

# **Nordic ICT Foresight**

## **External Scenarios for the Socio-technical Environment Around ICT in the Nordic Region**

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## 1. Introduction

The project *ICT Foresight and Roadmap towards Innovative Applications in the Nordic Countries* is a joint effort by four research institutes and a number of partners from academia, industry and policy makers. The aims of the project are to identify, select and present scenarios illustrating the prospects for possible future applications for IC technologies with respect to technology, application and market issues. It will explore the roads to commercialisation, provide solutions where ICT can provide the biggest competitive advantage. It should identify unique market opportunities with longer-term growth potential. The Nordic ICT foresight aims to contribute to the strategic intelligence of the Nordic knowledge region so that the full potential of IC technology can be exploited to increase the welfare in the Nordic countries and also in other parts of the world.

The future possibilities with applications of ICT in the Nordic region are to a large extent dependent on course of event outside the reach of decisions and policy actions taken in the Nordic countries. In reality, the outcome will be determined by the interaction of decisions taken and the external development. This is particularly relevant when the object under study is ICT and its application, given the fact that ICT is in itself a key driver in globalisation.

For these reasons, the project set out to study the external future world around the applications of ICT in the Nordic region. In this report four possible future scenarios are presented. Each scenario is first presented as a narrative, then a tabular overview is given for ease of comparison. An introduction to the methodological approach and a short description of the working process are also provided.

## 2. Scenario Methodology

In this work, the so-called Shell/GBN<sup>1</sup> method has been utilised for the construction of external scenarios. In this tradition, a scenario is thought of as being a picture of the future external world for an organisation (or a “system”). This means that the set of scenarios primarily deals with factors not under control by the organisation. The idea is then to discuss issues under the control of the organisation with the different scenarios as different scenes of possible future environments. Of course, in a globalised and, in many respect highly connected world it is hard to judge what factors are controlled by which actor; some of the factors in the scenarios presented below could very possible be influenced by the actors in the organisation.

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<sup>1</sup> For a general introduction see van der Heijden (1996).

In many cases scenario projects are carried out in a business environment, where the decision making for a single company is in focus. In this study, the organisation, or the system, is rather ill-defined. Perhaps the best definition that can be given is that the system is made up of all actors that influence the prospects of fulfilling the full potential of applications of ICT in the Nordic region so that to “increase the welfare in the Nordic countries and also in other parts of the world.” Focus is on *drivers* for the future socio-technical environment that may act as substantial barriers or carriers for the adoption of selected ICT solutions.

When constructing scenarios according to the Shell/GBN school, there are a number of criteria that they have to fulfil. Each scenario must be:

- Plausible – a scenario must not be perceived to be to far fetched,
- Relevant – the scenarios must be constructed in such a way such as the address the relevant issues,
- Challenging – for the scenario to add value to the strategic process, its must challenge, if not all, but some of our conception of the future.

In addition to these requirements on each of the scenarios, the whole set should span the uncertainty space of the problem of interest. Even though different participants may pick their “favourite scenario”, no assessment of the probability of each of the scenarios is made; it suffice that each of them are plausible. Each scenario shall depict a probable future.

It is important to point out that the scenarios are not the end-product of a scenario process. The scenarios are constructed for the purpose of being used in the subsequent steps of the process. In this project, the scenarios will be part of input to the work package “Science and technology roadmap”.

### **3. The Scenario Workshop**

A further key characteristic of the methodological approach adopted here is that the set of scenarios is developed in an interactive process. This work involves individuals from a number of different organisations of relevance for the question under study.

The kick-off of this scenario process was a workshop at Aronsborg outside Stockholm in February 2006. The workshop gathered 18 participants representing different organisations from the Nordic countries.<sup>2</sup> The theme of the workshop was to outline a draft set of external scenarios for the socio-technical environment around ICT in the Nordic region. The time horizon during for the scenarios was 10 years; they should describe different possible futures at the year 2016.

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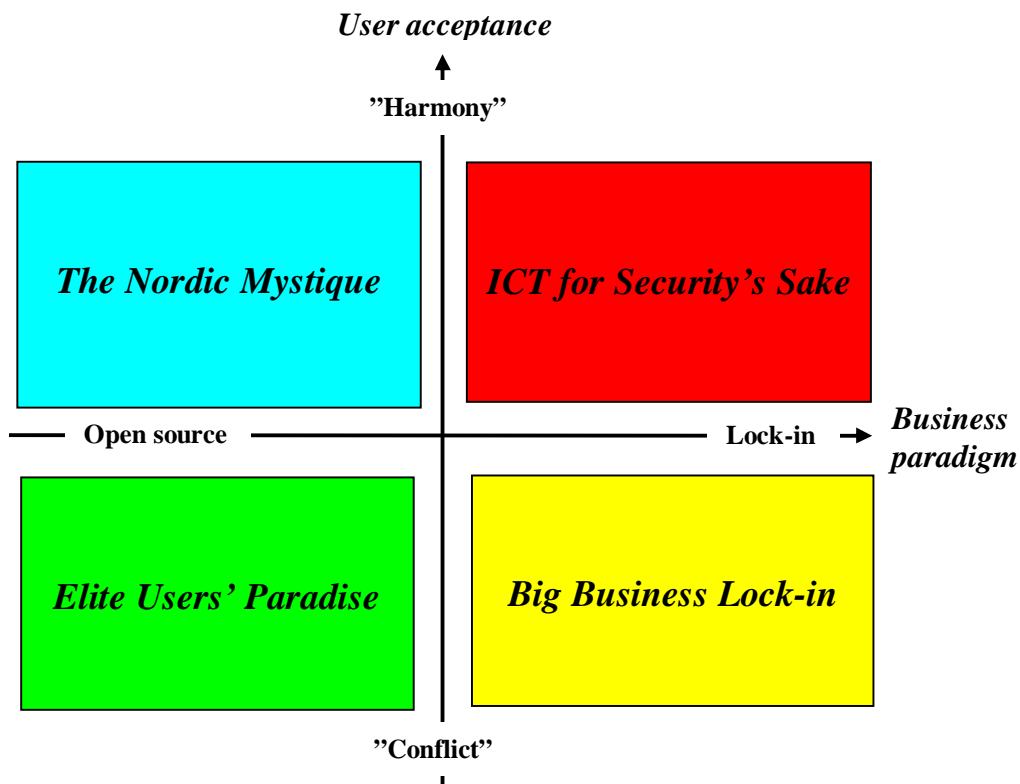
<sup>2</sup> A list of participants in the scenario workshop is provided in appendix.

In short, the working process looked like<sup>3</sup>:

1. Brainstorming on drivers: A broad collection on drivers without criticism and judgement on their importance. After this session in plenum, the drivers were grouped into clusters.
2. Priority setting for drivers: Participants were asked to prioritize according to importance and uncertainty.
3. Back-office development: Based on the results from the voting a further clustering was done. This work resulted in three dimensions of particular interest, see below.
4. Group work on “fleshing out” the scenarios: Based on the priorities of the drivers and the result of the back-office work, smaller groups developed the first grounds for four different scenarios.
5. Discussion in plenum: The result of the group work, four draft scenarios, was discussed in plenum.

## 4. The set of external scenarios

The four scenarios were constructed from the four quadrants following the construction of a so-called scenario cross, see figure. The dimensions spanning the space was *User acceptance*, with end-points “harmony” and “conflict” and *Business paradigm*, with end-points “open source” and lock-in respectively.



<sup>3</sup> For details on the results of all the stages in the workshop, see “Minutes from Workshop on Visions and Scenarios, 9 – 10 February 2006” (<http://nordic-ictfore.vtt.fi>).

## 4. Scenario storylines

### 4.1 Scenario I: ICT for Security's Sake

#### ***ICT for Security's Sake***

The 9-11 attack became the start of the Great War on Terrorism (GWOT), where EU and US stand side by side. Partly because of demand for energy (oil), China has created strong links with Saudi Arabia, which is ruled by radical Islamic groups. As a result of global conflicts – and of the fact that China has withdrawn its investments in US bonds – there is a weak economic development.

The global situation leaves no options for the Nordic countries: the region is tightly interconnected within the EU/US-alliance. Russia is both a strategic partner to the West in the GWOT and a important energy supplier, and – with different strategies – the Nordic countries tries to capitalise on these links.

Confusion, isolation and political debate characterised the beginning of this era lead to demand for countermeasures and security activities. The development in the ICT sector, and the policy measures, is heavily focused on security issues. EU has adopted more US-like ways in many fields of policy and homogenised solutions for ICT develops. Among other things, this results in Strong alliances between centralised political power (especially in the US) and companies, key to security. The market accepts monopoly as a price for (perceived) security. In this world there is no time for long lasting negotiations due to the fact that solutions and products are needed immediately.

As a consequence, very few big well-known companies are providers of products and services, both in the business to business sector and in the consumer market. Big brands are symbols of security and security comes first. MS takes a dominate role in the whole ICT world. Many companies in the telecom sector are under pressure because the desire for a single secure software platform induces MS dominance also in this sector.

In order to cope with the terrorist threat IT for e.g. surveillance has been more accepted by the population in EU and the US. Personal integrity has been pushed into the background by the authorities' need to detect and track terrorists. One reaction to this development have been the construction of physically isolated ICT infrastructure for certain applications.

Many users are discouraged to use different kind of ICT based service because the repeated attack on the infrastructure. And many users find the balance between loss of integrity and the added value from digital services unfavourable. In the Nordic countries, there are attempts to try to create safe internet platforms – initiatives with limited success mainly due to problems with interoperability.

## 4.2 Scenario II: The Nordic Mystique

### ***The Nordic Mystique***

In this future a stronger EU takes a more active role on the global scene. China and EU are partners in many strategic issues, e.g. economy and business, environmental solutions etc. Generally there is a substantial influence of Asian culture and thinking in Europe. The Nordic line of thought “balance in life” has partly been successfully spread throughout Europe, and there are even signs of interest in certain regions of Asia.

In this world the business climate has a new important component: successful business models capitalising on product developed within the open source community. In terms of performance and reliance, open source products showed to be more and more competitive, but it was the advent of new business models that really got the show going. During the time period between 2008 and 2012, people really started to understand how to organise a commercial framework around open source products. This was a development that mainly took place outside of the existing business actors, instead many new companies formed.

One of the centres of gravity in this new business climate is the Nordic region. The Nordic way of organising society showed to be particularly well suited for the new way of developing technology and running business. The open mind atmosphere, informal structure, and the lack of heavy bureaucracy create the necessary climate for doing swift application centred development.

The new development firms both constitute a complement and competition to the established companies. With varying success, the big companies also adopted the new development model. However, at the time being, new firms have taken a substantial part of the ICT revenue, hence making a serious threat to the big firms.

Because of the dynamic climate around the new ICT companies, the Nordic countries have become an attracting innovation region. Relative to its size, the Nordic countries have very strong links to many of the dynamic regions in Asia. Many Nordic companies have succeeded in responding to the new focus and demand for products and solutions for societal and environmental problems, particularly in China. In the opposite direction, many of the Asian ICT companies are quick mover in the new open source movement and they invest in R&D in the Nordic region.

The strong focus on user friendly services that characterise the development creates an atmosphere of techno mania; there is generally a very positive attitude towards the possibilities of new technologies. Issues around personal integrity are at top of the agenda and this also helps creating confidence in the development of new technologies.

### 4.3 Scenario III: Elite User's Paradise

#### *Elite Users' Paradise*

Around 2010, the demand for oil peaked which resulted in the start of a rather long period of slow economic growth. Since then, the US and the EU are on the same track regarding energy and environment. The perceived necessary heavy investments in technology for handling energy shortage and climate change have resulted in the slow down in economic development. There is a fragmented opinion among people in the West. One group is arguing for tougher methods against other nations for securing the flow of energy to the West, and others arguing for the need for a more sustainable society.

The Nordic countries have a rather strong position within the EU. The Nordic region play an important role in the transatlantic link, mainly due to the American interest in Nordic thoughts and solutions – technology as well as policy – regarding environment and energy.

Regarding the use of digital services, the inhabitants of the West can roughly be divided into three groups. First, there is the group of elite users. This group takes full advantage of the rapid development in the open source community. Via an interactive dialogue between users and developers – in many case identical individuals when talking about elite users – highly customised and well functioning software are available to people willing to accept not so user friendly tools. As an example, the quest for integrity is line of division between the elite users and the other groups; in practise, lack of integrity is a price other groups have to pay for the use of digital services. In contrast to ten years ago, the group of elite users is no longer a very small minority. In some regions, for example in the Nordic countries, parts of North America, South Korea, this group can reach up to 15 % of the population.

Due to the creative, but also anarchistic, development of open source based products, there is a need for packaging software for people outside the elite user group. Like the pioneering Red Hat – so successful in providing products based on Linux at the millennium turn – many new players (e.g. Wal Mart and IKEA) now provide products based on code from the OS world. These companies – together with transformed ICT companies from the old era, e.g. Nokia and MS – are the main supplier of products to the second group of users, the “plain users”. This group, the largest of the three, get access to user friendly software, but the functionality is lagging behind that accessible to the elite users.

There are a relatively large number of people in the West that does not take part in the digital society – this is the third group of “users”. These people, the “ICT outsiders”, do not have access to the internet in their homes, they do not possess digital identity cards, and they do not use all the new digital services in the health sector. The size of this group varies within the Western world, but in most countries somewhere between 20 and 30 % are digital outsiders.



## 4.4 Scenario IV: Big Business Lock-In

### ***Big Business Lock-in***

In this future the economy is dominated by the strong links that has been established between the US and China. Together, the two strong nations promote a big business oriented policy approach. In the politically marginalised Europe, the economy is lagging behind.

The internationally oriented Nordic countries try to reach out of the isolation of Europe. Partly as a compensation for the decreasing contacts with other regions, the Nordic countries turn their attention to Russia. Among other things, export of ICT solutions to the Russian health sector has proven a success for Nordic companies.

The ICT industry has matured into a “normal” industry characterised by oligopolistic competition and locked-in customer bases. Of course some of the so called New Economy features so enthusiastically debated in the late 20<sup>th</sup> century remain – e.g. the fact that consumer market driven electronics is also used in many business applications as are standards like IP, Windows and Excel. But for more complex ICT solutions in areas like entertainment, health, manufacturing and transport there typically exists a handful of different proprietary standards and “paradigmatic” products. To convert from one standard to another is typically prohibitively expensive. Most standards are available worldwide, albeit often with strong regional variations.

The leading companies are usually either based in the US or in China. The Nordic players have been either merged into one of the big consortium, or have succeeded in forming alliances. In any case, their role has been marginalised and they have been pushed from the front of business and technology.

The oligopolistic situation and the big business friendly policy approach have also lead to a strong cooperate influence over more basic research. A few big players can more or less dictate the agenda for public financing of research, and universities often get direct financial support from companies, of course in line with the needs of the companies. The best universities, which are private, are naturally very business oriented.

Big business typically works closely together with government, e.g. helping them to police the Internet. There is an opposition to this, and to the Big Business led business environment in general. The prime expression of – and the platform for – this is the “undernets”, a clandestine, invitation-only digital under-vegetation for criminals, terrorists as well as peaceful open source activists. The majority of users, however, use the standardised internet and the attached services provided by the leading companies.

## References

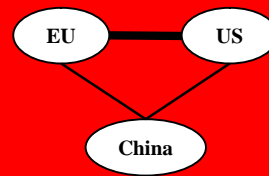
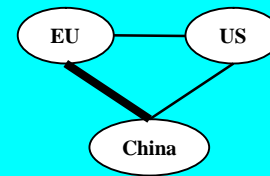
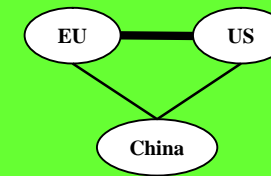
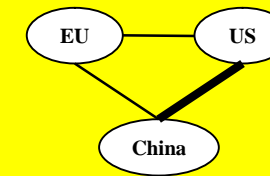
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## Appendix 1: Tabular format describing the scenarios

	<i>ICT for Security's Sake</i>	<i>The Nordic Mystique</i>	<i>Elite Users' Paradise</i>	<i>Big Business Lock-in</i>
<b>Global political scene</b>	 <ul style="list-style-type: none"> <li>- Global terrorism &amp; energy on top of global agenda</li> <li>- Shared values (conservative) US-EU in GWOT</li> <li>- Pakistan and Saudi Arabia ruled by extreme Islamists; allied with China</li> <li>- Suspected Chinese coalition with radical Islamic movements</li> <li>- Russia part of the coalition in GWOT</li> </ul>	 <ul style="list-style-type: none"> <li>- A more isolated and weaker US than 10 years ago</li> <li>- A stronger EU takes a more active role on the global scene</li> <li>- Strong links EU-China and positive environmental and HR development China</li> <li>- A positive attitude towards globalisation within the EU</li> <li>- Russia a strategic partner to US</li> </ul>	 <ul style="list-style-type: none"> <li>- Top of agenda: climate change &amp; energy</li> <li>- Shared values (liberal) US-EU</li> <li>- US and EU on the same track regarding energy and environment</li> <li>- EU/US concerns over HR and environment rights in China and elsewhere</li> <li>- Russia and China close partners</li> </ul>	 <ul style="list-style-type: none"> <li>- US oriented towards Asia</li> <li>- Terrorism mostly a concern for the US and China</li> <li>- Economically and politically marginalised Europe</li> <li>- Russia is important partner and supplier of energy to Europe</li> </ul>
<b>Global economic scene</b>	<ul style="list-style-type: none"> <li>- Decline in economic development</li> <li>- Higher interest rates; falling real estate prices</li> <li>- Slow down in US home market</li> <li>- Slow down in China</li> </ul>	<ul style="list-style-type: none"> <li>- Stable economic development</li> <li>- EU has a strong economy</li> <li>- China is still growing at a fast pace</li> </ul>	<ul style="list-style-type: none"> <li>- Small slow down in economic development</li> <li>- Big investments to handle and energy shortage and climate change</li> </ul>	<ul style="list-style-type: none"> <li>- Strong economies in Asia and US</li> <li>- EU is lagging behind</li> </ul>
<b>Nordic countries on the global</b>	<ul style="list-style-type: none"> <li>- The Nordic countries conform to the US/ EU position</li> </ul>	<ul style="list-style-type: none"> <li>- The Nordic countries have a high profile internationally; attractive region for ST&amp;I, not least as and test market; institutional role model</li> </ul>	<ul style="list-style-type: none"> <li>- Nordic region has important role in the EU-US link</li> <li>- International interest in Nordic environment and energy policy &amp;</li> </ul>	<ul style="list-style-type: none"> <li>- Nordic countries try to reach out of the isolation of Europe</li> <li>- The Nordic region is an important area for the</li> </ul>

<b>scene</b>		- Strong links between Nordic countries and certain lead regions in Asia	technology	collaboration between EU and Russia
<b>Societal development</b>	<ul style="list-style-type: none"> <li>- Back to “traditional” conservative values in the West</li> <li>- Social and religious tensions both within EU and between the West and the muslim world</li> <li>- Mental closure around the West</li> </ul>	<ul style="list-style-type: none"> <li>- “Balance in life” influential line of thought, especially in the Nordic countries</li> <li>- Less of American cultural dominance; more of balanced influences</li> <li>- Cultural and social influences from Asia into EU</li> </ul>	<ul style="list-style-type: none"> <li>- Fragmented opinion among people in the West; one group arguing for a tougher line against the rest of the world in the competition for energy, one group arguing for the need for a more sustainable society</li> </ul>	<ul style="list-style-type: none"> <li>- Increased wealth concentration</li> <li>- Social tension in Europe (unemployed, immigrants)</li> <li>- Standardised entertainment global phenomena</li> </ul>
<b>Relation between business and politics</b>	<ul style="list-style-type: none"> <li>- Strong alliances between centralised political power (POTUS) and companies, key to security</li> </ul>	<ul style="list-style-type: none"> <li>- Politicians in EU more positive to the new business climate than their colleagues in the US</li> </ul>	<ul style="list-style-type: none"> <li>- A sense of cooperation between the political sphere and the business world on energy and climate change.</li> <li>- Slight more of tension with the ICT industry; lack of consensus on issues related to innovation system and digital divide</li> </ul>	<ul style="list-style-type: none"> <li>- Strong alliances between and business and politics (US + China)</li> </ul>
<b>Business paradigm</b>	<ul style="list-style-type: none"> <li>- Very few big well-known companies are providers of products and services in accordance with the needs of GWOT</li> <li>- Big brands are symbols of security and security comes first</li> <li>- The market accepts monopoly as a price for (perceived) security</li> <li>- MS takes a dominate role in the whole ICT world; telecom companies one step behind</li> <li>- US government pick a few trusted partners as critical suppliers of ICT.</li> <li>- What’s good for MS is good for US</li> </ul>	<ul style="list-style-type: none"> <li>- Successful business models attached to the open source movement</li> <li>- Many new companies built around open source</li> <li>- “Application centred development”</li> <li>- Established ICT companies strive to adopt to the new business paradigm; some are successful, some are not</li> <li>- The Nordic region is a hot spot for the new business paradigm</li> </ul>	<ul style="list-style-type: none"> <li>- The suppliers to the consumer market is divided into two groups: smaller high-end players that can provide the best SW from the OS world and big retailers that control the low-end ICT markets by packaging OS code: IKEA, Wal Mart (and Nokia and MS) mobile phones, PC etc.</li> <li>- In B2B critical applications are provided by big companies.</li> <li>- Slow down in ICT innovation</li> <li>- Problems with interoperability; different competing platforms.</li> <li>- The consumer market has ceased to be an important development driving force.</li> </ul>	<ul style="list-style-type: none"> <li>- Influential big business; strong oligopolistic competition</li> <li>- In general terms US and China agree on business climate</li> <li>- Different companies linked to different political environments</li> <li>- ICT as an “ordinary 2000 century industry”</li> <li>- Technical lock-ins; No ICT hegemony</li> <li>- Leading global Chinese-US companies</li> </ul>

<b>Technological drivers</b>	<ul style="list-style-type: none"> <li>- Everything “security” is of importance</li> <li>- Logically, or even physically, isolated ICT infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>- ICT for healthcare and care of the aged.</li> <li>- ICT for environmental system solutions</li> <li>- Digital gaming</li> </ul>	<ul style="list-style-type: none"> <li>- Energy and climate has taken over the roles as the primary research area</li> <li>- The OS community is key driver in many ICT areas</li> <li>- Interoperability and large scale system engineering</li> <li>- Innovations in energy and environment key driver</li> </ul>	<ul style="list-style-type: none"> <li>- Gaming and entertainment services</li> <li>- Interoperability</li> </ul>
<b>Innovation systems and R&amp;D</b>	<ul style="list-style-type: none"> <li>- EU and the US invest heavily in R&amp;D for security (not only ICT)</li> </ul>	<ul style="list-style-type: none"> <li>- The OS model and the main areas of applications induce “innovation in networks” – users are important part of the development</li> <li>- Technology and business integrated in the R&amp;D process</li> <li>- Needs and business models push technology</li> </ul>	<ul style="list-style-type: none"> <li>- The very creative, and in many sense chaotic, OS community is at the centre of the innovation system</li> <li>- Large governmental research funds towards energy and environment in EU and the US</li> </ul>	<ul style="list-style-type: none"> <li>- Very business oriented private universities dominate the market for education and academic research</li> <li>- A few big players dominate the R&amp;D activities and sets the agenda for policy and academic research</li> </ul>
<b>IPR and competition policies</b>	<ul style="list-style-type: none"> <li>- Subordinate to security; “what’s good for MS is good for the US”.</li> </ul>	<ul style="list-style-type: none"> <li>- Clash of IPR between EU and US; EU has taken a radical position with regard to patent of SW; In the US, patent is the model</li> </ul>	<ul style="list-style-type: none"> <li>- Very difficult getting patent for SW.</li> <li>- Big companies adapt to OS model, but having trouble keeping up with the development.</li> </ul>	<ul style="list-style-type: none"> <li>- Patent for SW accepted; “in support for big business”</li> </ul>
<b>User Acceptance</b>	<ul style="list-style-type: none"> <li>- Because ICT infrastructure is also part of the GWOT, there repeating attacks on ICT systems discourage many users</li> <li>- Security wins over integrity</li> <li>- In the Nordic countries, people use the safe internet platform</li> </ul>	<ul style="list-style-type: none"> <li>- A tech optimistic attitude; techno mania</li> <li>- A strong focus on user friendly applications; almost no one left out in the West</li> <li>- Digital divide between rich and poor countries</li> <li>- High priority to digital integrity</li> </ul>	<p>Three groups of users</p> <ol style="list-style-type: none"> <li>1. Elite users: Take full advantage of the development in the OS community. In many cases users=developer. The group can be as large as up to 15%.</li> <li>2. Normal users: Low end ICT users. Byers of retail SW based on OS.</li> <li>3. Non users: Does not take part in the digital sphere; not online; do not possess digital ID.</li> </ol>	<ul style="list-style-type: none"> <li>- Majority use the standardised internet and the attached services</li> <li>- Opposition against big business/big brother climate via a number of undernets – a digital under-vegetation which takes many different form; criminals, political activists, OS etc</li> </ul>

## Appendix 2: Participants in the Scenario Workshop

Toni Ahlqvist	VTT
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Jonas Svava Iversen	DTI
Sonja Kangas	VTT
Ernst Kristiansen	SINTEF
Birgitta Lewerentz	FOI
Matti Penttilä	VTT
Antti Pirttimäki	VTT
Pekka Salmi	Sitra Industry Ventures, Finland
Patrik Sandgren	Vinnova – Swedish Agency for Innovation Systems
Svein Vefall	LO, Norge
Joakim Wikland	The Sahlgrenska Academy at Göteborg University
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