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HOW GLOBAL IS THE GLOBAL INTERNET? FIRST STEPS TOWARDS A POLICY-ECONOMIC ANALYSIS OF THE INTERNET

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ABSTRACT: Who exactly are the main players behind the technical infrastructure of the Internet? What paths are emerging at a global level about the use of the Internet? Where and by whom is content produced and consumed? To put it more colloquially, who are the 'spiders' of the Internet and how are they actually spinning their webs. These aspects, together with the issue of Internet governance, are amongst the most critical and important elements to understand how the Internet's political economy is articulating itself.

In order to start an analysis of the Internet's political economy, this article concentrates on the first two aspects: a technical analysis, which aims at understanding who is behind the Internet infrastructure, client and server applications, and paths of content production and consumption; and an assessment of which cultures and regions in the world are developing into important Internet players. The two parts are complemented by a critical assessment that aims to clarify why these issues are important in order to establish a first sketch of the Internet political economy.

This article presents a multi-level and multi-disciplinary analysis to technology development, very much in line with a socio-constructivist approach, in which technology and infrastructure, players and interests, and models of societal appropriation are considered as equally important. It will hopefully generate a first idea of how to map the main types of shareholders directly and indirectly interested and involved in the issue of Internet governance and what are the most important points of attention for scholars interested in the topic of Internet political economy.

This will lead to the formulation of a number of research questions, shaping and building a more articulated and coherent approach into research about the political economy of the Internet.

Introduction: Just who exactly is spinning the Web?

"As a philosopher, I'm not going to become involved in condemning some specific uses of the Internet and praising others. My question is a more speculative one: what if the Internet becomes central in our life?... What if it becomes an 'irresistible alternative culture?" Dreyfus HL (2001), *On the Internet*, p. 6, Routledge, London and New York.

Many regard the Internet[1] as a new participative communication medium free of the interference of the corporate sector which is evident in other mass communication media such as radio, television and press. This view of the Internet is justified mainly by its technical and communication characteristics which, while engendering a new user-driven communication space, enable a fresh kind of distributed and

1 Here defined as *the global hypermedia communication environment* which is the result of the use of the WWW protocols and applications on the Internet network's protocols.

participatory public sphere. The consequences of these statements in terms of what the Internet has brought and might bring to consolidated democratic processes and institutions[2] are enormous.

In opposition to the simplistic view that the Internet is free of economic and political interference, this paper shares the view that the Internet and the cyber-public sphere it enables, are a highly contested territory in which strong corporate and political interests are at play.[3]

The battle they are waging to control specific paths of evolution of the Internet might seriously undermine its democratic potential as it might change its very character of many-to-many, distributed and participative communication mediums. In other words, this article puts forward the argument that the functioning mechanisms of the Internet and the players behind them, while ignored by most of its users and scholars, are important aspects to be considered when trying to identify the elements of the Internet's political economy and valuable assets to help shape the best governance mechanisms and institutions. To ignore how the Internet works and its changing content production and consumption paths is one of the main dangers faced by this new communication tool and should not be permitted by either the scientific community or the user community itself. To use the words of Berners-Lee and Fischetti (1992, 2): "The irony is that in all its various guises – commerce, research, and surfing – the Web is already so much part of our lives that familiarity has clouded our perception of the Web itself."

In order to put forward these points, the paper is divided into two parts plus a conclusion. The first part aims at understanding who the main players behind the

2 Bimber, to quote just one author and to give an example of the amplitude of the debate about the future of democracy the Internet is generating, to summarise the many manifestations and potentials of the Cyber Public Sphere talks about "accelerated pluralism" to describe the effect of the Internet upon politics. By this expression Bimber wants to stress how the Internet is lowering the obstacles to grass-roots collective political organisations, it is speeding up the process of intensification and group-centered pluralistic politics. According to the same author, the result of this process might be a political system in which issues are developed and moved more quickly because of the "quicker cycle of mobilisation and response, and in which government officials increasingly hear from and respond to new kinds of groups – those without large, stable memberships or affiliations with established institutions" (1998, p. 158).

3 Amongst others, this view has been expressed by Goldsmith and Wu (2006). While their book focuses on how governments are controlling the development of the Internet and how borders are retaining their importance over the borderless Internet (and the communication flows within), this contribution tries to map the actors and players that can be considered the shareholders of the Internet's infrastructure and to see what paths of content production and consumption are emerging and whom they might favour.

technical infrastructure of the Internet are and how packets flow unevenly in and between different parts of the world. The first part will integrate a short description of the main elements of its infrastructure with an analytical assessment of the main players and their respective market shares. The second part analyses, in order to determine which cultures and regions are profiling themselves as strong Internet players today, paths of content production, content usage and content flows.

These two parts together attempt to provide a first map of the power structure in place behind the Internet. The conclusion will try to put the two parts into perspective and to present some research questions that might help to further develop this political economic analysis.

In a period in which decisions about present and future governance of the Internet are about to be taken, the author strongly believes that this article might contribute to the development of a more reasoned debate concerning mandate, configuration and *modus operandi* of the Internet's future governing bodies.

Part One: Technical Geography of the Internet[4]

"Rather, the marks of a truly transforming technology lay elsewhere and are, I have argued, twofold: the ability to serve recurrent needs better (qualitative as well as quantitatively) and having a major impact upon the form of social and political life" Grahan, G (1999) *The Internet: a philosophical enquiry*, Routledge, London and New York.

This first part analyses the technical infrastructure of the Internet, the main technical players and their respective market shares, and offers a critical perspective on the political economy of Internet infrastructure. This part also presents a picture of traffic flow over the Internet by showing in which parts of the world and between which parts of the world Internet traffic is more developed.

In order to guide the reader through the issues presented, the text has been divided into different subsections with the name of the infrastructure component they describe and/or the specific issue taken into consideration. In each specific subsection, the technical description is put into perspective with socio-economic considerations to show that there is nothing neutral in technological choices and that technology is strongly linked with the political and social context.

4 The technical elements necessary for the description of the infrastructure of the Internet and its components are taken from a variety of technical sources listed at the end of the References section under Technical References.

The Internet and how it works

The Internet is a connectionless datagram network of networks in which packets are forwarded independently of other packets. The main innovation behind the Internet is the chunking of application-specific information into small data packets before being sent and reassembled on the client's machine. IP and TCP are the Internet's two main communication protocols. On top of the Internet, the WWW offers the users a manageable and intuitive interface to navigate through the many resources and services available. Data packets travel between senders and receivers through Internet backbones and cross, in their journey, smaller networks, routers and exchange points in a process during which browser applications communicate and interact with server applications.

Internet backbones

Internet backbones are formed by the biggest networks in the system and are also called Tier 1 ISPs, which means that they have only peers around them and not higher level providers of interconnectivity. They are currently owned by a small group of major Internet Service Providers, inter alia AT&T, Global Crossing, Level 3, Verizon Business, NTT Communication, Qwest, SAVVIS, Sprint Nextel Corporation and XO Communications.[5] Having only peers around them, these Tier 1 ISPs can very easily decide policies and agreements amongst themselves that can work against the smaller companies and indeed the entire community of Internet stakeholders. It is also easy to understand that these Tier 1 ISPs are heavily financed by the subsequent tiers, as a fraction of the money paid by Internet users ends up in their pockets without any need to reach the other lesser Tiers. This becomes evident when one considers that most of these Tier 1 ISPs have peer agreements amongst themselves. A study carried out by Kende confirms this. He showed that in spite of their importance in 2000 there were no domestic or international industry-specific regulations governing how the Internet backbone providers inter-connect to exchange traffic, unlike other network service such as telephony. What emerged from the study is that Internet backbone providers tend to adopt and pursue their own interconnection policies. They largely interconnect using two different kinds of arrangements: peering and transit. In a peering arrangement, they agree to

5 See http://www.caida.org, site accessed 05/01/2008; http://navigators.com/isp.html, site accessed 05/01/2008; and http://en.wikipedia.org/wiki/Tier_1_carrier, site accessed 05/01/2008.

exchange traffic with each other at no cost. They only exchange traffic which is destined to each other's end users, not the end users of a third party. In a transit agreement one backbone pays another for inter-connection and the transit supplier provides a connection to all end users (Kende, 2000).

At the end of the 90s, the ITU reported how in the backbone market, the top three providers controlled more than 70% of the market, while the market leader in the retail service provision business, AOL, had more subscribers than its top 10 competitors worldwide added together (1999). A study from PriMetrica Inc., the Global Internet Geography 2004, found that about 600 companies in the world operate international Internet backbone links, but that the top 50 operators control 95% of the Internet backbone capacity.[6] These figures show that the backbone market is in the hands of a very small number of powerful operators. They are in the most favourable position to decide, in a closed circle, policies affecting the use of the global Internet.

Nameservers, Routers and Internet Exchange Points

Nameservers are particularly important points in the Internet infrastructure as they create the links between domain names, which are easy to remember, and Internet Protocol numerical addresses. Without nameservers, using the Internet would not be the easy and gratifying experience it is today.

Among the nameservers, the root nameservers handle the most basic part of the translation, that of the top-level domains (TLDs). In order to ensure their proper functioning and the redundancy needed to properly re-route traffic and user requests, root nameservers should be geographically widely spaced. This would ensure that the Internet does not suffer from technical failures. The situation is quite different today from the ideal one: there are currently 13 main root nameservers, 10 of which are located in the US and six in a restricted area (Virgina, Maryland and Massachusetts).[7] The other three are in Sweden, Japan and the UK.

6 http://www.telegeography.com/products/gig/pdf/gig2004_key_findings.pdf, accessed 30/06/2004.

7 See http://en.wikipedia.org/wiki/Root_nameserver, site accessed 05/01/2008.

Routers and Internet exchange sites connect major networks, as well as regional scale networks by "routing" packets of data to the right destination through the right paths. Internet exchange points (IXPs) are where ISPs exchange traffic with one another. IXPs have rules governing their interconnections; some are run on a not-for-profit basis as a consortium of local ISPs, and others are run on a commercial basis, where ISPs must pay to peer.[8] In some parts of the world, like the US, the network is so developed that if one part fails or slows down, data can be quickly routed over another part.[9]

In 1999, Nortel Networks, Cisco, Marconi and Newbridge were the leaders in manufacturing ATM switches. Cisco, Lucent, Nortel Networks, Juniper and Avice, with Cisco being the undisputed leader in IP routers (Montagne, Drolet, Saulinier, 1999, pp. 43-44).

Cisco is currently the dominant player in Internet routing technologies. Amongst its main competitors are Juniper Networks, Lucent, Nortel Networks and 3COM.

Autonomous systems and ISPs

The individual networks that together make up the Internet are called Autonomous Systems and are operated typically by National Service Providers or very large ISPs. They are a collection of IP networks and routers under the control of one entity that presents a common routing policy. After Tier 1 ISPs, Autonomous Systems are the most important pieces in the Internet infrastructure as they manage entire pieces of the Internet and the interconnections of networks within.

Until 1997, largely because of the academic origins of the Internet, small ISPs enjoyed free peering agreements with important backbone suppliers of international size such as MCI, UUNET, AT&T and Sprint. The situation started to change when leaders such as UUNET and Sprint, started to sell access to their backbones according to the transit agreements negotiated. Finally, when WorldCom, which had previously purchased UUNET and several other backbones, announced a merger agreement with MCI, there was a very real concern that the combined backbone would become the dominant backbone with the ability to exercise market power over smaller competitors in a variety of ways (Montagne,

8 An updated list can be find at: http://www.ep.Internet/ep-main.html, accessed 20/02/2007, or http://www.telegeography.com/ee/ix/index.php, accessed 20/02/2007.

9 For example in the US there are actually five points where the main lines intersect, three of these are called network access points (NAPs) and two metropolitan area exchanges (MAEs).

Drolet, Saulnier, 1999, p. 39). Consequently, the major Internet interconnection points developed into 'closed clubs' comprising major ISPs.[10]

The way ISPs connect to each other and the number of users they can reach is an important measure to evaluate their power and strength on the market. FixedOrbit provides very useful information about the connection of networks amongst themselves, the IP address control of given networks and the number of hops that need to be made between any IP address on a given network and any other IP address on the Internet. These measures are relevant for understanding the weight, the economic and geographical importance of the providers and the consequent quality of service they can offer to their customer. Further, the value of a given network is also expressed by the number and size of the networks with which it has direct peering agreements. Amongst the top 10 networks defined by numbers of peers one can find UUNET Technologies, AT&T WorldInternet Services, Sprint, Level 3 Communications, Qwest, Cogent Communications, Global Crossing, AboveInternet communications, Time Warner Telecom and Savvis. Level 3 Communications, AboveInternet Communications, Sprint, Swisscom Enterprise Solutions, Microsoft Corp., Qwaest, Reach network Borders, RIPE network Coordination Centre, AT&T WorldInternet Services and Verio Inc. rank amongst the top 10, when the relative size of a network and its IP address control is considered. Another useful measure for understanding the relative importance of a network is to look at the share of Internet traffic a single network controls. The top 10 networks defined in terms of IP addressing control are DISA CONUS, Level 3 Communications, SBC Internet Services, UUNET Technologies, Softbank BB Corp., AT&T WorldInternet Services, Cogent Communications, Data Communication Bureau, Merit network Inc. and Hewlett-Packard.[11]

Web browsers and web servers

An Internet browser is a software application that enables people to display and interact with information located on web pages stored on web servers. Web browsers and web servers are also key infrastructural technologies on the Internet architecture. ServerWatch is useful for observing the relative penetration of servers and web server software, operating systems, Internet Browsers and server and host technologies. The statistics published in mid 2004 show, very clearly, that the

10 Eg: MAE-Est (Washington); LINX (London); DG-IX (Stockholm); AMS-IX (Amsterdam).

11 See http://www.fixedorbit.com/about.htm, accessed 15/05/2005.

worries of a "monocultural-Internet" are realistic in terms of software and hardware: Apache and Microsoft enjoy together, respectively, 88.69% and 98.98% of the market for web server software and web servers.[12] In 2007 the situation is no different: the same companies share 90.95% of the market for web server software (with Apache having 60.17% and Microsoft 30.78%), and 93.49% of web servers (with Apache enjoying 73.17% and Microsoft 20.32%). The top market developers were and remain Apache, Microsoft, and far below in percentage of market share, Sun, Oversee and Zeus.[13]

The W3Schools tells us that the Internet Explorer family of browsers, at the beginning of 2007, dominates users' preferences as well as the Windows family of operating systems with roughly 59% and 86% respectively. The closest browser competitor is Firefox with 31% of market share and, for operating systems, Macintosh with 3.5% and Linux with 3.3%.[14]

The web browser market is shared between a couple of recurrent names who enjoy a clear duopoly and who are in a strong position to influence market developments and user preferences.

Internet backbones, routers, nameservers and autonomous systems, have, at least in principle, the power of (technical) control over packet exchanges and traffic flow. The issue here is that a few players own, on a global scale, the infrastructure of the Internet. They have established, largely ignored by the majority of Internet users, an oligopoly over the Internet infrastructure and over the connectivity between important parts of the Internet. They constitute the first group of spiders of the Internet that this article wishes to highlight. Decisions that can be taken at the backbone and exchange levels by these private owners of the Internet's infrastructure, irrespective of the interests of the Internet's users, might change dramatically the way we use and enjoy the Internet. The situation does not look different when we refer to the "software" of the Internet. Here the numbers are even lower than for infrastructure. The market shares for browsers and operating system software, and for software server technology is dominated by no more than three or four companies.

12 http://www.serverwatch.com/stats/Internetcraft/article.php/3377261, accessed 05/01/2008.

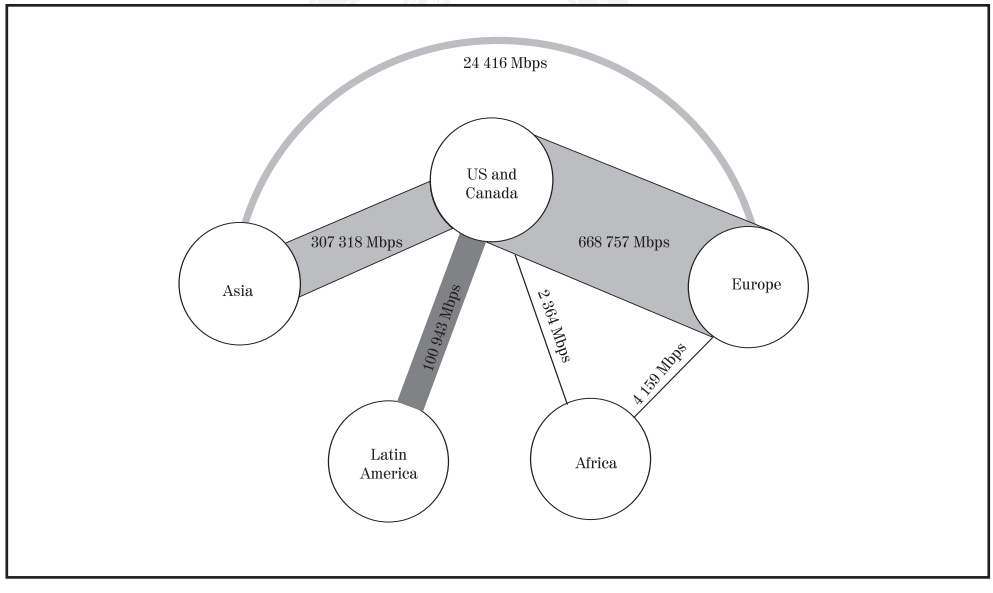
13 http://survey.Internetcraft.com/Reports/0701/byserver/index.html, accessed 05/01/2008, and also http://www.securityspace.com/s_survey/data/200702/index.html, accessed 05/01/2008.

14 http://www.w3schools.com/browsers/browsers_stats.asp, accessed 05/01/2008.

Traffic flow & bandwidth

On the backbones and routers making up the Internet infrastructure, traffic of packets seem to prefer specific routes. In spite of the substantial bandwidth and user growth in the entire world[15] there are important imbalances in the packet exchanges between regions. The EU and the US are the most interconnected regions, Africa being the least. Castells (2001, p 209), quoting Cukier (1999, p 53), tells us that the Internet resembles a star with the US at its centre and it is often the case that connections between two European or Asian cities are first routed through a US node. Hafez (2007) and McPhail (2006) years later still share the same view.
The following diagrams can help illustrate the situation.[16]

Figure 1: Inter-regional Internet Bandwidth 2005 – Data as of mid-2005.
Inter-regional bandwidth below 1 000 Mbps not depicted.

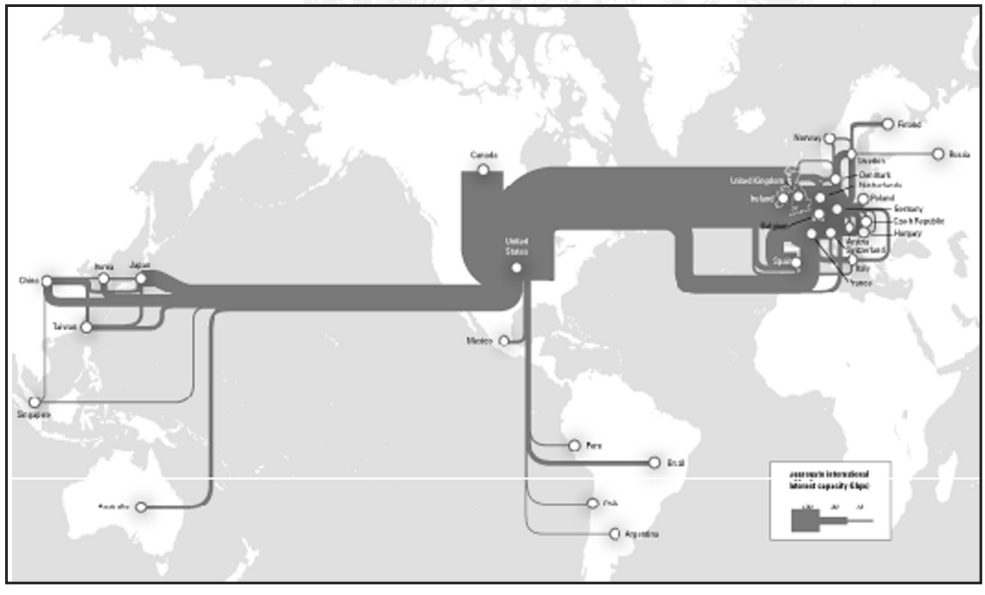


Source: PriMetricia, Inc. 2005

15 See http://www.interInternetworldstats.com/stats.htm, accessed 20/02/2007; ITU (2003, p 12); OECD (2003, pp. 119-124).

16 http://www.telegeography.com/ee/free_resources/figures/gig-02.php, 05/01/2008; http://www.telegeography.com/ee/free_resources/figures/gig-03.php, 05/01/2008.

Figure 2: Map of major international routes 2005 – Map includes international routes with at least 9 Gbps of aggregate capacity. Figures represent Internet bandwidth connected across international borders to each country. Domestic routes are omitted. Data as of mid-2005.



Source: PriMetricia, Inc. 2005

The amount of bandwidth a country and a region have to interconnect to other countries and regions shows how much and how speedily information can travel from one country to another. This can heavily influence users' experience when navigating the Internet. The fact that Internet traffic is distributed highly unevenly throughout the world (bridges.org, 2001, p. 19; 2006; Hafez, 2007) indicates which countries and regions are most favoured in terms of the quality of experience they can enjoy. Users, countries and regions in Europe, US and some parts of Asia today are privileged when using the Internet.

On the Internet information flows very unevenly through the channels opened mostly by private investors, who are determined to invest more in developing the infrastructure of those regions where it is easier to have a quick return on investment. The challenge this situation poses to the Internet's potential to consolidate and further develop into a robust participative global medium is evident.

"Thus, developing countries are caught in a tangled web. On the one hand, being disconnected, or superficially connected, to the Internet tantamounts to marginalisation in the global, networked system. Development without the Internet would be the equivalent of industrialisation without electricity in the industrial era."
Castells M (2001), *The Internet Galaxy - Reflections on the Internet, Business, and Society*, p. 269, Oxford University Press, New York

This part of the article is dedicated to the analysis of how content is produced and used on the Internet and how different countries and regions in the world have, due to different cultural and technical conditions, very different potential to take advantage of the Internet. In order to do so, the following pages report and put into perspective data and studies about current uses of the Internet and the capabilities of countries to take advantage of it.

As was the case for Part One, Part Two is also divided into smaller sections which aim to guide the reader through some of the main factors that influence how the Internet and its content is produced and used in different parts of the world. A critical assessment is presented along with factual descriptions.

Ability of individuals and countries to take advantage of the Internet

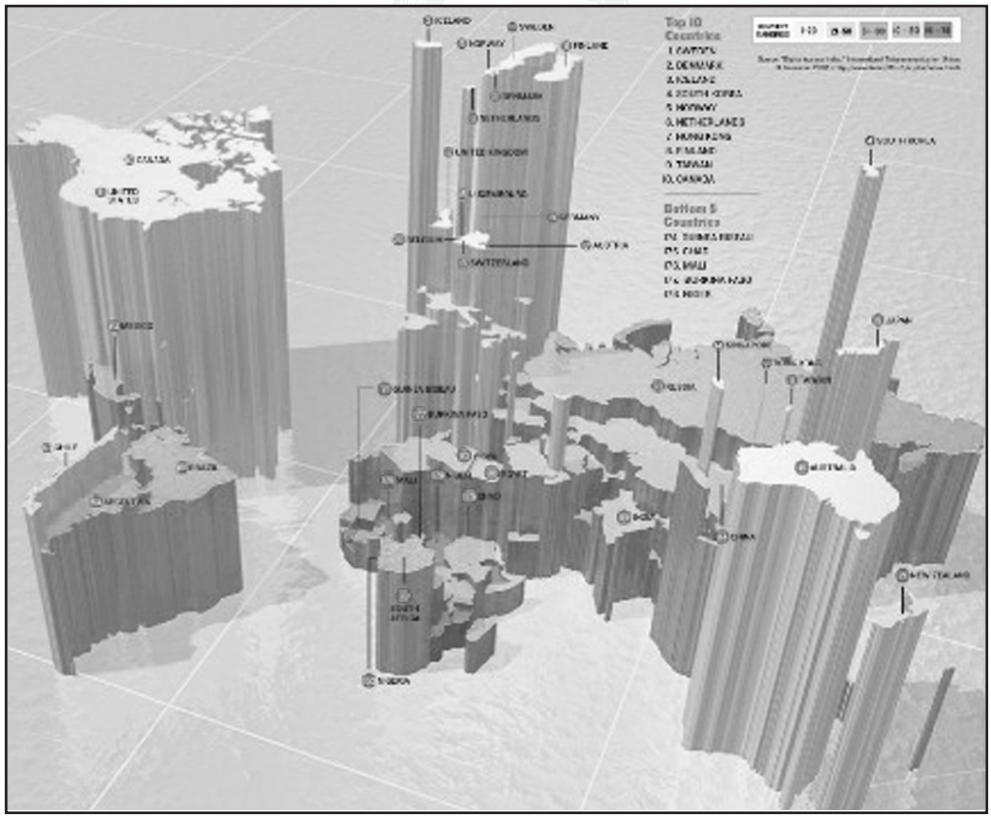
Given the current shortcomings of single and composite indicators in measuring access to the Information Society and also the inaccuracy of e-readiness assessment tools and their poor representation of some regions of the world,[17] ITU felt the need to develop a new tool: the Digital Access Index (DAI). This measures the overall ability of individuals in a country to access and use new ICTs and allows countries to see how they compare to peers and their relative strengths and weaknesses. The DAI is built around five fundamental factors that impact a country's ability to access ICTs: infrastructure, affordability, knowledge and quality as well as the actual usage of ICT. Eight indicators are used to represent the five factors (fixed telephone and

17 Bridges.org (2002) has dedicated a specific study entitled *E-readiness Assessment: Who is Doing What and Where*. In this study, Bridges.org evaluated major assessment models in term of topics covered, level of detail, methodology and results. The conclusion was that, in 2002, there were at least five initiatives currently underway to conduct e-readiness assessments, including those driven by UNDP, ITU, the World Bank, the World Economic Forum and national donor agencies. The study found that a significant duplication of efforts was occurring in some countries while others were devoid of useful data. A total of 137 countries had been assessed at least once, 55 at least five times and 10 at least eight times. The most important finding of the study was the confirmation that many of the poorest countries which have the most to gain from the information technology revolution, have had no assessment activities to drive their planning toward e-readiness.

mobile cellular subscribers for infrastructure, Internet access price for affordability, literacy and school enrolment for knowledge, international Internet bandwidth and broadband subscribers for quality and Internet users for Usage). Once weighted and indexed, these are added up to obtain an overall index score.[18] So far the DAI has been calculated for 178 economies whose scores are reported in the following table. Values are calculated on a scale from 0 to 1 where 1 represents the highest access. The DAI ranking is useful because it is able to assess aspects of Internet penetration and usages that go beyond pure technical factors.

The DAI ranking clearly reveals a huge gap between high and low scoring-countries. This is symptomatic of the efforts and the long way the vast majority of the countries still need to go to reach the standards of the top group in terms of e-readiness (ITU, 2003, p. 22). Graphically the figures produce the following map:

FIGURE 3. MAP OF COUNTRIES' DAI RANKING[19]



18 See for more details on the weighting and indexing method ITU (2003)

19 http://www.spectrum.ieee.org/WEBONLY/resource/feb04/0204bmapf1.pdf, accessed 30/06/2004

Recent studies, in line with this e-readiness gap, confirmed the necessity of a political response to this socio-technical issue. Human capital, telecom infrastructure and regulatory framework are all equally important aspects to fill the gap existing in "digital readiness" (Chinn, Fairlie, 2006), which is a broader phenomenon than just access to technology (Govindan, 2005, Chadwick, 2006).

Cities as Main Geographical Internet Players

If we move our attention towards paths of information production and consumption, Zook, through empirical research and analysis, questioned the assumption that thanks to NICTs and the Internet in particular, geography was losing its importance, especially with regards to content creation. In his research, he stresses how Internet users and producers are currently mostly located in urban areas alongside the most innovative firms. He also reports how one should not be mistaken by directly associating the global character of the Internet with a model of global production of information (Zook, 1999). Zook, who still remains one of the few to have tried such an investigation, based his studies on the determination of the place of content production on domain names, using the evidence that domain names have the advantage of containing geographical contact information for the persons or institutions registering them. Another reason to determine the extension of regional and local content production over the Internet is that, especially for non CCs or CONE domain names (.com, .org, .Internet., .edu), both typology of domain names might be registered from and for countries which are different from the countries where the information is produced (Zook, 2001, p. 1 682). In line with Zook, Kolko has also shown that the Internet actually reinforces the importance of places, as domain names remain highly concentrated in urban areas (2000).

Figure 4: Number of CONE and CC Domain Names per 1 000 population[20]

In January 1999, the top 25 cities in the world in terms of total domain names were, with the exception of London and Toronto, in the US. The Los Angeles metropolitan statistical area comes out on top with 197 015 domains, the New York metropolitan statistical area follows with 144 200. London, in third place, had 125 139 domain names. After Toronto, which comes in at 24, one could find Tokyo, Vancouver, Paris, Seoul, Copenhagen, Hong Kong, Berlin and Munich (Zook, 2001, p. 1 686). Big cities continued to play a leading role in the Information Society and in the geography of cyberspace.[21]

In Zook's analysis, the US and Europe have the largest concentration of domain names with 59.5% and 27% respectively. In Europe, Western European cities are sites of significant domain names concentration. Main cities within countries also tend to dominate the share of domain name registration (*ibid*. p. 1 687). Today, only China has substantially ameliorated its ranking.[22]

This shows how the Internet content production follows, despite the presumed decentralised nature of the Internet, a pattern of high spatial concentration: content production is concentrated in a few countries and, within them, in the most important metropolitan areas.

20 Zook, (2001), p. 1 689.

21 See also Gilder and Peter (1995), Neff (2005).

22 http://www.webhosting.info/domains/country_stats/, 20/02/2007.

Castells identifies three main reasons for this imbalance in content production: the connection with the metropolitan structure of the information economy; the presence of pre-existing centres of technological innovation; and the role played by venture capital in financing innovation and entrepreneurialism in the Internet economy. The geography of the Internet production is the geography of cultural innovation (2001, pp. 222-224).

Patterns of Content Production and Consumption

Zook also considers the demand and consumption of information generated over the Internet when, for example, somebody visits a web page, downloads contents or purchases a given good. In other words, Zook asks himself whether a country is an importer or exporter of content on the Internet. To answer, Zook developed the Internet Consumption Quotient (ICQ), a technique used to standardise the comparison of the number of domain names and users across countries.[23] He applied the ICQ to 59 countries using data from the NUA Internet Surveys 1999. By doing this, Zook identified a four-type typology of countries in relation to their Internet content consumption and production and the way it is oriented towards a domestic or a global presence. These are: export enclaves; content consumers; global traders; and Internet islands. Export enclaves are countries that appear to be exporters of content without having well developed indigenous content production systems. Content consumers are primarily importers of content from the rest of the world and lack a well-developed indigenous system for producing content. Internet islands are countries which have adequate domestic content production for the demand of their users but are content importers in the global market. Global traders are countries that have both a well-developed indigenous system of content production but are also exporters of content to the rest of the world (Zook, 2001, pp. 1 690-1 693).

23 The ICQ is calculated as follows: (number of domains in a country / number of Internet users in the country) / (number of domains in the world / the number of Internet users in the world).

FIGURE 5: TYPOLOGY OF COUNTRIES BASED ON THEIR SPECIALISATION[24]

GLOBAL PRESENCE			
Strong	**Weak**	**Strong**	**Weak**
Export Enclaves	**Content Consumers**	**Global Traders**	**Internet Islands**
	Bolivia	Argentina	Australia
Costa Rica	Chile	Austria	China
Ecuador	Colombia	Belgium	Finland
Egypt	Estonia	Brazil	Iceland
Haiti	Hungary	Canada	Israel
India	Japan	Czech Republic	Mexico
Indonesia	Malaysia	Denmark	
Jordan	Morocco	France	Norway
Kenya	Philippines	Germany	Portugal
Paraguay	Poland	Greece	Russia
Peru	Singapore	Ireland	South Korea
Saudi Arabia	Slovakia	Italy	Sweden
Thailand	Spain	Netherlands	
United Arab Emirates	Sri Lanka	New Zealand	
	Viet Nam	South Africa	
		Switzerland	
		Turkey	
		United Kingdom	
		United States	
		Venezuela	
Weak	**Weak**	**Strong**	**Strong**
DOMESTIC PRESENCE			

Language, history, migration paths, literacy, e-literacy, socio-economic conditions and existing commercial relations are all important aspects playing a role in positioning countries in the table above. This approach is useful as it helps one understand why some cultures exert a stronger influence over the Internet.

DISTRIBUTION OF DOMAIN NAMES AND LOCAL VS FOREIGN CONTENT

The OECD reports (sourced from the Internet Software Consortium)[25] that in July 2002 there were 162 million hosts connected to the Internet worldwide (2003, p. 125).[26] Since 1998, this number has increased by 45% per year. More than 100 million of these hosts were under the generic domain names (gTLDs), of which, .net with 56 million,

24 Zook, (2001, p. 1 692).

25 http://www.isc.org, 30/03/2004.

26 OECD defines a host a domain name that has an IP address associated with it.

and .com with 44 million were the largest. The largest country code domain (ccTLD) in July 2002 was .jp with 8.7 million hosts. If the various US related domains (.edu, .mil, .gov, .us) are combined they total 14.3 million hosts. Using data coming from netcraft,[27] the OECD calculated the number of web servers per 1 000 inhabitants. According to the OECD this is an accurate indicator of the relative national content development. In 2002 there was an average of 31.4 websites per 1 000 inhabitants across OECD countries. Germany ranked first with 84.7 websites per 1 000 inhabitants followed by Denmark, Norway, the UK, the US, the Netherlands, Iceland and Canada. Mexico along with Greece, Japan, Portugal, Poland, Ireland, Hungary, the Slovak Republic and Spain scored the lowest (2003, pp. 125-126).

The same study (*ibid*. pp. 131-132) also measured, using Google, the internationalisation of web hosting. This was done by counting the number of web pages reported by major search engines both per domain and per country (country ISP-related IP address block) which is a sign of the domestic versus foreign ISP location of hosted web content. According to this exercise, the share of ccTLDs-related content hosted within domestic ISP-IP address spaces varied from 74% for pages in the .us domain to a low of 28% for pages in the .de domain. In the study, content is attributed to a given country only when it is under the country's ccTLDs and gTLDs and also hosted within that country's ISP-IP address spaces.[28] In August 2002, countries with relatively high levels of domestic content hosting included US (95%), Canada (91%), Luxembourg (90%), Spain and Switzerland (84%), Belgium (83%), Sweden (82%), the UK (81%) and Finland (80%). On the other side of the spectrum, countries with relatively low levels of domestic content hosting included Germany (44%), Japan (50%), Czech Republic and Poland (54%), Slovak Republic and Hungary (59%).

What the data clearly shows is that the Internet domains are highly concentrated with the US dominating the world panorama. Also a growing asymmetry is emerging between content production and consumption of Internet related content with the developed world, and particularly the US, producing for the rest of the world (Castells, 2001, p. 216). Content provision for the Internet is clearly becoming a metropolitan phenomenon. According to Castells, this asymmetry is even greater when measured in terms of top-sites and page-views. He reports that in 2000 the US

27 http://www.netcraft.com, 30/03/2004.

28 The proportion of a country's total content that appears to be hosted overseas is the ratio of ccTLDs pages not under national ISP IP addresses to the sum of pages in the ccTLDs and total gTLDs pages found within the country's ISP IP address space (OECD, 2003, p. 132).

accounted for 65% of the top thousand websites, and 83% of the total page-views of Internet users.

In spite of the decentralised nature of the Internet, a pattern of high spatial concentration emerges in terms of content production, which is coupled with a pronounced asymmetry between content production and consumption. Use of the Internet follows the uneven distribution of technological infrastructure, wealth and education. This poses challenges to the presumed global nature of the Internet and the responsibilities of policy makers in addressing the issues that accompany unequal distribution of technological and social wealth.

Connection Type and Costs

It is also possible to find heavy imbalances when the type of connection is investigated. ITU quantified the number of users with broadband access as 10.7% in 2002 (2003, p. 5).[29] The same imbalances appear when the price of Internet connection is considered. While the ITU study tells us that the vast majority of today's broadband users are in the developed world, it is possible to notice, even amongst developed countries, large disparities. This is true not only in terms of service availability but also in terms of quality of access and price per Mbits/s. The divergence goes from Costa Rica, where the price for subscription corresponds to 23.41% of the average salary, to less than 0.01% for Japan.

The Association for Progressive Communications[30] clearly states that the cost of Internet access is much lower in developed countries than in developing countries, that countries with the lowest Internet access cost generally have the highest Internet penetration rates, and where there are disparities of wealth within countries, the less-well-off are less likely to use the Internet.

Languages usage over the Internet

Interesting data is observable when one directs one's attention to language usage over the Internet. The following table represents the share of languages used to produce content. The dominance of English is evident, although rapidly diminishing (Hafez, 2007, p. 103). What is striking in the following table is the gap between English and other languages listed.

29 The term broadband comprehends here DSL, which is the most common deployed platform, cable modems, EtherInternet LAN, Wireless LAN, satellite and other technologies.

30 2004.

Figure 6: Web Content by Language[31]

English	68.4%
Japanese	5.9%
German	5.8%
Chinese	3.9%
French	3.0%
Spanish	2.4%
Russian	1.9%
Italian	1.6%
Portuguese	1.4%
Korean	1.3%
Other	4.6%
Total Web pages:	313 B

When we direct our attention to the languages utilised by the users, according to *Global Internet Statistics - by languages* by Global Reach, 10 languages dominate the Internet, as 93% of the total on-line population is a native speaker of one of the 10 languages. Non-English speakers outnumber native English speakers. Around 64.2% of the total world online population are from non-English speaking zones. Nonetheless, English is the most popular language, being the native language of 35.8% (down from 40.2% in March 2002) of the worldwide online population, accounting for 287.5 million people. Ranking second is Chinese representing 14.1% of the online population.[32] Specific language communities, with the implications that they might have for the oblivion of less advantaged cultural groups, are important factors in determining current presence and spread of specific content, and the representation of cultural communities and cultures in the future.

Internet islands vs global networks

All this shows that despite its potential as a universal, participative and inclusive communication medium, the Internet is a selective network that parallels the geographical and socio-economic development of the world. In particular, the distribution of the supply of Internet-related services is significantly more concentrated than its use. The majority of the most visited websites in terms of hits continue to be located in the US. The US appears to be the most concentrated location of domain names worldwide. The two most interesting countries in terms of

31 http://www.global-reach.biz/globstats/refs.php3, 16/07/2004.

32 See http://www.glreach.com/globstats/index.php3, accessed 05/01/2008

absolute growth and in terms of their potential for future expansion are India and China. It is interesting to note, furthermore, that contrary to what some, even eminent, thinkers forecasted about the fact that the Internet would loosen the ties of economic activity to localities and hence end the economic importance of cities (Gilder, Peters, 1995; Cairncross, 1997; and Negroponte 1995 and 1999), the reality looks different. With the introduction of NICTs and the spread of a globalised economy, spatial proximities and cities have retained their importance in economic and social development (Malecki, 1999: Porter, 1998; Markusen, 1996; Florida, 1995; Gertler, 1995; Scott, 1995).

The use of the Internet is highly varied in territorial terms.[33] This follows the uneven distribution of technological infrastructure, wealth, and education on the planet. So while the Internet is spreading fast, it is following a spatial pattern that fragments its geography according to wealth, technology, and, ultimately power. Also within countries, there are major differences in terms of connectivity and usage. Urban areas come first, true for developed and developing countries, whereas rural areas and small towns lag behind considerably in their access. In particular, the most important cities around the globe tend to be the ones with the fastest and largest adoption and use.[34] State-of-the-art telecommunications nodes are being formed within and between specific areas around the world. These appear to be loosely or not-at-all integrated with their surrounding hinterland.[35]

Search engines: the main spiders for culture and knowledge visibility

According to Nielsen/InternetRatings (January 2004), 39% of Americans used a search engine (for about 114.5 million users or 76% of the active US online population) spending approximately 40 minutes per month each. According to Nielsen/InternetRatings, the top five search destinations were Google, Yahoo! Search, MSN Search, AOL Search and Ask Jeeves. Edelman, in a 2002 study, provided evidence that Google accounted for more than half of the queries sent to online search engines.

In 2007 Google held a substantial lead over its rivals, Searchenginewatch.com reports how of the 9.4 billon searches performed in the US at the five major engines, Google maintained a 57% percent share.[36]

33 Chadwick (2006), pp. 53-54.

34 Castells, 2001.

35 See also Castells (1989) and Castells and Hall (1994).

36 http://searchenginewatch.com/showPage.html?page=3627654, accessed 05/01/2008

As such, search engines prove to be one of the primary ways for people to navigate the Internet or to start their navigation.

The fact that search engines are one of the most, if not the most, used entry point to the Internet is a fact of major importance in relation to the specific culture and knowledge being shaped by these knowledge tools. Many see the Internet as the major tool for a uniformisation of cultures into a digital English culture that, in the long run, will contribute to the disappearance of both cultural differences and the richness stemming from cultural diversity. In a kind of vicious circle, as observed earlier, web content is mostly produced and accessed in English, search engines use algorithms and worms mostly targeted to the English language and later ranking systems based on the popularity of web-pages measured by the number of click-throughs. This largely results in lists of items which reinforce each other in a vicious circle and that re-propose themselves continuously. While the issue of a predominant English content production (and hence culture) has already been referred to, here it is important to point to an issue that has only recently come to the attention of academics. The issue is the possibility that the knowledge and the world indexed by search engines are only a partial and arbitrary representation of the many voices and points of views that make and shape online information. Furthermore, the issue of uniformity of results remains, as most search engines use the same (often third party) search tools and databases. As an example, Inktomi is very popular for crawler-based search engines and LookSmart for human-powered ones. Furthermore, search engines often present the results of other search engines or of the third party they use. Currently, a market for visibility on search engines exists: major search engines with significant traffic accept paid listings or paid placement advertising. Even if paid listing is most of the time related to commercial listings, this nevertheless means that willing clients can find ways to be guaranteed visibility in the top-list results for the terms for which they pay (Sullivan, 2002, 2004).

The challenges that search engines pose to the use and development of the Internet in terms of a global communication is strengthened by the fact that search engines are today so much a part of the Internet environment that users tend to use them without asking too many questions on the type of results they are getting from them and which part of the world these search engines make visible to them. This is indeed an issue that educators and policy makers will have to address carefully when defining education policies for the digital age. In the words of McPhail (2006, p. 311) when he refers to Google's initiative to digitalise knowledge from five of the world's greatest English-language libraries: "defining the future of knowledge in the

electronic digital environment…will have profound implications for what is considered information."

Part Three: Conclusions

"Humans have not inhabited Cyberspace long enough or in sufficient diversity to have developed a Social Contract which conforms to the strange new conditions of that world. Laws developed prior to consensus usually favour the already established few who can get them passed and not society as a whole" Barlow, 1994, *The Economy of Ideas*

> "The Internet represents an extraordinarily important development in the field of social communications. To slam the brakes on before we even know where it might take us would be self-defeating in the extreme." Newey, *Freedom of Expression: Censorship in Private Hands*, 1999, p. 40

This article aimed at presenting a first mapping of the typology of players behind the Internet. The paper focused, in particular, on the analysis of its infrastructure, content development and usage and on the uneven opportunities users in different regions of the world have to take advantage of the Internet.

Part One aimed at showing how the few bodies that currently control important elements of the infrastructure, such as Internet backbones, routers, nameservers and autonomous systems, have, given the very specificity of the Internet's modus operandi, enormous power over packet exchanges and traffic flow. They control, de facto, the communications flowing over the Internet.

The technical geography of the Internet has revealed how a few ISPs, Autonomous Systems, Nameservers and backbone owners make up a very precise, yet far from public, set of players currently dominating the Internet's technical and infrastructural development. Together they have established an oligopoly over the hardware and software infrastructure and the connectivity between important parts of the Internet. They constitute the first group of spiders of the Internet this article wants to highlight.

The situation worsens when one concentrates on the code with which web protocols and web applications are built. In spite of the open architecture concept, which has inspired and still inspires the development of the Internet, a few companies are enjoying the biggest percentage of market shares for browsers and operating systems software, and for software server technology.

The article has also shown how the Internet has a geographical spread that is not unlike that of developed countries. On the Internet, information flows very unevenly

through the channels opened by investors which, following market rules, are determined to invest more in developing the infrastructure of those regions where it is easier to have a quick return on investment. This poses a real threat to the Internet's potential to consolidate and further develop into a robust participative global medium.

> *How global is a global medium if the infrastructure of connectivity is unevenly distributed and no healthy competition exists amongst infrastructure providers, web software and hardware vendors?*

Infrastructure-wise, the central hub of the Internet remains the US. As most of the main pieces of its infrastructure belong to private corporations, the question arises whether they will be willing to invest in infrastructure aimed at increasing the connectivity of developing nations whose inhabitants are not (yet) the main target groups of commercial initiatives. Where connectivity and infrastructure are concerned, the Internet no longer looks like a network but rather an archipelago of connectivity in which only a few islands are well connected amongst each other while the majority of them have to rely on insufficient connectivity.

Part Two focused on patterns of content production and usage and the conditions that enable them. It clearly showed that the current patterns of content production and consumption on the Internet match the geography of globalisation.

A frightening gap exists amongst the regions and countries in the world when one considers 'readiness' to get the most and the best out of the Internet. In spite of the decentralised nature of the Internet, a pattern of high spatial concentration emerges in terms of content production. This is coupled with a pronounced asymmetry between content production and consumption. The developed world, and particularly the US, is producing for the rest of the world. Two thirds of Internet content is written in English and a little over one third of Internet users can use content produced in English. Castells (2001, p. 211) is very useful in summing up the results of this analysis when he states that the use of the Internet is highly varied in territorial terms: the use of the Internet follows the uneven distribution of technological infrastructure, wealth and education on our planet.

So, although the Internet is spreading fast, it follows a spatial pattern that fragments its geography according to wealth, technology and, ultimately, power. In this way, it configures a new geography of development. Even inside countries, there are major differences in terms of connectivity and usage. Urban areas, and in particular the most important cities around the world, come first, and this is true for developed and developing countries. Rural areas and small towns lag considerably behind in their

access and use of the new medium. The way connection costs are shared amongst local and international ISPs, with ISPs and users subsidising major (mostly western) Internet backbone providers, is directly working towards the continuation of the present situation.

It appears that the most potent factor determining Internet access and use was and remains the wealth of a nation. Benshop confirms this finding by showing a clear correlation between the gross national product of a nation and the rate of Internet penetration (2004).

According to many, the future social geography of the Internet and its imbalances will be mostly due to the lack of skills and competences necessary to fully enjoy the range of communication and interaction possibilities the Internet environment offers to its users and to the scarce opportunities the majority of the world population has to acquire and develop them. Today, only a few advantaged users use most of the Internet resources. It seems that the Internet, for a long time considered a tool of integration and civil development, could, when looked at more closely, actually increase the number of those that are marginalised and excluded rather than reduce it.

This situation gets worse when one considers the important role that search engines now play in guiding the navigation and the significantly growing number of users that use them. The five top search engines in 2004 (Google, Yahoo!, MSN Search, AOL and Ask Jeeves) literally monopolised Internet searches. While these engines represent for many users, easy entry points to the Internet, they define *de facto* the portion of the Internet which is visible to them. By offering users selected content, they shape the knowledge and the culture(s) existing on the Internet by giving them visibility through click-through links. This situation could noticeably reduce the presence of minor cultures on the Internet. In parallel, search engines have the theoretical but at the same time realistic possibility of excluding segments of knowledge present on the Internet by, simply, not referring to them. Needless to say, in the long term, the repercussions over the richness and variety of cultures and 'knowledges' developed by human kind could be considerable.

How global is the Global Internet if its content production and consumption and its cultural-linguistic soul is dominated by three or four major countries?
How global is the Global Internet if the main tools for retrieving information are shareholder-driven enterprises?
How global is the Global Internet if search engines do not display all the existing info to the requests put forward by their users but run, according mainly to the popularity principle, only the same usual part of it?

Deepening the Debate

From the evidence shown, it would seem clear that there is a need to deepen the research into the political economy of the Internet, especially if the digital gap leading to global-social exclusion is to be avoided and the Internet is to be preserved in its character of global communication. Such research around the political economy of the Internet should start and be based on a user-centred perspective. Freeman and Soete (1997, p. 410) argue that social exclusion is a serious threat when people cannot achieve effective access to the new mode of communication. According to them, social exclusion substantiates itself in a growing group of people who are not able or not willing, even in the richest countries, to use or to gain access to new communication technologies and to new mode of communication.
When considering the Internet, nothing is a neutral decision void of political, cultural and/or societal implications.
Building on the structure used in the rest of the article, possible research paths will be presented following the same structure of the article and be related to the line of thoughts pursued in Part One – and Part Two. At the end, more general paths of research will also be proposed.

Technical geography of the Internet

An approach to a political economy of the Internet that put the users at the centre should investigate the mechanisms and financial incentives to assure a sufficiently distributed Internet architecture, and, at the same time, investigate the best way to put in place a legal and economic framework for the establishment of solid global competition rules to increase the number of infrastructure and software providers. This would probably also solve many related problems such as cost of infrastructure and many security issues related to the fact that today the Internet is relying on only a few software and server packages.

It is the author's opinion that research needs to be done in order to see how and if patterns of content production and consumption have changed during the last years and in which directions.

Zook's very interesting analysis about the CONE domain names should also be supplemented with data coming from the new domain names recently introduced and matched with new patterns of global economic delocalisation of content and services provision.

A framework for digital education should also be investigated in which search engines are evaluated, assessed and put into perspective and cognitive means are conceived to help their users to use them with a critical approach. The author would welcome a vision in which the concept of global public goods could also be extended to these very important tools.

To take the above considerations a step further the importance of the many issues at stake demands a thorough consideration before a position can be taken – the Internet is a medium that is naturally participative and inclusive in comparison with other media.

These include freedom of speech and regulation of content, access to a potentially global democratising communication medium, a new global regime for intellectual copyrights, individual privacy and last but not least, protection of the public interest. Breslow, better than others, sums up the current danger the Internet is undergoing and the important interests at stake. He tells us that the Internet:

> "…is a disputed site; it is contested by, on the one hand, commercial and political forces that wish to define the Internet in much the same way as television was constructed – as both a commodified communication apparatus (which television accomplished through the economic valorisation of air time) and market (the display of commodities to viewers). On the other hand, the Internet is contested by individuals and organisations who wish to preserve the Internet's status as non-commercial communication system, since it is in this guise that the Internet is seen as a progressive socio-political force" (1997, p. 237).

If the Internet is to be preserved in its original meaning as a decentralised, participative, inclusive and open medium, the author believes that it is important to begin to think of the Internet as a global public product. Research on the political economy of the Internet should try to investigate and understand how the value of distributed pluralism can be preserved.

In order to do this, another stream of research should be directed towards an understanding of the best possible manner to conceive and organise Internet governance. In line with the discussions started in Geneva in 2003, continued in Tunis in 2005 and culminating in the establishment of the Internet Governance Forum promoting multi-stakeholderism in addressing issues related to Internet Governance, research should be directed at investigating the mechanism to ensure that governance of the Internet has a truly **global** multi-stakeholder character (see Kleinwächter, 2007), which also takes into account the important dimension of diversity (Padovani, Pavan, 2007). It is a fact that the issue of Internet governance has only recently emerged on the world political agenda (Chadwick, 2006). And even more recent is the realisation that Internet governance, irrespective of the form it will or should take, should be a phenomenon that is broader in its reach than the reform of ICANN and the regulation of particular issues such as copyrights and e-commerce, to quote only two of the most frequently debated, on which attention has been focusing so far. ❑

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