but it would take expert interpretation to make sense of it anyway.

5. This scenario confuses monitoring and action. There is little purpose of enhanced monitoring unless the data can be put to a productive use (e.g. action to lower abatement costs) and this scenario fails to explain how this might happen. It also completely misunderstands the fast dispersion of greenhouse gases. A single monitoring point at any fixed location in the world is sufficient for monitoring atmospheric CO2 levels. Lastly the bandwidth requirements of most environmental monitoring are very low - today's internet is more than sufficient. It is hardly a justification for new infrastructure.

6. While increased monitoring of the environment is more than likely, this scenario says nothing about the political will that will be needed to link monitoring to controlling pollution. Perhaps if the monitoring were part of the infrastructure required to efficiently and effectively tax emissions, measure footprints, etc., then we might have something.

7. Again, it's the overstatements in this scenario that limit my ability to agree with it. The climate change postulated can hardly be seen as desirable, but if it's happening then using the internet to combat it must be desirable.

8. The use of the internet in responding to climate change is inevitable, but I don't think that will shape the internet to such an extent that it warrants a distinct scenario, as depicted here.

9. A "green planet equipped with sensors" does not and cannot exist. A "green planet" is not equipped with sensors. it is equipped with plants and animals. Only dubious marketing campaigns can brainwash people into believing that "green technology" is a green solution.
10. Sensor networks will be attached to the Internet, but they will remain to form inhomogeneous, unconnected islands of sensor networks. Even if not, access to most of these networks will remain restricted for most network users.

11. "Lingering recession" is on a completely different timescale than climate crisis - time horizon of years versus decades. A bit confused this scenario. Strange that green scenario forgets about video conferencing.

12. The "internet of things" technology (RF chips and transmitters) and orientation (global monitoring) has great potential to constantly watch all things, all firms, all governments, all people, and, their behaviour. Who will limit the negative impact of 'Big Brother'? Who or what will watch and monitor the watchers?

13. Sensor networks may support these goals, but this will form a small portion of Internet use.

14. At one level, the Internet of things may look green. But the manufacturing and use of the Internet is often not green. And then there is the question of disposable of the e-waste. I expect more regulations to mitigate the impact of the Internet of things on the environment.

15. It's at best doubtful if the scenario you propose makes sense and would work. Documenting a crisis does not make it go away. The political instability in Africa, the savage oppression in China are all well documented, but persist. It's unlikely that anything like the current internet would survive in a world of climate catastrophe. An internet of things is desirable, with good privacy controls, backed by legislative sanction, but it's naive to suppose that it can fix the world.

16. There is little economic incentive to major actors to support this type of scenario.

17. The "internet" is only a network. It facilitates communication about social issues, however monitoring and controlling of emissions is done with sensors, located nearby position sources. The scenario of a green society is likely, but internet has not a specific influence on this. Nevertheless green computing will be an issue.

18. Yes, very important application of the internet and it is very desirable and feasible, too.

19. Lots of issues of industrial secrecy. Probably need legislation to open up data, maybe provenance means to restrict use - sort of DRM for data!

20. I'm not quite sure why the global climate crisis having hit everyday life should be desirable.

21. Despite many announcements, it seems that there is an antinomy between the development of Internet and the global climate crisis. Internet requires energy; Internet promotes goods and their consumption; Internet is developing the global market which tends to increase the life standards everywhere in the world and then the pollution, which is a side effect of high life standards. The only positive issue would be to use video-conferences to decrease airplane transportations, which constitute a real nuisance for the environment.

22. Beware of "who controls the controller" ...

23. Unfortunately this is not a lingering recession. Significant threats to the Euro area have not yet worked through the banking system, notably the crisis resulting from irresponsible and stupid investment in unwanted and unsaleable housing.
24. Use of Internet for climate change questions and development of green technologies are highly desirable. Dematerialization seems even more important to me to handle climate change than the use of connected sensors.

25. Expect much progress in sensor-systems that further greenness. How much interconnection and how much identification with the Internet is another matter—unless you call anything networked “the Internet.” Also, desirability of some things (e.g., investment in green) may be > desirability of interconnection.

26. The sensors will not be publicly accessible, though, and they will remain in many heterogeneous subnets/overlay networks pertaining to different organisations.


28. Isn't this already happening?

Comments from Business actors

1. I don't think sensors are going to develop fast enough to meet this need by 2030.

2. “Green IT” was a major seller in 2007 and 2008. Today it is all about cost again and nobody talks about “green” anymore. Taxes on power consumption have turned a “green” into a “cost” argument. But, where is the business case for the “all sensors Internet”?

3. The misguided assumption of this “Future Internet” nonsense seems to be that somehow the Internet can be transmogrified into some teleological agenda. Might as well ask if the Future Internet will support Fashion or Gardening

4. Wishful thinking.

5. Waste reduction is one of the fields where the Information Technologies can do much more. I agree the scenario is very likely.

6. One more time sensors and networks are nothing compared with the application for monitoring and controlling any kind of climate related challenges and nothing compared with the willingnessness to do it. Technologies and especially Internet technologies allow such a new scheme to be put in place. Who wants to make it?

7. This scenario is far too limited in its description of the role of the Internet to contribute to a greener society.

8. As mentioned already in scenario 1. Whether and when a global climate crisis reaches a critical stage is beyond the scope of this survey. From today’s point of view, it appears very probable; the real-time internet based sensing and monitoring will play an important role in the future concerning energy efficiency, waste management, traffic management and environmental issues. This scenario should be subsumed as one of the various “internets” portrayed in scenario 1.

9. I find it naïve to hope that the Internet is going to help solve the climate crisis. I would stand the same opinion vis-à-vis all human problems. The Internet cannot be a “fix” for the mistakes that the human beings have committed. In my opinion, it is just desirable to make sure that the Internet is not going to worsen the situation.

10. I have great difficulty that mankind will become better in the future thanks to the Internet. Technologies never helped save the planet! Look at mining, oil industry, chemical industry, even intensive agriculture played a bad role.
11. This isn't mutually exclusive with other scenarios. It isn't explained why high frequency and high density sensors helps with coping with climate change per se. Perhaps one good daily observation suffices for modelling - and so no radical change in fabric of Internet needed for that. Green energy generation to power the Internet is nice, but not logically dependent on improving the Internet per se. It is also possible that climate change is not man-made or man-correctable, or alternatively that it *can* be corrected with a relatively quick hack (a Ventner CO2 eater?). A fashionable but incoherent scenario (being a bit mean).

**Comments from Government actors**

1. Sensor networks will be attached to the Internet, but they will remain to form inhomogeneous, unconnected islands of sensor networks. Even if not, access to most of these networks will remain restricted for most network users.

2. Using technology to monitor the environment is important, but only second best to doing something that will actually modify current climate change trends.
Appendix 3: Comments about Scenario 3

Comments from Research/Education actors

1. This scenario is unduly pejorative as it assumes that a small number of players is bad (e.g. do we really want every type of cola imaginable; we still pay a premium to a small number of newspaper editors and TV channels to edit the content we access, because it is very costly to edit it ourselves or rely on only a small number of close associates to do so for us), and does not focus on the ways in which we can live with large players whilst they serve the interests of the majority but can facilitate their elimination when they pass their 'use-by' dates. E.g. IBM used to be the 'big' manufacturer; it isn't any more. It wasn't bad, and ultimately market forces backed up by competition law ensured that a new computing paradigm could emerge. Indeed, it couldn't be stopped even despite some competition concerns because consumers really valued the new product highly.

2. There will always be some alternative net environment built by/for users, but it won't be the default for most people who trade privacy for convenience. We'll see how the net neutrality thing goes in the U.S. If that can't be protected then there's not much hope for government restraint.

3. While the theme is much more likely than scenarios 1 and 2, the proposed split-up of major players make no economic sense. Competition will ensure that the owners of physical infrastructure become strategically irrelevant - i.e. ISPs, datacenter owners and telcos. Similarly software services such as search will become commoditised and no longer a source of economic profit. The large players will be those whose walled gardens offer the most attractive bundle to consumers: each bundle containing proprietary applications, content and security together with 'just enough' interoperability with the remainder of the internet.

4. Hard to imagine the process through which "user-initiated initiatives on applications" cease to exist. Major players will still serve as the managers of the "internet idols" contests, but I suspect they will continue to depend upon independent development and supply of the apps that are growing the net.

5. This is a relatively likely scenario in many ways (see iPad), because the economic drivers are clear while the motivation for government to stop the construction of walled gardens is much less clear. I would strongly question the notion that cybersecurity problems would abound if the walled gardens succeed; indeed, cybersecurity problems are likely to be a prime driver for users who perceive the walls round the gardens as an effective way of getting protection.

6. Again maybe I'm quibbling with how you've stated this (surely not "purely") but it certainly looks like a significant and undesirable trend.

7. As I read through the scenarios in succession I become increasingly confused. All three so far could be equally valid - and I think they will all occur. They are not mutually exclusive; therefore, my votes should not be taken to be for one over another. My assessment of likelihood is based on the extreme position the scenario depicts regarding laissez faire (all governments will continue to regulate, though some more than others), user-generated content, cyber-security problems, and lack of privacy.

8. There might be a desire of the international collaboration of police to keep commercial good order and legality, to fight the malicious behaviours etc. There should be worked out a globally recognized ethical norm for the online behaviour of everybody.
9. nice description of today’s world

10. Governments will only apply laissez-faire towards large commercial entities. Against their own citizens, however, the governments will apply censorship and surveillance mechanisms and exert tight control over the network - just like China, Iran and many Arab states already do today.

11. Anti-trust regulation anyone? Review the theme, 2nd sentence seems out of place.

12. For privacy to disappear it first must exist. We really don’t know how much privacy or security we actually have until they are breached. Once private information enters the public domain we no longer have control over it as it belongs to those who systematically capture, store, process and manipulate it for commercial gain or social and political control. To some extent privacy and security are already commercial goods or commodities. Those who can and do pay for such have more. Or at least they think they do. The Internet was built to be open and to survive a nuclear war. It encourages open discussion, open debate, transparency and the free flow of information content. While certain commercial transactions are ‘protected’ by encryption and e-locks, such protection is ultimately an illusion due to human and machine errors. Moreover, the more ‘secure’ the encryption technology becomes, the more attractive it becomes to cyber crooks, cyber-warriors and curious non-state agent hackers. Information wants to be free; information leaks. And everything is for sale; so it appears. I trust that you will not disclose my candid responses herein to any unauthorized person. And it is only my trust in your brand and reputation that I rely upon to protect my privacy. But on the Internet, with widespread use of avatars, multiple identities, Trojan Horses, cookie, etc., who can you trust, especially in a declining global economy?

13. Although commerce will drive Internet development, communication will remain a key component. Major players will have significant power, but not such absolute control.

14. Laissez-faire has not worked in the financial markets – where the incentives for industry self-regulation should be strongest. It is hard to see how a laissez-faire approach can be maintained in the present zeitgeist. Also, the Internet seems more fragmented than centralised, as appears to be envisaged in the scenario. Overall, I envisage more rather than less regulation.

15. 1984 redux? This is a scenario we need to stop, as the people we elect to govern us won’t. A major dimension of future struggle is likely to be citizen vs. corporation, and we’d better win this one. The good side is that a multitude of walled gardens are unlikely to be viable. AOL tried this and died, and Apple is doing the same thing (Android phones outsold Apple phones last quarter in the US...).

16. There will always be gaps between, in which users can carve their own spaces, though the power these will wield remains to be seen

17. In a certain way, this is already realised, but only in a specific subnet of the internet. Other subnets will never be commercially controlled.

18. The future will be the competition between "user-originated initiatives on applications and content" (like Youtube, Twitter, Facebook as well as iPhone applications), and the commercial applications and content.

19. This was envisaged by many in the late 1990s including the dot.com era. At the time there were counter visions, e.g. http://www.hiraeth.com/alan/ebulletin/websharer, but this was seen as the exception. Now it is hard to see the democratisation of the web
failing... although of course the tools used for this are still held by a small number of companies.

20. I am afraid that it is scenario which realizes in the future


22. Preventing such an outcome must be the primary objective of public policy in this area. In practice it is not likely to come about. Autonomous user control over the Internet is already sufficiently developed that few people would buy into the "walled garden" concept. Regarding advertising, I remain totally perplexed. I continue to remain amazed that this is a viable business model. I have never bought anything as a result of Internet advertising.

23. The results of present Network Neutrality debates in various countries could be a step forward or backwards regarding this scenario. The end of individual/non commercial contents is very undesirable, as it would hinder personal initiatives and democratic processes. They should continue to exist besides commercial contents. I am also much concerned about threats for privacy in this scenario.

24. Two sentences of theme seem at odds with each other. Somewhat evocative of "Snowcrash".

25. Privacy will become more and more an illusion.


**Comments from Business actors**

1. The "branching out" is a bit over the top - at least for the EU. Good argument to revive competition law and prevent forward integration.

2. Weird division into 3 industries. E.g. Google, Amazon, & Apple & virtually all the mobile manufacturers, at least are already well into cloud-computing, so the boundaries between search and cloud computing are dubious, while the listing leaves out retailers and equipment manufacturers. Also, there is material competition in all of these sectors (the weakest rivalry occurring in broadband provision to the residential user). That means to some degree the consumer will remain sovereign.

3. The substance of the Internet is collective circuits and computing resource which both need big investment to deploy, where scale economy works. Personally I feel like believing the protection of the personal Internet users will retained by such big players. And then the governments should not be taking laissez-faire attitude but place an adequate protection of privacy and personal initiatives. The above scenario well describes some likely scenarios but the conclusion might be different to be worse if we need a contrast, or to be better to raise a ideal situation.

4. Internet has to become both a (cheaper) commercial channel and an information channel. Buying without information and to be informed without using (and buying) does not make sense. But the next step is not only "commercial" or "informative", it is all about interaction where products or services will be user or consumer "based" and information will come from both the producer and the consumer.

5. This is only one scenario of a controlled world. It is very much based on the "as is". Other scenarios of control are possible.
6. In the past there has always appeared a trend towards interoperable products and services. Consumers are generally unhappy with walled-off platforms (providing linear content) nowadays. Few large players as main drivers of content innovation would probably lead to stagnation and loss of interest for everyday consumers. The internet evolved into the information society phenomenon it is today because of the highly competitive user driven environment with low entry barriers. The simple alternative would be a "back to the roots" phenomenon in which consumers "leave" the virtual world behind them, in which case the internet players lose the market they are trying to control for themselves. It appears highly unlikely, that (European) governments will allow for a rules-free, survival-of-the-strongest internet-based commercial sector. We should rather expect further harmonised regulations for internet based services as governments try to regain control. Concepts of data protections and privacy will most probably evolve within society though.

7. This certainly is the biggest threat. Marketing plays a leading role in making the internet a purely commercial channel for entertainment, retail commerce, and personal communication. In order to correct this trend, governments may have to take a very strong attitude to support the B2B which probably generates less profit for the Internet service actors, but is vital for the economy.

8. Here we run into the Delphi paradox. I assign a high likelihood because I want to warn of this scenario, but if my warning is heeded then the likelihood is zero. Therefore I cannot expect my warning to be heeded. A common mistake is to assume the Internet policy apparatus status quo is relatively benign. It isn't - giving us data retention, 3 strikes, and a political child protection hoax of MEPs with the fingerprints of the copyright industry all over. This is by far the likeliest scenario because of the power wielded by a small number of corporate but individual actors, largely in secret and completely unaccountably.

Comments from Government actors

1. Governments will only apply laissez-faire towards large commercial entities. Against their own citizens, however, the governments will apply censorship and surveillance mechanisms and exert tight control over the network - just like China, Iran and many Arab states already do today.

2. Traditional industries will continue to fight for their business models and ten years will not be enough time to sort this out. In addition, privacy advocates and enforcers will not allow privacy to become a commercial good in the short term. Until the internet generation and those below it out number other generations, privacy will still be a value that most want protected.

3. This is part of the picture, but not the dominant picture.
Appendix 4: Comments about Scenario 4

Comments from Research/Education actors

1. There will be some of each of this and scenario 4. it is not an 'either/or' case
2. I think this kind of activity will exist in pockets, but it won't dominate the net.
3. Very unlikely. This will characterise a subculture within overall society but not define it. For most of us the internet is a tool for other end purposes - just like a car is a tool for transportation - and we have no interest in what's under the hood. As long as the internet requires big investments in physical infrastructure, then a commercial model will be required to pay for it. And as long as the chance exists to make a dollar (or a fortune) from the creation of unique applications and content, then people will try to do so. And as long as people place a positive valuation on access to specific applications and content, they will be willing to pay for it.
4. As with the concentrated corporate model in the prior scenario, this representation is also a bit extreme with regard to the scale of innovation at the grass roots level. Similarly, corporate actors can't survive as spectators. And Puhleeze, what is this "new ways of protecting privacy are soon found..." It is not clear that we really understand the myriad ways in which privacy and its entailments will go into decline.
5. This is an idyllic scenario, but one that becomes less and less likely as the Internet is increasingly taken for granted. A key factor for this scenario is that of the engagement of users and their willingness to take responsibility for shaping "their" Internet, rather than sitting back and accepting external government or business control.
6. I see some of this happening, in parallel with elements of the other scenarios.
7. The assumptions behind scenarios 3 and 4 seem to be, "corporations are bad; consumers are good". For example, privacy is abolished in 3, but solved by the commune in 4. I think this is a false dichotomy.
8. This is an attractive perspective but unlikely could be realized. Once they still exist in the world, the big powers (Governments and big Corporations) would play their role in establishing the future world no matter you like it or not. Besides, there are serious attempts to work on the cyberwar and all related topics and things. It is also key factor in describing the future world.
9. Placing "ordinary people" at the heart of all concerns should not mean that ordinary people must design their own applications and their own internet. why can't governments and corporations be the drivers of a world where user and consumer rights rule?
10. What is meant by the term: "human-oriented engineering"? Sounds like just another version of social engineering and control. Currently, some one billion and a half of the world's population uses the Internet. The above scenario implies that when the digital divide is finally closed and six to nine billion people are active 'netizens,' a democratic utopia will emerge from the bottom up, usurping the present concentrations of power held by the duopoly of governments and multinational corporations (mal-defined as legal 'persons'.) Who will become 'the ordinary users helping each other' in this future? How will they organize to govern themselves online? And, if they can do so successfully online, then can't they also organize politically to make the nation state redundant and obsolete? Historically, does there exist any model for any of this glorious self-help,
bootstrapped remedy of pure democracy in action? I don't think so. Nonetheless, I must admit that neither governments nor large corporations were the drivers (up to this point) to how the Internet grew and shaped itself. Largely, governments have been spectators while large media technology and content firms continue to set the public agendas, attempt to control or dominate online markets and manipulate consumers with targeted sales pitches, infotainment and various kinds of distractions away from conversations that empower communities in democracies. The most appropriate role of governments are to provide essential public goods and public services, including the development and deployment of a high-speed broadband Internet infrastructure, by wire and radio, to all of their residents, that is affordable, ubiquitous, and easy to use for the efficient delivery of government services, content (including literacy, lifelong learning opportunity materials, training, education and instruction, health information, and access to knowledge), and to applications that enhance the quality of life and efficiency of work. Governments must not be mere spectators, but instead become hyper-active drivers toward the kind of information society desired by the people of the 21st century and well beyond the year 2030.

11. This scenario envisages an extreme of chaos. But it need not be. Already, consumers have tips about hotels, airlines, etc, through tip-sites such as TripAdvisor and its ilk. But for these e-consumer sites to work, they have to be credible, not chaotic. Any industry where consumers can begin to have more information about it, such as hotels and airlines, are going to see their margins erode because of the Internet.

12. This is possible, and for the technologically sophisticated elite, like most of your participants, it's already here. However, it's still far too hard for most people to do this. I'm not convinced about the multiple internets idea. This can be done, e.g. SWIFT, but it requires vast investment in redundant networks.

13. I think Scenarios 3 and 4 will constantly be in tension, never producing a clear winner.

14. This is although realised in a specific subnet. Both, the private and the commercial subnets will grow in the future.

15. Desirable, but difficult due to commercial power and government power.

16. Although dangers in this scenario too, certainly more appealing than media control. Main counter to this is that while the content may well be democratised, at present point it looks like the platforms will not be. In particular, the benefits of collective intelligence seem to still favour larger platforms. I think this is a potential future, but not one that will just 'happen' without some fairly major technological and social pushes.

17. It's unlikely, undesirable and inefficient to oppose the people and the governments. Better explore a multi-governance framework.

18. I do not agree with the title of this scenario because "creative chaotics" is a tendentiously negative expression. In other respects, something like this is what is most likely to happen.

19. Seems very unlikely to me. No so desirable without any kind of global governance that users might fail to initiate, regarding for instance security/stability/privacy questions. I also doubt that digital divide could be solved by people alone without a kind of political commitment.

20. Small is beautiful never seems to win. One reason is that stuff has to be paid for, and there are associated dynamics.
21. In reality we will see a mixture of elements of all four scenarios; each has both good and bad points.

22. Bring it on.

**Comments from Business actors**

1. I think, broadly, this is good but individuals currently lack resources to really control the network -- but this is roughly the direction to press.

2. Much of this scenario is compatible with Scenario 1. Consumer sovereignty will continue to play a key role in ensure some of the kinds of outcomes described here, but it will be much more commercially than "socially" driven (just like the use of radio, TV and movies were and are). But there is no doubt the Internet has opened the door to vast improvements in competition for ideas, including content, and competition among people (an Indian in 2030 will directly compete with me to be an economic consultant in an antitrust case conducted in New Zealand).

3. Good to have both 3/4 and this 4/4.

4. Again, this scenario is one of many on the theme of "power to the people", which may be neither creative nor chaotic.

5. Grass roots initiatives will provide a valuable societal service in a checks and balance manner towards professional service providers and governments. Rather than single dimension scenarios as put forth in scenario 3 and 4, we will probably experience a cooperative as well as competitive environment in which user-driven and corporate services run parallel as well as in an integrated manner respectively. It appears highly unlikely, that a highly data driven society will led to fewer privacy problems. On the contrary it appears more realistic that society will forgo the strict understanding of data protection we have today.

6. This is close to my vision - but the forces conspiring against are formidable, and the revolution needs defenders of the true creed, and deviation from the true line must be excoriated... and possibly exterminated! Now, how to keep the institutional and corporate forces at bay, for that is what is entailed. Confuse them. Build things that don't work (very well) if tables turned. Avoid giving control to people with Davrosian tendencies. Fair amount of inspired subversion. Mistrust central mechanisms.

**Comments from Government actors**

1. Normal people do not see the huge chances and opportunities this may bring. Moreover, people are too lazy to assemble and to protest or revolt in masses - as long as the oppression of the Internet through lobbyism by large economic entities (helped by a corrupt political caste as their wilful acolytes) sets in slowly and is hidden well enough, which can be seen at this very moment, right within the European Union.

2. Not sure that we are ready to leave the couch just yet.
Appendix 5: Delphi Survey

Screenshot of Delphi Survey’s welcoming session

Welcome to the Second Round of the Delphi Survey

In the second round of this Delphi survey we wish you to analyse a series of scenarios. They are based on the first round’s results given here plus inputs from:

- socio-economic research on trends that will impact the internet, as well as inputs from other related projects

So we present four scenarios for you to consider and critique. They may seem to be extensions in particular directions but this is to make them identifiable different so that particular characteristics can be clearly seen, although overlaps may exist while combinations of several scenarios may be preferred.

Your region *
- European Union (EU)
- Other

Occupation
- business
- education/research
- government

If you selected EU, please indicate your country:

Please select...

If you selected Other, please indicate your region:

Please select...

Email (optional)
If you would like to receive the final report of the Future Internet study.

Navigation tip...
Click NEXT to save & move forward

The survey and the report are available at:
http://www.4-sight-group.org/oii/futureinternetdelphi
Scenario 1 of 4: The Internet Economy

The Internet supports the global economy.

**Theme:** The Aim of the internet is to enable all facets of work as the foundation of a new era in the world’s development, a Knowledge Economy.

**Key Characteristics:** Digital connection & interaction; global mobility via mobile handheld devices.

The internet forms a part of all jobs as well as providing the key economic factors of job search, enterprise investments, trading platform, financial transactions, etc. The Internet technology of today continues much the same, with one important difference - the mobile handset is the primary working interface. It therefore must provide the tools for e-working and e-education - with the majority of applications used via a mobile link. Improved radio coverage and quality makes it possible for users to work anywhere globally and from any device. There is strong support for education and career renewal with continual professional development through online teaching/virtual immersion and simulation of work practices. Gradually several different ‘internets’ emerge - e.g. one for financial transactions with heavy security and privacy, another for vocational education with wideband media and for general use. The training/vocational element starts with assuring digital literacy. There are teaching bases - with ‘books’ that hold conversations on their subject. As it is designed for a mobile handset - we may expect quite different interfaces - largely spoken and/or gestural and touch e.g. GPS point, see and learn - an educational tool of the future.

On a scale of 1 to 5, please rate the **likelihood** in 2020-2030 (1 = very unlikely; 5 = very likely)

On a scale of 1 to 5, please rate the **desirability** of this scenario (1 = very undesirable; 5 = very desirable)

Please give any comments and remarks/modifications to the above scenario.
Scenario 2 of 4: A Green internet Society

A 'hot, wet' internet world.

**Theme:** The global climate crisis has hit everyday life and can no longer be pushed aside. It has become so threatening that the internet is harnessed to help save the planet.

**Key Characteristics:** Monitor and control, environmental industries - Green technology.

The internet is the only global network capable of monitoring and controlling emissions and other pollution effects. Internet development is focussed on climate change and pollution, specifically to equip the planet with sensors as a way of measuring and combating climate change and pollution. There is a strong economic move also to invest in green technology generally - the environmental industries - including that for the internet's own infrastructure as the largest electrical machine on the planet. An economic link to the lingering recession is an additional factor driving infrastructure projects with public spending, opening a new segment of industrial growth, in 'green technology'. The internet has a major segment of real-time sensor networks, growing an 'Internet of things' technology and orientation, for its large geography sensor networks including subsea networks.

On a scale of 1 to 5, please rate the likelihood in 2020-2030
(1 = very unlikely; 5 = very likely)

On a scale of 1 to 5, please rate the desirability of this scenario
(1 = very undesirable; 5 = very desirable)

Please give any comments and remarks/modifications to the above scenario
Scenario 3 of 4: A commercially controlled consumer world

**Theme:** The internet becomes a purely commercial channel for entertainment, retail commerce and advertising - "we have ways of making you buy". It has become so threatening that the internet is harnessed to help save the planet.

**Key Characteristics:** Large, key players hold purse strings: laissez-faire governments, passive user initiatives. Privacy disappears.

The internet is mostly directed by the largest players in online sales of fast-moving consumer goods, advertising and media publishing. The internet is dependent on their funding. It is also driven by three 'carrier' infrastructure industries, who are the largest internet players - firstly, ISPs and search engines plus social networking sites all rolled into one; secondly fixed and mobile telecommunications incumbents globally - who branch out into being national ISP and media brokers to the main content providers, with their own 'walled garden' media products; and thirdly, the cloud computing service providers. It is based on the assumptions that generally governments take a laissez-faire attitude, and allow a perfectly commercial environment. User-originated initiatives on applications and content do not exist – except in limited fashion within the rules and platforms operated by the major players. Cyber security problems abound for the users but far less for the major players. Privacy becomes a commercial good.

On a scale of 1 to 5, please rate the **likelihood** in 2020-2030
(1 = very unlikely; 5 = very likely)

| 1 | 2 | 3 | 4 | 5 |

On a scale of 1 to 5, please rate the **desirability** of this scenario
(1 = very undesirable; 5 = very desirable)

| 1 | 2 | 3 | 4 | 5 |

Please give any comments and remarks/modifications to the above scenario
Scenario 4 of 4: Creative chaotics

Ordinary people take the helm.

**Theme:** power to the people - user and e-consumer rights rule, building their own environments and applications.

**Key Characteristics:** Ad hoc user driven: governments, large corporations watch.

Cooperative solutions rule built by ordinary users helping each other - the internet advances in an ad hoc manner, as ordinary people have a wide choice of easy to use tools to build a set of cooperative and commercial spaces for their own use as a safe environment. They build a Digitally Connected Society (but not digitally controlled) from a grass roots level upwards. People take the initiative, but in no organised way to start with - they push back against the status quo and demand their own way for the internet, to close the digital divide with a more human-oriented engineering. Governments and large corporations are not the drivers, but the spectators to a newly shaped internet. Privacy problems abound but new ways of protecting privacy are soon found, for a safer online world, using separate divisions - with multiple internets effectively.

On a scale of 1 to 5, please rate the **likelihood** in 2020-2030

(1 = very unlikely; 5 = very likely)

| 1 | 2 | 3 | 4 | 5 |

On a scale of 1 to 5, please rate the **desirability** of this scenario

(1 = very undesirable; 5 = very desirable)

| 1 | 2 | 3 | 4 | 5 |

Please give any comments and remarks/modifications to the above scenario
Appendix 6: About the 110 Delphi respondents

**Region**
- European Union (EU): 61%
- Non-EU: 39%

**Non-EU respondents**
- North America: 58%
- Asia: 21%
- Oceania: 9%
- Latin America: 9%
- Africa: 2%

**Sector**
- Education/research: 63%
- Business: 26%
- Government: 11%