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Techno-politics, Internet Governance and some challenges facing the Internet

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This paper addresses the Internet as a terrain of techno-political controversies between various cultures with their interests and values, which have influenced the development of the Internet since the start. I describe what I call techno-political cultures of the Internet and then examine the dynamics of the RFC/IETF/ISOC and the recent Internet Governance Forum (IGF) as regulatory instances that are expected to handle the challenges of the Internet. It is argued that the Internet faces some structural changes for the IETF/ISOC, that cannot easily be met or resolved through the procedures of the Internet Governance Forum.

Karl Popper (1971) wrote his major work *The Open Society and its Enemies* some fifty years ago. For Popper the open society was a society in which individuals are constantly faced with an ever-increasing range of personal decisions and opportunities. The necessity of reflecting on such choices is an inevitable aspect of living in a modern democracy. It poses the risk of the population submitting to ideologies that force them in a 'fictive' direction where choices and decisions are already made by administration and technology, thus narrowing the field of personal choice. Several post-war philosophical and sociological studies use this as their standpoint for analysing changes in modern society. Many have concluded somewhat pessimistically and paradoxically that along with modern democracy's emphasis on human rights and individualism, bureaucracy and technology have undermined society's openness and freedom.

Today the totalitarian ideologies in the West have collapsed, and the threats are of a different kind. Capitalism and democracy (in national, regional and global variants) represent the combination that generally remains for western countries – not because we hail it as an undisputable benefit, but because there are no alternatives. Books written about the death of ideologies are perhaps premature. Nonetheless it means that the closed society has been eradicated once and for all. If we however consider the closed as a *dimension* that in varying degrees forces its way into all societies, it is evident that the arenas of democratic capitalism are both extended and threatened by the never-ending stream of innovations it produces (Beck 1999, 2000).

The Internet is in itself one of the most significant of such innovations, at the same time as it forms the basis for innumerable others. The history of the Internet reveals prolonged tension – in fact almost open controversy – between the closed and the open. We can see this in the construction of the ARPANET (Advanced Research Projects Agency Network), in the struggle for an open Internet protocol, in the fight to promote open source code and to prevent restrictive forms of copyright and patenting, in the anti-trust cases against Microsoft, and in the battle against censorship. Since the establishment of the ARPANET in 1969 (more details of which are given later in this article) the Internet has not only represented a medium for ideas about freedom, open communication and a more viable democracy, but also about bolder capitalism. The Net represents a space for open conversation, open innovation, open software development and an open market at the same time as it creates barriers in the form of regulation by the government, more restrictive rights for patents and copyright, public bureaucracies and commercial near-monopolies.

In the following, I discuss the Internet as a contested terrain with techno-political controversies between groups and cultures with their interests and values, which have influenced the development of the Internet since the 1970s. I briefly describe what I call techno-political cultures of the Internet. I then address the dynamics of the RFC (Request for Comments) IETF (Internet Engineering Task Force) ISOC (Internet Society) and the recently established Internet Governance Forum as regulatory instances for the Net. I conclude that the Internet faces some structural problems that

cannot easily, if at all, be met or resolved through the procedures of IETF/ISOC and Internet Governance.

Techno-politics

To enable the Internet to serve the general public it is of course important to analyse the techno-political interests that have had an impact on the Net's development. The Internet came into being under certain social, political and cultural conditions and was propelled forward by clearly defined techno-political cultures, which are currently in the process of losing much of their power over Net development. Other techno-political cultures are exerting an ever-growing pressure and are pushing the Net in new directions. What was unusual about the original innovators as a techno-political culture was that technology was regarded as something that was essentially open and therefore neutral and non-political. This was a techno-political view that in a way denied its own existence. Political self-identity was not necessary as long as the creators and users belonged to the same equal and limited circle. Only when the interest from other commercial groups began to grow did the creators and users have to justify their existence and make their techno-politics more explicit.

What I call the Net's techno-political cultures differ from each other by their questions about what openness actually is and how it is threatened and must be defended. They navigate according to different ideals: they articulate different dreams about the Internet in both social and technical terms. Regardless of whether the Internet can primarily be defined via its technical protocols or its patterns of use, it still represents varying sets of values, groupings, alliances and conflicts. Partly based on the thoughts of Manuel Castells (2001:37), I call them innovation culture, hacker culture, entrepreneur culture and bureaucrat culture (Rasmussen 2007).

To identify the cultures, I draw on the sociologist Alain Touraine's distinctions between the identity principle, the opposition principle and the totality principle (Touraine 1965, Castells 1997:71). Methodologically, the principles help to ask the right question vis-à-vis a world of conflict and dispute, to identify social movements and cultures, and how they acquire distinct social and rhetorical shapes. The first refers to the culture's own presentation of what it considers itself to be and on whose behalf it is speaking; the second refers to what or who the culture presents as the main opponent, while the last refers to the culture's vision and the social order for which it is struggling. To these three principles, I would like to add a regression principle, i.e. the well-known syndrome, that ideology and visions often become perverted and turned into their own enemies. Here, these four principles are used to distinguish between four techno-political cultures. Together, they point to quite different aspects of the ideology of openness and freedom that dynamically promote the development of the Internet.

Innovators: Open architecture!

Innovators are people with a first-rate technological education – for example from the MIT. They believe in scientific progress and the engineering spirit, but are also well aware that such concepts can be fatal if they fall into the wrong hands. During and after the Second World War the prevailing attitude in the USA was that the free world must protect itself with advanced scientific knowledge. This was the point of departure for the ARPA institution, which funded a number of advanced scientific

environments led by outstanding researchers. The goal of these communities was to convert financial resources into new innovative technical solutions that in the long term could prove useful to society. The large major innovations that became the ARPANET and the Internet were conceived by this culture, which was in its heyday from the 1960s and which directed all its energy to problem-solving and to discoveries that can be realised in new technical solutions. This is technical science at its best since it is the techno-scientific field as a whole that evaluates the solutions. The means used take the form of methods, systematic work, open discussion and collegial criticism, openness about solutions, creativity and project organisation, as well as a high degree of individual freedom. A culture of this type also has its opponents: political and technological elites who cannot see the significance of new discoveries and are unaware that such discoveries demand substantial budgets. Other opponents are environments that ignore technical solutions and standards to gain short-term profitability. Among innovators the spotlight is directed towards free research for the good of society as a whole.

Hackers: Open source code!

The hacker culture has been described as a culture and a set of ethics, but also as an undermining ideology, as criminal etc. In this context the concept points to the form of agreed activity and discussion that arose with the establishment of the ARPANET, and subsequently – to mention the major software projects that were developed on the basis of a specific ideology of openness – with Unix, GNU/Linux and the World Wide Web.[1] Hackers are also often self-taught experts or semi-qualified amateurs from university data centres. The hacker culture constitutes a set of values and notions that came into being in the wake of the first data network projects, where data programs were regarded as common goods that could be developed in a net-based community. Stemming from the innovation culture came a more specific concept of software as *a public good*, personified in the Free Software Foundation (Williams 2002). And the ideal of the Open Source movement constitutes effective and creative programming through cooperation. In contrast to the innovators, the links to overarching scientific paradigms and to techno-military and political elites are far looser. The perspective is broader and more explicitly political than that of the innovators. Values about how software can be created are connected to ideals about openness that are also found outside the actual developer environment. References to money and formal projects are less prevalent. The principle of open source code is assigned intrinsic value and is to only a small extent connected to a scientific or other career. A number of values define how the work of software development is to be conducted and identify the economic and business norms that an ethos of this kind encourages and dissuades (Himanen 2001). It has its opponents and enemies, with Microsoft holding a unique position (Raymond 1999). However, as in all ideologically oriented movements, there are also conflicts within the movement, and the other side of the coin reveals sabotage and the vandalising of others' software (cracking).

Entrepreneurs: Free market!

The World Wide Web and Mosaic around 1990 heralded the arrival of a more visible and potentially tempting and fascinating Internet that at that time put a name to absolutely all forms of information and communication (Reid 1997). And with the commercialisation of the Internet the road was wide open for creating a virtual market

[1] On Hackers as a technopolitical culture, ses Hafner & Markoff (1995), Moody (1997), Dafermos (2001), Levy (2001), Wayner (2000), Stallman (2003), Williams (2002), DiBona et al. (1999), Leonard (1998), Himanen (2001), Raymond (1999), Risan (2006).

for all possible and impossible business concepts (Winston 1998). It is safe to say that the 1990s were characterised by entrepreneurs' wild treks on the Net, ably abetted by investors who badly needed to place their funds in new and promising markets (Castells 2001a,b). On the tail of the new digital technology, of the new open software and open discussion spaces, a new virtual market opened up with inconceivable opportunities. 'What's in it for me' became a legitimate question for many who so far had been standing on the sidelines of Net development. But to enable the Internet to be exploited as a market it was necessary to change the financial rules of the game. Entrepreneurial activity did not only extend to testing out a new and so far untouched terrain, it also entailed experimenting with the market's values, and this was christened the new economy. The entrepreneurs' models no doubt include people like David Filo and Jerry Yang (Yahoo), Jeff Bezos (Amazon), Larry Page and Sergey Brin (Google) and Niklas Zennström (Skype). Entrepreneurs met opposition in the state control of the telecommunications sector, a conflict they won when these companies were privatised and joined the entrepreneurs. Many also see opponents in the *new* forms of monopolisation that are appearing with the growth of the remaining telecoms, Microsoft and the gigantic alliances that ensure both horizontal and vertical integration in the digital information market (Rasmussen 2007). Here it was *industrial freedom* that was allowed to bloom into something that could represent a huge new global market – not only for the future sale of information but also for goods and services. But the other side of the coin is also visible here: swindle and the sale of illegal services.

The IT bureaucrats: Democratic Governance!

These bureaucrats fight first and foremost for a democratic and formally ordered society, and their efforts increasingly encompass the Internet. The EU, the UN and several nations have shown interest for the Internet as an inadequately regulated area since the middle of the 1990s (Drake 2005, Crocker 2000, ICC 2004, IGP 2004). A series of initiatives related to copyright, e-commerce and censorship have been promoted – a focus that intensified during the 1990s partly as a result of the international macro-industry's struggle for stricter copyright law (WIPO 2004, Gross 2003, Hugenholtz 2000, Vaidhyanethan 2001). Further pressure followed the terrorism in the West after the turn of year 2000, and this placed security far higher on the agenda. It worries the IT bureaucrats that the Internet is not subject to formal democratic control. During the past ten years both the EU and the UN have become strong players in designing the Net's future; the process connected to the Internet Governance Forum, which started its activities in 2006, is a key component of this.

I do not argue that this list of techno-political cultures is exhaustive, but that they are the most important in the social history of the Internet. They are also, I think, mutually exclusive in that they would be problematic to combine on an institutional level. As mentioned, they are identified according to their descriptions of themselves, their declared enemies and their goals. In addition to Touraine's identity principle, opposition principle and totality principle, I added what I call a regression principle, i.e. that ideologies may take perverted forms. The Net's openness is at times mistaken for the total absence of governmental control and regulation. Within the Open Source movement in the USA, for example, the belief in openness was in some cases accompanied by a strong liberalism and libertarianism that led to the refusal to support the anti-trust case against Microsoft since this would have resulted in state intervention in the market. In the so-called new economy, unrealistic notions about the Net as a medium for advertising and sales led to enormous over-establishing around 1999-2000, which in turn resulted in a number of bankruptcies and dismissals. The 'new' economy proved to be no more rational than the 'old'. And where technical architecture for the Internet is concerned, it is precisely the

democratic openness of the Net that makes it possible for strong players to force their solutions through.

The cultures represent certain groups of players with their values and their perception of enemies. They constitute relatively autonomous discourses consisting of the themes, actions, threats, challenges, opponents and surroundings that form their contribution to the construction of the Internet. They are doubtless linked to general and centuries-old debates on freedom, democracy, the market's common sense and the extent of the state's power. With the ARPANET, the world's first real data network, these legends acquired a new object. The ARPANET was split, and then merged with other similar nets to form an Internet. Several of the special aspects of the Internet were developed in the ARPA project where the foundation stones were laid for the Internet's 'distributed' nature, its independence from the telecommunications sector and the emphasis on open communication. Already with the ARPANET can the first paradoxes be glimpsed – those that were to flare up later.

It is also important that all the techno-political cultures consist of both an original core and a wide periphery of sympathisers. One example of the latter is the many people who in different ways support the work of keeping the Net independent and open even though they are not themselves involved in standardisation measures. Another example is the hacker movement, which now numbers many supporters of the principle of open source code who do not know how to program. We refer here to cultures that stem from a practice but that to a greater extent now describe a large hinterland of supporters and sympathisers.

Phases of techno-politics

The Net is a result of the material and ideal interests of various social groups. Norms are something that develop through collectivisation, where individuals seek togetherness. Instruments are used that appear reasonable in the struggle – whether they be knowledge and shrewdness or weapons. For the Internet it is matter of knowledge and values of various types that are interwoven to form different and opposing techno-political cultures. Innovators represent one such culture, and the so-called hackers another. Common to all these is that they assumed, and still assume, a key position in the debate on the Net. For some interested parties it is clearly a case of acquiring personal wealth, while for others it is a matter of defending the Internet as global common property. Some stand at the barricades to defend what they own, others to protect their right to national supremacy.

A not uncommon outcome of collisions between opposing cultures is armed conflict. A peaceful result is institutionalisation where consensus is reached on the subject of the disagreement and stable procedures are found for handling it in the future. This is done in mutual awareness that there is no tempting alternative. It is the road to compromise. By battle and conflict I do not mean armed fighting but rather incompatible verbal and technical strategies that disclose equally irreconcilable values. The point is to first identify the Net's techno-political cultures and their programs and then to clarify their importance for maintaining an open and viable Internet.

The conflicts and the concept of the Net's openness have changed character through four phases, the *first* of which extends from the Second World War to 1972. The

ARPANET project was accomplished, and the Net functioned. It was in this period that the basic principles of package switching and distributed architecture were formulated by the innovators. This is the story of a merciless Cold War that followed a brutal and merciless warm war, and of the offspring born of this global conflict. The *second* phase covers the ARPANET phase from 1972 to around 1990 during which the ARPANET developed its own institutions and new services – and not least a new protocol for joining several networks (TCP/IP). The TCP/IP protocol clearly demonstrated its superiority: it was free and openly available and was built into operating systems that were widespread in university circles. This phase was characterised by new so-called virtual communities, by increasing international use, and by the development of an address system. It was also the time for conflicts with the telecommunications sector and with the growing tendency to make software closed. The development of the Net was dominated bu the innovators and the hackers. The *third* phase comes under the sign of the World Web. The World Wide Web has changed both the Net and the Net's institutional surroundings more than anything else. This phase is moreover marked by incredible growth and a number of conflicts that resulted from the advent of commercial interests, due to the powerful entering of the entrepreneurs.

From the turn of the century, we have entered the *fourth* phase of the Net's history, characterised by several opposing tendencies: increasingly advanced technical solutions that bring new terminals and platforms and a greater awareness of what the Net represents in a social sense, but also a closer legal and political intervention in the Net by the IT bureaucrats. From one standpoint this means that the Net is in the process of becoming civilised as a complete and integrated dimension of world society. Currently the Net is situated in a world that has totally different requirements for what it is to perform, a world that cannot handle its growing complexity in any other way than by producing even *more* complexity. It is a world that seldom gives priority to robust and transparent solutions unless they are accompanied by financial gains. It is a world of such heterogeneity that even the Net cannot tackle it and is therefore subject to more complexity and functionality. The question is, at what cost? Individually and in the short term any improvements and modifications can represent real progress for many, but at a general and long-term level such changes can alter the course of the Net's evolution.

Disintegrating architecture?

The ARPANET saw the light of day in the politically turbulent years 1969-1972, the period that encompassed both the Cold War and the warm Vietnam war.[2] One could be forgiven for thinking that these also had an impact on a project that was so directly related to war technology, but the entire emphasis of the project was placed on its position within fundamental research rather than applied defence research. The Net could be utilised for everything and would not acquire a clear area of application for many years to come. It was of great benefit for the researchers that research funds were used to promote fundamental research rather than to develop bombers. The ARPA management constituted a buffer – they did what they could to keep research separate from the political and military goals behind the investments (Abbate 1999:75-77). It was a dual strategy: vis-à-vis the Pentagon they drew attention to the possible strategic defence advantages of the project, while their communication with the project itself emphasised the independence of the research. The project thus took

[2] On the history of ARPANET, see Abbate (1999), Ceruzzi (2003), Cerf (1993, 2001), Hafner & Matthew (1996), Hauben & Hauben (1998), Kirstein (1999), Moscovitis et al. (1999), Segaller (1998), Salus (1995).

the best from two very different worlds: from the military sector's enormous budgets and from science's inventiveness. The latter could be realised with the former.

Abbate (1999:218-19) and others are of the view that the Internet's history bears the hallmark of the unexpected. From early days the ARPANET's development was exemplified by unintended events and new turnings. The unexpected is in fact something that characterises all technology history, but in this case what is unusual was head of ARPANET Larry Roberts' decision not to make a detailed, planned and centralistic system – which could probably be expected of a military project. The flexible and decentralised structure meant that to some extent the Net went its own way as the context and the users changed. Castells (2001:19) claims that the ARPANET was consciously designed with the functions we are familiar with today and with very few military ambitions, and in a sense both these claims are correct. Two main functions of the Net that we use daily are electronic mail and the local area network, both of which are unintended products of a network that was planned as a remote log-on net. But it is a matter of *planned unexpectedness* (and this is where much of the Net's ingenuity can be found). The *planned* constituted creating a distributed and flexible net that paved the way for the unexpectedness. What is decisive is thus the enormous social importance of the innovators' choice of an open and distributed switch method (Bush & Meyer 2002, Callon 1996). Openness meant that the Net could follow developments from the 1970s to the 1990s as society changed. A new innovation such as the World Wide Web could take its position on top of the Internet and could be used immediately. In a way the Net became a road map: one only needed to build one's own road that led to the main road, one could drive different cars as long as they had wheels, and later on, one could freely establish petrol stations, workshops and roadside cafés.

Today the Net's innovators represent a single culture in a somewhat different and more diverse community of offensive environments. Most Internet providers are commercial. Considerable time has passed since the Net became the playground for all forms of business concepts and commercial innovation – a function that is in accordance with the Net's ideas. But many of these have no comprehension of the original ideas behind the Net. The consensus of opinion that prevailed between the users no longer exists and expectations regarding what the Net should be able to achieve are constantly increasing. New business ideas may well be developed that involve the Net doing things for the user instead of the user doing things with the Net. The development of broadband and IP telephony are examples of services that do not easily allow themselves to fit in with the Net's architecture and that require adjustments. The principles of end-to-end and best effort mean that the Net is better suited to data transmission, email and the web than to telephony, advanced graphics and video-based information. Business models that are based on such new applications call for the Net's capacity to be prioritised for defined purposes. For the current providers of commercial services, 'best effort' is no longer 'good enough'.

The Net is therefore being supplied with bandwidth to prevent the queues becoming so long that packages are thrown away and must be despatched again. With the direct transmission of sound and video, two-way image communication, multimedia services, broadband services and IP telephony, robustness is not sufficient. On the contrary, capacity itself is a prerequisite for such services functioning at all. Speed is part of the service, at the same time as a certain degree of package loss can be tolerated. In other services speed is not so imperative – although it is important that packages do not disappear (for example money transfers). To allow such varied forms of use, something must be done with the Net itself as well as with the edge nodes. As a result of the transition from a uniform techno-political community to a

multifaceted Net world, the end-to-end principle stands in conflict with powerful providers' interest in access and content.

When such adjustments are made on a large scale they result in changes to the Net's architecture. As long as the Net's technical rules are neutral and are only visible at the ends where the users meet the Net, producers of software and terminals compete in creating good solutions for the same Net boundary. Competition and innovation are weakened when the Net's main functions have to be drawn into the Net itself. The fear is that the Net will be less capable of serving users with all types of equipment, ideas and needs, and can more easily become subject to players who have such great market power that they will be able to define the technical solutions.

Since most Internet providers are commercial, the owners demand profit. This constantly forces the production of new and more advanced services for which patience and expertise cannot be required of the user – only the ability to pay. This also means that the Net provider is more interested in increasing and retaining its user group than in respecting the Net's end-to-end principle. The fact that the market is trying to convert the Net to a money machine surprises nobody – it is an inherent quality of a dynamic market. The first large-scale attempts culminated in the so-called dot.com wave that was out to exploit the Net for sales and marketing, i.e. commercial *content.* This was a legal if not always well-considered experiment. The *second* wave (more of a breaker) is what we are experiencing now. This is more serious even though less is written about it. Now it is the Net's *architecture* that is being re-drafted in order to satisfy the world's entertainment industry.

One of the biggest challenges facing the Net today is therefore to preserve its end-to-end architecture as a prerequisite for what is valuable about the Internet: openness and diversity (Kempf & Austein 2004, Saltzer et al. 1984). The greatest threats against the Net are that not all those involved respect this open structure and that the Net will attract so many innovative users that it will be filled with complex special solutions that deviate from its original ethos of technical neutrality, flexibility and robustness. Instead, various players force in more advanced, proprietary solutions that are propelling the Net towards the classic tele-model where complexity and 'intelligence' lie in its deeper more central layers.

The Net's end-to-end architecture not only constitutes its key value with regard to development over time, it also ensures competition, innovation, reasonably priced services, simple equipment and high accessibility. It allows the Net to tolerate extreme strain and very different forms of use.[3] But the Net's widespread extensiveness also creates pressure on privacy protection, threatens information security and makes considerable amounts of noise possible. We can inadvertently do harm by receiving and passing on viruses and worms. As users of the Net, we ask ourselves more and more frequently whether a message is genuine and authentic, and who has actually sent it. And when no clear answer can be obtained, the outcome is filters, firewalls, systems for certification and authentification and other

[3] On principles for design of the Internet, see Reed et al.: Active networking and End-to-End Arguments. http://web.mit.edu/Saltzer/www/publications/endtoend/Ane2ecomme Kempf and Austein (2004) The Rise and the Middel and The Future of End-to-End: Reflections on the Evolution of the Internet Architecture. RFC 3724, Carpenter, B. (ed.) (1996) Architectural Principles of the Internet. RFC 1958:4). Paul A. David (2001) argues that: 'It is the openness and transparency of this network – resulting from the distinctive 'end-to-end' design of the architecture and transmission control mechanisms – that enables the Internet to tolerate extreme diversity and heterogenity in the technical specifications of its constituent networks and platforms.'

functionality on the Net. And this presents a paradox: the Net's architecture assumed moral surroundings – which the same architecture's success is now in the process of weakening. An increasing number of functions are being installed on the Net to protect users against breakdowns, sabotage and contamination of information, but such measures distance the Net from its original principle. The number of users who do not possess any particular knowledge of or interest in the Net's mode of operation is totally excessive compared with the former old users.

The Net was constructed to enable people to use their computers at other locations and to allow them to send and receive messages to and from others. For this the Net is unique, as well as for disseminating information on websites that refer to each other. However, commercial use (and misuse) demands ingenious registration and control schemes, manipulation techniques, price and duty systems, and security regulations. Since the Net basically makes no distinction between the various forms of content or identifies its users, some forms of control must be introduced. One target is the Net's anonymity, which from both a commercial and a political standpoint can be regarded as a weakness. In principle it is difficult to use the Internet to make segmentation models that join users and information, which enhances the efficiency of sales and marketing. The Net lacks functions that make it easy to run businesses, which in turn paves the way for criminal and unethical use and impedes police investigations. The Net's architecture makes it difficult to acquire an overview of users and the information that flows through the networks that the Internet consists of. This therefore also constitutes an area for new innovations that can position themselves on top of the Net's distributed architecture and can result in greater control. Over the past ten to fifteen years, inventive people have given the Net a number of supplementary functions that can hardly claim to follow the Net's original spirit. Keywords are electronic questionnaires, cookies, global registers, spyware, digital certificates and protocols for payment security. Some of these are propelling the Net in the direction of what Lawrence Lessig calls the architecture of control (Lessig 1999:41).

The Net's parliament

I have addressed the most important techno-political groups involved in the development of the Internet, and in general terms, some of the problems that the architecture of the Internet currently faces. I turn now to the main mechanisms for handling infrastructure questions, to see how it is positioned to deal with the problems. As we know, the Net is not without governance. Several procedures and organisations have coordinated the Net's technical development, and continue to do so. The first and in many ways the most important of the Net's public bodies is a remarkable phenomenon that originated in 1968 and that is prosaically called *Requests For Comments*.[4] Len Kleinrock at UCLA was assigned the task of looking at the difficult issues concerning the Net's construction, and students and researchers from the first four data centres met to discuss various aspects of the net that was to be built. At that time little had been decided, and BBN had not yet been given the contract for building IMPs. Len Kleinrock established the Network Working Group (NWG), which was to develop software specifications for host machines and

[4] The following is based on Abbate (1999), Cerf (1993), Hafner & Matthew (1996) and on several RFCs about RFC, among them RFC no. 2555, (ftp.rfc-editor.org/in-notes/rfc2555.txt) with the title '30 Years of RFCs'.

also to serve as a forum for discussions on the use of the Net. The group agreed to meet three times a year, and the hosting was to be taken in turns. The group grew rapidly, from fewer than ten researchers the first time they met to almost a hundred two years later. Active participants included Vint Cerf, Steve Crocker and Jon Postel – people who were to leave their mark on the development of the Internet for many years to come (Cerf 1993, 2001).

As the ARPANET experiment proceeded, ideas had to be documented and put into a system. A more frequent and more specialised exchange of information soon became important among those who were concerned about the special problems that had to be solved. In time the NWG was obliged to document its results, and the group created a system for circulating and identifying the memos. Suggestions and ideas were circulated in memos marked Request for Comments (RFC). The RFCs often consisted of comments to previous RFCs, and they gradually formed part of a problem-solving process.

The first RFC was sent out by paper post on 7 April 1969 by Steve Crocker at UCLA and was entitled 'Host Software'. The next one was despatched via a well-known collaborative system (NLS), constructed by Douglas Engelbart at Stanford University, but this was also sent by normal post. It was the NLS system that became the archive for the RFCs for quite some time. Email and the transmission of files still belonged to the future. The style in the RFCs has since been characterised by the participants as congenial, to-the-point and oriented towards cooperation and consensus.[5]

RFC no. 3 claimed that the minimum length for an NWG memo is one sentence. Short contributions are not so easily considered authoritative and established, and in addition it was important to communicate ideas quickly – even though they were not polished into the language of scientific publications. There was simply not enough time. The free flow of information was not only the ideal but also a practical necessity. In addition, RFC constituted a type of continuous review process and was to be the way in which the ARPANET and subsequently the Internet found solutions. There are now over 2500 memos in this series.

The RFC scheme was a peculiar phenomenon in a project that was financed by the Armed Forces and that took place during the Cold War. All the aspects of the development of the ARPANET and the Internet were openly presented in RFCs. The work that was put into the NWG formed the basis for what was subsequently to be called TCP/IP – in practice what we now call the Internet. RFC can safely be called *the reflective dimension* of the development of the Net, and can therefore also be regarded as the main source of the technical history of the ARPANET and the Internet. RFC was the ARPANET's and the Internet's 'public sphere' where everyone who had something to contribute could take part and where the distribution had no limits – in spite of the fact that the Ministry of Defence financed the project, and did so at a time that was characterised by suspicion and secrecy. None of the RFCs were ever classified or limited. RFC kept a discussion going about the best solutions without a sidelong glance at the special interests of the individual data centre or university. But the memo series had an editor who managed and synthesised input

[5] Steve Crocker in RFC no. 3: 'The content of a NWG note may be any thought, suggestion, etc. related to the HOST software or other aspect of the network. Notes are encouraged to be timely rather than polished. Philosophical positions without examples or other specifics, specific suggestions or implementation techniques without introductory or background explication, and explicit questions without any attempted answers are all acceptable. The minimum length for a NWG note is one sentence'.

and who determined whether a new contribution was good enough. Jon Postel was the editor of RFC for 28 years and it is partly through this that he has had a low-profile yet strong influence on the technical development of the Internet.

The solutions that resulted from this work were based on the principle of an open end-to-end architecture. The reason this road was taken was not only that the group was far-sighted, although they had no premonition of the growth the Net was to experience, a more prosaic reason was that the NWG was dominated by ingenious young students who had no formal authority. They did not dare to implement key solutions that were to form the ultimate basis for the further development of the Net. Instead they worked on the premise that all the solutions would and should be replaced by others over time, that they had to be scalable (to tolerate growth) as well as observable for everyone, and that the burden of implementing them was as far as possible to be assigned to local places. Establishing a complete set of protocols for all parts of the communication and for the future as a whole was both too frightening and too complex. From the very beginning the most important factor was that the Net was to be based on an open architecture with several layers of protocols in which only some were decided centrally in the project. For the same reason the RFCs placed great emphasis on the fact that they represented contributions in an open debate and did not express any form of top-down regulation.

RFC has the key task of distributing central technical ideas and suggestions for discussion, a job that is decisive for the further development of the Internet. As the memory for the activities in their entirety, RFC counteracts many superfluous double discussions and ensures progress in the work of finding new ideas. It also contributes to committing the community through *rough consensus and running code* as well as safeguarding a retrospective view of all the significant threads in the Internet's technical development. RFC publications constitute one long sequence of documentation of the route taken by the Net from 1969 up to today. Consensus and progress have prevented both fragmentation and proprietary standards, at the same time as they have ensured a smooth development towards more and better standards for new innovations. The principle concerning open source code has been a cornerstone. With this as the fundamental perspective, it is not difficult to see what the threat against providing continued communication opportunities for the general public actually constitutes: closure in the form of monopolies, proprietary software and detailed regulation.

Currently RFC plays a different role from that which it had in the 1970s and 1980s. The working groups usually work on so-called Internet-Drafts, i.e. drafts for documents about standards. If the group wants these to be published as RFCs, the IESG reviews the document and advises the RFC editor about possible publication – although ultimately it is the editor who takes the final decision. RFCs have thus been given a more formal status and now resemble publications in a professional journal, while Internet-Drafts bring to mind the activities of RFC in earlier days (Bradner 1999).

The Internet Engineering Task Force (IETF)

It was the RFCs in the NWG that formed the basis for the most important organisation within the techno-scientific culture I have called 'the innovators': the Internet Engineering Task Force (IETF), formed via other types of organisation. A

group that Vint Cerf and Robert Kahn had set up in the 1970 called the Internet Configuration Control Board (ICCB) continued to assess changes and different suggestions for protocols and experimented with them to check whether they functioned. The group had discussions with all those who were interested, with consensus as their goal, and they sent suggestions out as RFCs. The governance of the Internet was decentralised and was managed by its users – as it had been under the ARPANET.

In 1983 Barry Leiner decided that the ICCB was to be expanded and he founded the Internet Activities Board (IAB), led by Dave Clark. The experts from the ARPANET were thus joined by people from other universities in the USA, as well as individuals from a number of European countries. Anyone with the required competence and an interest in TCP/IP was in principle allowed to participate (Abbate 1999:207). Participants came from several of the nodes in the ARPANET and from an increasing number of other institutions. Originally the IAB started as a gathering of ARPA-financed researchers, but it soon included other interested parties. Due to the growing interest, it was decided to divide the activities between an Internet Engineering Task Force (IETF), which was responsible for protocols and addressing and for other technical issues, and the Internet Research Task Force (IRTF) which coordinated research. The gradual organisation that had begun with the formation of the NWG in 1972 and with the IAB and the IETF in 1983 was intended as a form of protection of the open and distributed structure of the Internet (Harris 2001).

The first IETF meeting was held in 1986 and had 21 attendees. The IETF soon became the most important social institution for the Internet's development. Participation rose steadily from around 30 in the first year to more than 2100 in 1998 (Bradner 1999). There are more than one hundred working groups organised into areas that are controlled by area managers who form a group together with the Board (IESG) to approve suggestions for new standards.

The IETF has the task of finding solutions to pressing technical problems in the Internet. Its job is to specify protocols and other aspects about the architecture in order to solve problems on the Net, and it is to direct recommendations on the standardisation of protocols to the Internet Engineering Group (IESG) as well as facilitating the transmission of technology from the Internet Research Task Force (IRTF) to the Net in general and serving as an open forum for the exchange of information between the Net's various technical players. Throughout the 1980s it was the IETF that was responsible for the technical planning of the Internet – not least the development of protocol standards. Since 1986 the various working groups in the IETF have drawn up all the standards for the Internet, i.e. in practice almost all of them apart from TCP/IP. Consequently it is the IETF that should be thanked for the fact that the course of the technical development of the Internet has been relatively steady.

It can safely be said that the IETF is a grassroots organisation even though it consists of data experts (Bradner 2006). The meetings and the working groups are open for everyone with competence and interest in the subjects involved. Suggestions for new working groups seldom come from the management: new groups are set up when a number of members agree that a new group should be established to solve a given problem. When a large majority agrees to establish a new standard, it is given the status of a proposed standard. After six months it is termed a draft standard, and after a further four months it becomes an Internet Standard. All documents and discussions in the process are open, which – together with the fact that the initiators should come from low down in the hierarchy – has produced commitment and new recruits.

The IETF represents much of the Internet spirit since everyone can participate, there is no membership, all discussion is open etc. It was in connection with the IETF that David Clark formulated the motto: 'We reject presidents, kings and voting; we believe in rough consensus and running code!' This describes the point of departure for a standardisation process: relative agreement and further testing through functioning program codes. The innovators' aversion to formalism was also clearly demonstrated when there was talk of introducing an election process to appoint members of the steering groups in the IAB and the IETF. The practice of people appointing themselves was well-established, but looked strange from an external viewpoint. Jon Postel and several of the other pioneers made it clear that they would not participate in the work if they had to stand for election. Presenting oneself as formally responsible vis-à-vis a large audience was not their perception of democracy on the Net. Instead they supported the established Internet line of thinking: those who have knowledge and willingness participate where they think they have something to contribute. The former president of the Internet Society, Don Heath, points out that in the early days consensus was the only way they could find out how the Internet was to function. By this he means that many people from different organisations at different places joined together and collaborated until things worked. He adds that it has since been shown that this was in fact the dawning of self-governance in the Internet world (Hamm & Machill 2001:189).

Typically enough the IETF does not have any formal legal status – it is neither a company nor a government administrative body (Hoffman & Bradner 2002). It is an organisation that is positioned outside both market and state, well-rooted in civil society. For a long time the IETF acquired financial support from the American authorities and from participation charges. However, when the Internet Society (ISOC) was established in 1992, the IAB suggested that the IETF operations should be included under the ISOC's umbrella, thus ensuring its many activities a more long-term and stable foundation.[6] This is a formal arrangement, and the ISOC does not interfere in the IETF's activities. The IETF is financed via meeting charges that are paid by the representatives' organisations. Participation in the IETF's meetings has declined, which has resulted in a somewhat weaker financial basis for the IETF. Although it also has other sources of income, such as donations, the total constitutes a fragile basis for a secretariat that has to take on increasingly large assignments.

The international interest that standardisation efforts aroused in the 1980s made the IETF the core of the Net's technical development. Today the IETF is one of the most important and most successful organisations in the digital world. To a large extent it is the IETF's work that has enabled everyone to use the Internet for more and more operations. But the IETF is also suffering from the large changes in the organisation's surroundings – in the first place in the data industry. This is manifested in many ways: greater attention to costs in the industry makes it more difficult for volunteers to take part in the IETF's work, and the commercialisation of the Internet has converted much of the technical standardisation work to financial issues. More time is spent on and attention paid to competitive implications at the expense of technical aspects. Both commercialisation and the interweaving of data with the telecommunications

[6] Milton Mueller (2003:89-90) writes: 'The group formed a tightly knit cadre with strong backing from U.S. government research agencies. As the infrastructure and user base expanded, however, their status as researches began to blur into a new and very different role as the managers of a new international standards organisation. Rising to meet this challenge, they succeded in forming a robust and unusually open protocol development community. As the importance and size of the Internet increased, they constructed more formal organizational structures around themselves to maintain their position as stewards of the Net. This process culminated in the formation of the Internet Society in 1992.'

sector have led to pressure from experienced and competent people – but they have other values and objectives for such work. New techno-scientific cultures have also jumped on the bandwagon, mainly from the telecommunications sector, but they do not necessarily share the original perception of the organisation's object.

The IETF is based on individual membership, and the individuals must not only represent their respective companies or countries. All the 120 working groups in the IETF are open and are working on new versions of the Net and on mobile solutions, security, routers etc. Email lists are the most important working medium where the group of interested parties tries to identify a problem, find the possible available solutions and define how they can work, and subsequently produce a technical protocol that can be tested. The IETF itself is struggling because such processes are inhibited by the fact that not all those involved have consensus as their goal, but aim to force through certain solutions or neglect to follow up agreements on progress. Harald Alvestrand, the Norwegian who formerly held the Chair of the IETF, has often referred to the challenge involved in adapting the Net while taking many divergent wishes into account.

When the workload increases and the problems that are to be solved become progressively more complex, difficulties arise in attaining *rough consensus.* The organisation appears to have problems in managing the growth in assignments while also maintaining the quality of the solutions. The problems in the IETF have been addressed in several memos and are recognised as something the organisation must resolve. But the predicament is also reflected in the discussion in that it is becoming more and more difficult to reach consensus on what the problems actually consist of. The Net's incredible popularity poses a major challenge for the IETF as the Net's coordinating intelligence since the participants have divergent perceptions of the world.

With the steady addition of new networks, the ARPANET elite were able to leave much of the technical work to others and to spend more time on planning. After the Internet was privatised, the technical administration had to be moved from public bodies such as the NSF. The Internet Society (ISOC) was formed by members of the IETF in 1992. The ISOC is a non-profit member organisation that has the tasks of maintaining an overview of the task forces and spreading information about the Internet to the general public. With over 16 000 members from more than 180 countries, the ISOC's ambition is to be the leading organisation for defending the Internet in all major techno-social areas, such as privacy protection and freedom of speech. Apart from the technical standardisation issues that the IETF and other subgroups take care of, the ISOC is to provide everyone with high-quality information about the Net, to support teaching and Net development in poor countries, and in general to lead the wide-ranging discussion about the future of the Net.

The establishment of the ISOC was a step taken by the pioneers (the innovators) to safeguard their authority over Net development. Power over the Net had to be institutionalised to enable the Net to develop in the desired direction. The work performed in the IETF needed protection, funding and a broader legitimacy in the international Internet environment. The goal is a Net that is as open as possible and that has open architecture and self-regulated content as well as the minimum of censorship and discrimination. The formation of the ISOC also represented an acknowledgement that the Internet had a growing social impact and that society would therefore also exercise reciprocal influence on the Net. IETF and the ISOC are no doubt competent and engaged agencies, and should be well equipped to deal with the problems I have touched upon. However, a highly concentrated Internet-market with powerful actors as well as the trend to move several Internet issues to a

'multi-stakeholder' arena, create a new situation. It is however too early to say how the new Internet Governance initiatives will affect the 'old regime'.

The new Internet Governance

In the brief history of the Internet, the power to influence its course has largely been with the innovators, the hackers and the entrepreneurs. In the 1990s another techno-political group appeared on the stage: the IT bureaucrats. The future of the Internet was no longer only decided in the IETF, in commercial products and business ideas that enter the market, or from the Open Source movement. General issues on trade, pornography, marketing and privacy related to the Internet, were bundled together and called 'Internet policy'. Internationally Internet policy was linked to other techno-political groups and consequently labelled 'Internet Governance'. Can this new regime sort out the problems I have addressed here, that causes much concern and worry in the IETF and ISOC?

In 2004 and 2005, The Tunis agenda for the Information society (TAIS) building on the Geneva Declaration of Principles, identified some main challenges. Among them where problems like lack of network availability and capacity and skills to use the Internet, affordability and availability of the Internet, multilingualism, International interconnection costs, privacy, spam and fraud. The Tunis Agenda also reached a compromise on how these issues should be addressed beyond the WSIS stage. It laid the foundation for the 'Internet Governance Forum for multi-stakeholder dialogue on policy', which was given the mandate to discuss public policy issues in order to 'foster Internet's sustainability, robustness, security, stability and development'. It was to have third world development as an overall perspective. The IGF was a compromise in order to keep the involved stakeholder groups together, and to ensure that the process continued.

The long-term trends that lead to the IGF, were several. First, liberalisation and digitalisation of telecoms transformed them into important players in the ISP business, and gave energy and authority to the ITU as an international policy agency. Second, the general integration of the Internet into society continued in all sectors of society created mixed experiences and a diversity of views about the blessings and dangers of the Net. Particularly, the Internet-based mass consumption from the mid 1990s led to rising demands, new expectations, and a number of new market players (software developers, ISPs, research, public regulatory bodies). Third, Internet infrastructure became increasingly deployed in developing countries, which also created political awareness about barriers and potentials of the Net. This debate was subsequently linked to the general globalisation debate, and to the globalisation-critical movement. Finally, the new regime of the domain name system ICANN (Internet Corporation for Assigned Names and Numbers) received a lot of attention because of its ambiguous status (Hamm & Machill 2001, IGP 2005b). The ICANN debate put the topic of Internet regulation on the agenda.

Some definitions of governance emphasise that it is a process of collective action that guides or restrains other collective activities. We could draw on Anthony Giddens' formulation: Governance is collective action that applies certain rules and resources on a distinct set of social issues. Others would stress communication more than action: Governance is communication that applies certain rules and norms (formal and informal) which are connected to a set of issues. Broadly speaking,

governance is a mechanism for tackling an area of complexity, by directing different perspectives towards what may seem as a set of common problem. It is a paradox, in the sense that it is a mechanism for tackling an area of complexity by adding complexity.

And evidently, the IGF is a complex mechanism, with four stakeholder groups (governments, the private sector, civil society including research, and inter-governmental organisations) that see themselves as interdependent and with common aims. The question is whether the acknowledged stakeholders may develop a unified semantic space from where they can develop common or overlapping ideas about the Internet in society. Whether that will actually happen, is too early to say.

In earlier UN processes, issues have usually been handled by governments. The problem of legitimacy was limited to the problems that governments have. Now, Governance rests on different expertise groups as legitimate powers. We might distinguish between at least three forms of legitimacy at play in the IGF process: First, *representative* legitimacy based upon the representative electoral political system of states or systems like the EU where everything said and done should have the national interest in mind, and where the freedom of the delegates here is very limited. Second, *interest* legitimacy based upon personal engagement, involvement and knowledge, as is the case among innovators and hackers. And third, *market* legitimacy based upon private business success on the market of the entrepreneurs. This indicates that the techno-political cultures involved in Internet Governance have different mandates, and different kinds of expectations and responsibilities directed to them. Another side of the 'Multilateral and Multistakeholder dialogue' is what we may call 'differentiated legitimacy', which poses a considerable challenge because the players and bodies involved are quite heterogeneous and do not share common values with regard to the development of the Net.

The agenda setting in Internet Governance is a more complex, vulnerable business than it used to be when there was only government legitimacy involved. With multi-stakeholderism, and different strategies of legitimacy, several paradoxes are introduced into the governance process. If the IGF is to be more effective (more than simply issuing 'visions for the future'), it needs to narrow the thematic field, but then it also may undermine its legitimacy base. Also, business and the civil sphere are international, but governments are largely national. The Internet as a global information system is largely locked into national legislations. Multi-stakeholder policy dialogue carries with it a tension between 'multi-stakeholderism' and 'enhanced cooperation' on the one hand, and the fact that public policy remains the task of governments on the other.

The EU, the US Government, private businesses, NGOs and international organisations all welcome a focused process. The structure that organises the forum is not *hierarchies* of governments, not the *law of supply and demand* or the *private initiative* in the private sector, but rather hybrid networking involving all four types of stakeholders – just as Internet Governance in its original IETF shape, but this time in a more complex and less egalitarian version. Deliberation takes place but that fact should not let us forget that we were witnessing a power struggle. In a Weberian perspective, power is about realising ones intentions strategically, more or less regardless of others' interests and intentions. Internet Governance is expected to be focused interactivity where threads are spun between agents, organisations, issues and sub-issues, which derive from the vast diversity of interests and powers in society. Network as a principle for international governance has many virtues, but simplicity is not among them.

A proposal has been to build on the *original* Internet Governance model, the IETF. It has been suggested that the working model from the original innovators would do the job. Evidently, the IGF is quite inspired by the IETF: According to the WSIS Agenda, the IGF should be 'open, transparent, lightweight, decentralised'. As we have seen, the task force does not apply voting, there is no formal criteria for participation, all meetings are open, all documents are available and free to anyone, all have equal rights to speak – the decisive is 'the better argument'. Anyone can appeal to the chair to re-review decisions based upon the argumentation. The task force builds upon respect for technical expertise. The pragmatism of IETF comes through in its admiration for the simple, the neutral, the robust and the useful. It has, as we have seen, traditionally been a relatively unified techno-political culture of what I called innovators, with a large number of effective working groups as its essence. The IGF functions in another environment where less is taken for granted, and where there is less common ground for consensus. Not surprisingly, the IETF is concerned about the rise of both commercial and regulatory power. The question from its point of view is whether the new Internet Governance regime will be able to protect the Internet infrastructure from political and commercial interference and manipulation. Historically, there is some pessimism regarding the ITU as an agency qualified to organise a system of Internet Governance.

More important, however is what we may call the *Internet Governance Dilemma.* Like the liberal dilemma, we have The Internet dilemma: The openness of the Net is available for all, including those who do not bring further the original open structure of the Net, for commercial, political, or even destructive reasons. The Internet Governance Dilemma is that Internet Governance is a process genuinely open for everyone, including those who are ignorant of, or even reject the original Internet Governance model, mainly among the expert cultures I have called entrepreneurs and bureaucrats. There is also an underlying concern among people involved in developing the infrastructure and code layers, that the growing complexity of governance issues may create *vertical chain reactions.* That is to say, that by addressing problems at one layer, one might create unintended and unwanted consequences at another layer. Issues discussed at the information layer may have side effects to lower layers. One example is International Domain Names, demanded by many developing nations, but may create a number of side effects at deeper layers. Although the IETF has developed a standard for non alpha-numerical DNS addresses, there is a controversy over whether DNS is to be considered a mere technical solution or not.

The Internet Governance Forum is intended as an arena for multi-stakeholder deliberation on complex Internet issues. Its first meeting in Athens in 2006 indicated that there is a long way to specific policy making. If the IGF ends up being a success, it is not because it solves problems, but simply because it keeps multilateral diplomacy on the Internet going. For reasons of complexity and fragmentation of interests, it is however unlikely that it can muster the authority and consensus that is needed in order to seriously address the problems I have touched upon in this paper.

Layers of Governance

Code is Law says Lawrence Lessig (1999), but code is more. The starting point for this paper's socio-historical review of the Net's most important challenges and conflicts was that *code is politics*, i.e. that the Net is a social structure created

through collective social action. I have discussed some of the social and structural changes that the Internet is in the process of undergoing and that set new limits for communication in society. There are far more changes taking place than those I have mentioned here. As Milton Mueller (2003:266) concludes: 'Now, of course, the world is starting to close in on cyberspace. Formal organization, property rights, and commerce, regulation and geopolitics are reasserting themselves systematically.'

The Internet's digital and social structure is a product of social actions in and through techno-political cultures. Social structure is both a medium for and a result of code. It is created socially and in a wide sense politically, but it affects several forms of individual and institutional activity.

The Net's structure has been developed through models where layers are positioned on top of layers. In the light of the discussion in this paper we can reduce these to three main layers. We should distinguish between (a) the infrastructure layer that is the layer for the physical lines and central Internet protocols, (b) the code layer that concerns formats and standards, i.e. where we as users meet the Net through the implementation of Internet protocols in several types of software and services, and (c) the information layer where use, norms and laws seek to handle the meeting between the Net and society.

In all three layers there is controversy about the Net's openness.

The *infrastructure layer* includes more than the network layer in the OSI model and concerns the Internet protocols IP, TCP and UDP that are incorporated into the principles of open architecture, *best effort* and a distributed and neutral end-to-end structure. Nonetheless it is here that we find discussions about the domain name system DNS and the protocols for the World Wide Web. Currently it is particularly the organisations the IETF, the Internet Society and W3C – along with a number of other *ad hoc* organisations – that present these thoughts through the practical development and agreement about protocols and open standards. An intricate international Net environment of what I have called innovators rally around these efforts along with their supporters in their conviction about the importance of the Net continuing to function as a global public good. Attempts to intervene and pressure must be counteracted.

Over the infrastructure there is the *code layer* where battle rages about writing, reading, listening, publishing and communicating in open formats (rtf, xml, pdf, odf). The code layer is also about operating systems and other forms of software in server machines and personal computers. Those I have called hackers (who include many more people than those who actually write code) are fighting on data-political, economic and technical grounds for open source code, milder forms of copyright and the abolishing of patenting. Here we can find the practical development of global software such as GNU/Linux, Apache and other types of open and free software. These are supported by organisations such as the Free Software Foundation, Open Source and many other movements and mergers. A major instrument is alternative licence schemes such as GPL and others. However, we can in general also see the fight for open standards here.

On the top we find the *information layer,* which contains the arrangements, agreements and initiatives that are to contribute to ensuring that information is open and available to as many people as possible. It is here that users such as consumers, students and researchers (both individually and through institutions and government authorities) are preoccupied with the possibility for texts and content to be exchanged and stored in open and independent ways and without exposing them

to surveillance or censorship. Instruments in this battle are projects such as the Project Gutenberg and alternative use of the rights of copyright such as Creative Commons. In this layer we can also find the movement for Open Access publishing, which works to promote free availability of scientific publications for both the general public and poor countries independently of expensive commercial channels. And not least we find legislation and Internet Governance including the discussion about spam and attacks on privacy.

In addition to the main controversies that can be found in all three layers, the big challenge in the years ahead is to prevent giants consolidating their dominance in value chains *across* the layers. Microsoft is the colossus that dominates the personal computer by its total supremacy regarding operating systems, practical word processing programs, presentation, calculations and browsers. Apple Macintosh is its little brother with a (design-)friendly image and an often more sympathetic policy towards the Open Source movement. But Apple also exploits its market dominance whenever possible to safeguard its hegemony, unless pressed to do otherwise.

Following the turn of the century however, it is Google that has built itself up to be the world's most valuable media enterprise. Google's entrance portal to the Net is not an operating system or music sales but a series of innovations in the wake of its advanced functions, which enable Google to make the Net far more constructive for the user. Google aims at making work processing and other common data use a direct extension of the Net. One of the ways it earns money is by so-called relevant advertising, i.e. the advertisement is selected on the basis of what we use the Net for – even on what we write in emails and with word processing. This doubtless has significant personal privacy aspects. It is also important to question whether this utilisation of central server machines for users alters the Net's distributed *best effort* structure. And what will the consequences be for Microsoft and Apple if Google's strategy succeeds?

Conclusion

The term 'techno-politics' illustrates that it is never possible to make clear distinctions between technology and politics. Politics uses technical standards because they can be more effective than laws, at the same time as technical expertise is acquiring a political power that was not intended. It is this grey zone that is so important for understanding the Net's development, which I call the Net's techno-politics. I have addressed some of the structural changes the Net has gone through by describing the norms and social conditions that existed during the rise of the Net, and the crisis trends that may lead to a less inclusive Internet than that we are familiar with today. These dynamics of conflict are the basis of the Net's gradual transformation from being an open technology to being increasingly more responsive to marketing, legal and political problems. It is the challenge of openness in the light of this transformation that was the main theme.

As is the case with a sustainable natural environment, the expression 'a sustainable Internet' can only be understood in a long-term perspective. Activity on the Net is sustainable if we can visualise it continuing in thirty years' time without the core values of openness being undermined. On the basis of what I have described as values through the Net's techno-political history, it is possible to set these as standards that the Net's politics must meet. From the point of view of the techno-

political cultures I have called innovators and hackers, the Net ought to be governed – or govern itself – according to norms that allow it to continue to be at the service of all interested parties. The Net's players should respect the Net's openness and demonstrate this respect as esteem for standards and the Net's formats and open architecture, and should continue to support diversity in all Net-relevant technologies as well as formats that make texts readable in ten, fifteen and a hundred years' time. Hopefully, it will continue to advocate creativity and innovation and to support all those worldwide who want a simple and robust Net. It would be unfortunate for the Net if democracy takes precedence over expertise, or monopoly power over technical rationality.

The Internet is a common good that many people use and nobody owns. Nonetheless, someone must steer the development of the Net's language and protocols, and take decisions about the Net's address space. The Net's openness needs to be safeguarded for such a colourful world of users, computers and software. As we have seen, the Internet has come into existence through groups' and cultures' commitment and their fight to take part in this (self-)governance. This paper has presented a view of the Net as formed by techno-political controversies and as still standing at the centre of more than one conflict. It has thus provided a foundation or backdrop for a very significant point: if the Net is not protected by sustainable, long-term norms, it will degenerate.

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