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GEOG2059: Geography of Information Technology

Mid-term project

- 1. What is the internet? The geographical diffusion of the internet has been highly uneven at both the global and national scales. Do you agree? Justify your arguments with facts and figures.**

In 1990s, the world has entered the computer age. The use of internet has become popular in many developed countries. It results in a lot of changes. For example, companies began the B2B (peer-to-peer) business mode (or e-commerce) to trade with their commercial partner and customers. Many commercial websites were also opened to explore the unlimited commercial opportunities on the web. According to IDC (International Data Corporation), there were 20 million users in the web in 1995. In 1998 there were 160 millions worldwide¹. It is estimated that in early 2005 there will be 1 billions internet host (i.e. uniquely reachable connected computers²) in the world³. In average, there will be 79 new computer hosts and 19 new domains in the world. All these figures seem to suggest that the internet is very popular in the world.

Nevertheless it is never the case. The use of internet in the world is greatly diffused throughout the world. Internet is popular only in highly developed countries. Most of them are countries in North America, Europe and Australia. The countries like in South America and Africa, due to various reasons, the use of internet is still limited.

So in this paper I will first try to attempt what is internet first. Giving “internet” some information before proceed. Then I will try to find out whether the use of internet is greatly diffused geographically, is internet being used in everywhere? Or just exist within a small sector? – either in global and national scale. I will try to give reasons to explain the situation acquired, giving figures to substantiate my answers.

What is “internet”?

¹ <http://www.topkimo.com/menu6.htm>

² <http://www.ngi.org/trends/trends-regional.html>

³ <http://www.ngi.org/trends/TrendsPR0009.txt>

Many people believe that “internet” means “inter” + “net” – i.e. “network of networks”. A strict definition useful for describing internet was a book revealed by John S. Quarterman. In his book *The Matrix: Computer Networks and Conferencing System Worldwide* (Digital Press, 1990) he describes the internet as “an inter-network of many networks all running the TCP/IP protocol suite..., connected through gateways, and sharing common name and address spaces.”⁴ In the other words, internet is:

“The Internet is a unique collection of networks, “network of networks”. It is mainly found in U.S., but also throughout in the world. Most of them are built using the Transmission Control Protocol/Internet Protocol (TCP/IP) protocol suite [which is used for moving messages and handling errors⁵]. It uses compatible communications standards and share the ability to contact each other and exchange data, mainly via electronic mail... via Telnet... and via File Transfer Protocol (FTP)⁶”

And internet are computers connected globally in the network. That mean it is a open network, with unlimited public access. If it is closed with no or limited public access, it is called “intranet” Networks in banks and other institution are not internet⁷”. So to sum up, internet is:

- | computers connected using TCP/IP
- | It is a open network, with unlimited public access.

Probably someone will ask: why is the internet needed to be connected through protocol? And why TCP/IP was developed? It is highly related to the origin of internet.

The origin of internet can be traced in 1960s, when researchers in the U.S. Defense Department’s Advanced Research Projects Agency (ARPA) began linking computers through telephone hookups. The purpose of building such network was not to build today’s international computer-using community, but to develop a data network that could survive a nuclear attack from U.S.S.R.

⁴ Gilsta, P., 1994. *The Internet Navigator*, New York : Wiley. p. 20

⁵ *Ibid.*, p. 16

⁶ Marine A., 1994. *Internet: Getting Started*, Englewood Cliffs, N.J.: PTR Prentice Hall. pp. 1-2

⁷ Kitchin, R. M., 1998. Towards geographies of cyberspace. *Progress in Human Geography*, 22, 3. p.386

Academic researchers also aspired to build an inter-network connecting all the computers in different university to conduct online conferences⁸. This led to the rise of ARPANet in 1969 by Bolt, Beranek and Newman. It is a network connecting university, military and defense contractors. And since different network may use different protocol, the right protocol was required to ensure compatibility, handling errors and moving messages among computers. This led to the rise of TCP/IP protocol in 1974 by Robert Kahn and Vinton G. Cerf, in which TCP ensures messages are delivered to the correct location, while IP is responsible for network addressing. Therefore, in the simplest definition, internet is “a network of networks that run the TCP/IP protocol suits⁹”.

In 1983, ARPANET was spilt into MILNET – to be used for military communication and ARPANET – for continuing research into networking. After that, internet was no longer a military secret, but began to popularized in the domestic and entertainment purpose. The ARPANET then continued to grow in the next 20 years, and resulted in today’s internet. That is why people would date the true arrival of internet at 1983¹⁰.

The geographical diffusion of the internet

It seems to be correct that the internet is popular throughout the world, given the figures in the introduction. The internet has been described as “flows of data and communications speed around the globe with little regard of municipal, regional or national boundaries¹¹”. This probably gives people wrong impression that internet exist all around the world. The fact that information/content can be easily and widely distributed is often mistaken for an indication that internet is also diffused¹². Nevertheless when we take another look of the situation, it seems to be incorrect. For example, in India, people are suffered from poverty. They do not have internet access. And there are about 78 millions population in India, a significant part of population in the world. So the question will be, is internet geographically diffused and clustered in certain location only? Are majority of human with their computer connected to the world using the TCP/IP protocol?

⁸ Gaffin, A., 1994. *Everybody Guide to the internet*, Cambridge, Mass.: MIT Press. pp. 16-17

⁹ Gilsta P., 1994. *op cit.*, p. 16-17

¹⁰ *Ibid.*, p. 18

¹¹ Zook, M.A., 2000. *Old Hierarchies or New Networks of Centrality? The Global Geography of the Internet*. http://socrates.berkeley.edu/~zook/pubs/Global_Internet_Geography-Zook.pdf. p. 1

¹² Zook, M. A. 1998. *The Web of Consumption: The Spatial Organization of the Internet Industry in the United States*. Paper present at the ACSP Conference. Pasadena, CA (Nov. 5-8). <http://socrates.berkeley.edu/~zook/pubs/acsp1998.pdf>. p. 1

Global diffusion of internet

Studies have been carried out by geographer to explain the global diffusion of internet. That is, to find out if there are disparity of internet between and within nations. Larry Press has presented an overview of the global diffusion of the internet in the third quarter of 1999. The indicators he employed as follows:

- l **Connectivity:** the speed of connection, the internet backbone (connection) etc.
- l **Host counts:** the number of hosts, computer with domain name. In the other words, the number of computer connected to the net worldwide.
- l **Number of Web sites:** the number web server in all nations.
- l **Language distribution:** the language used in the web content.
- l **Number of users:** the number of internet user in a nation.
- l **Compound indices:** Other indices and methods employed by the Mosaic Group to explain the national diffusion of internet¹³.

In the following paragraph we will use (1) connectivity; (2) Host counts; (3) Number of web sites (4) Number of users to illustrate the global diffusion of internet.

Connectivity

“Connectivity” here will present the global performance of internet in all countries in term of the speed of connection and internet backbone.

It is surprising to see that almost in every part of the world is penetrated with internet connection. See Fig. 1, it shows the internet connectivity all around the world. It shows that almost every corner of the world is connected with internet in 1997. Besides some area in Africa, Middle East and South East Asia where internet was not developed, almost all nations in the world has developed the “full internet permanently”. The disparity is not as great as imagine.

Concerning the internet backbone, see Fig. 2, it shows that major internet connection and route are built within the developed nations such as North America, Europe, Australia and East Asia. From Fig. 3 it further shows that the major information flow in the internet mainly occurred within the countries listed

¹³ http://www.isoc.org/inet2000/cdproceedings/8e/8e_4.htm

above. It shows great disparity/diffusion either the construction of global internet network and its usage.

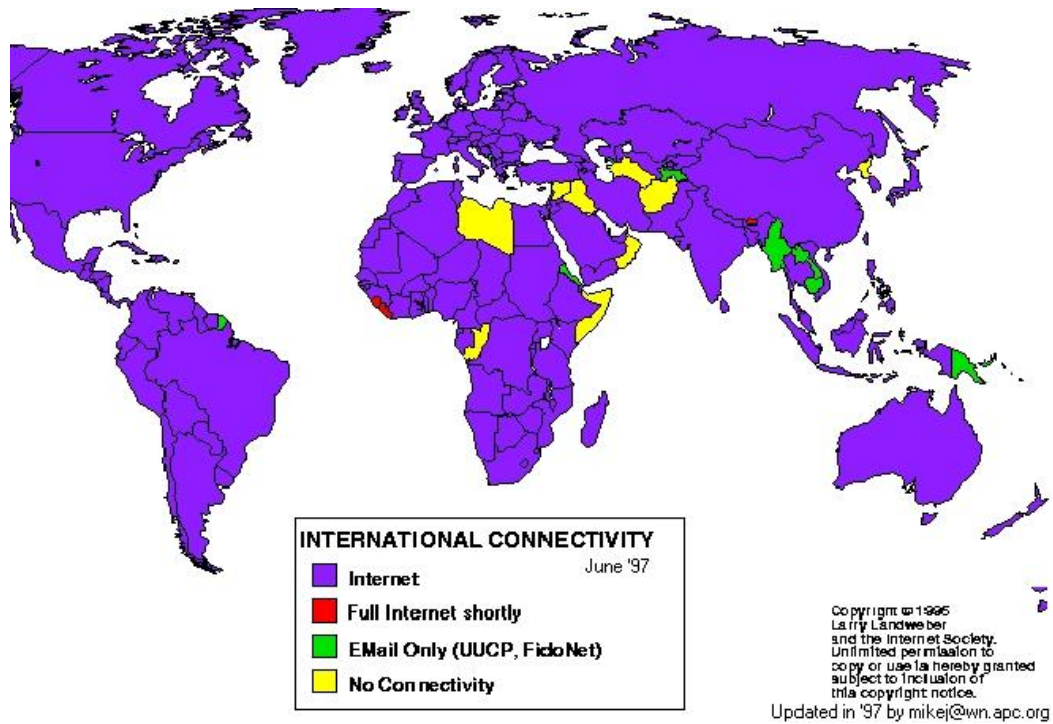


Fig 1: International connectivity, June 1997¹⁴

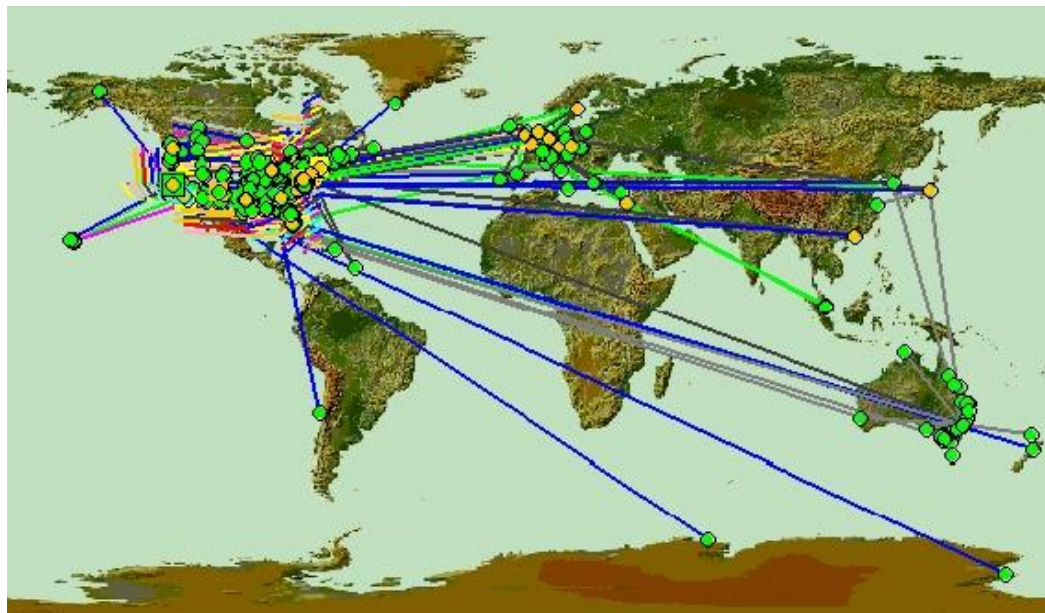


Fig. 2: A composite of 48 national and international backbone networks¹⁵

¹⁴ <http://som.csudh.edu/cis/lpress/netstate/selected/land697.jpg>

¹⁵ <http://som.csudh.edu/cis/lpress/netstate/selected/allwithmap.gif>

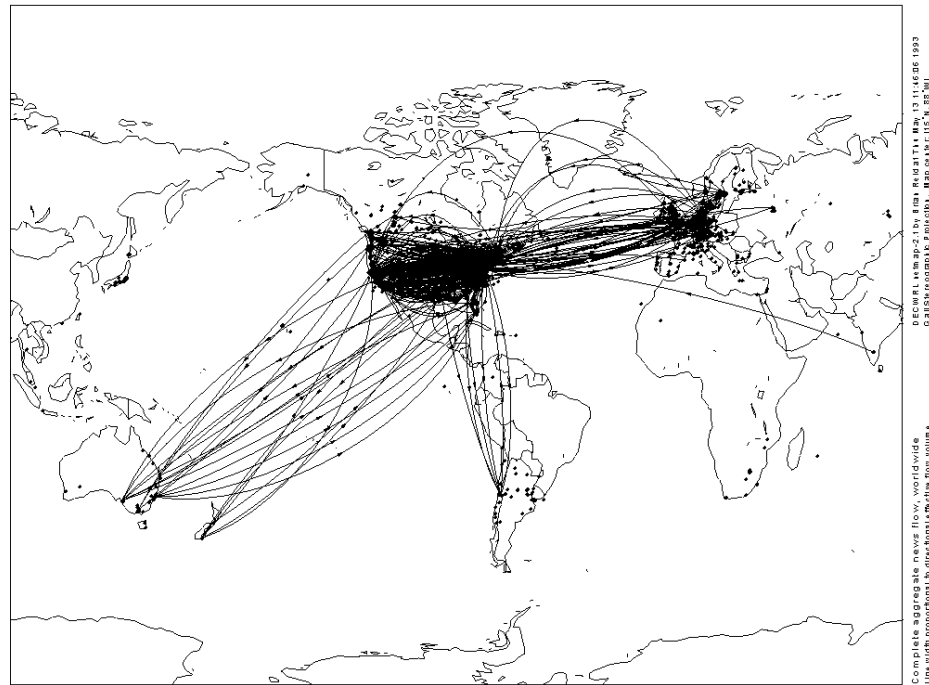


Fig. 3: Complete aggregate news flow worldwide, in USENET¹⁶

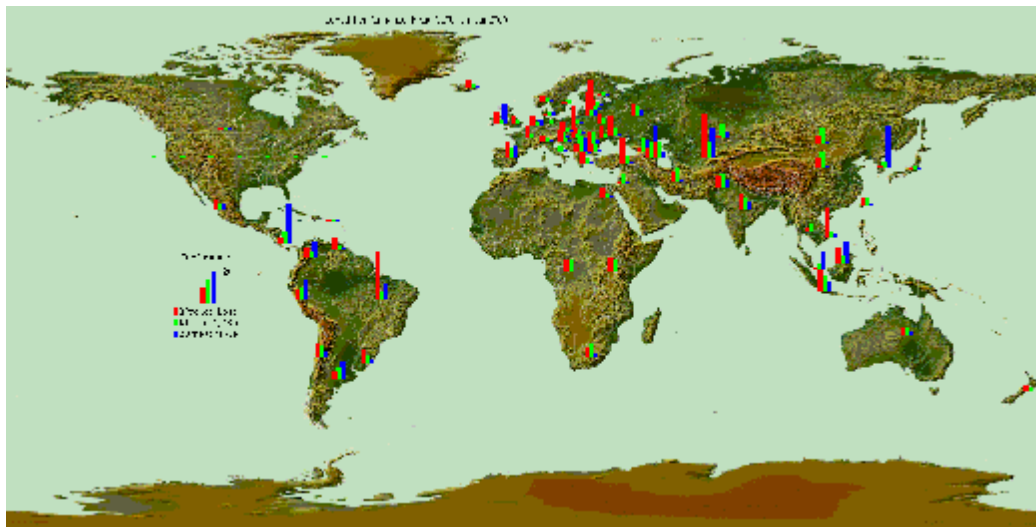


Fig. 4: The world performance of internet¹⁷

Yet it seems to be a little surprising to see the performance of internet as depicted in Fig. 4. The higher the bar means more connection problem (or slower the speed) It is probably a misconception that in less developed countries there will be more

¹⁶ http://www.geog.ucl.ac.uk/casa/martin/atlas/usenet_flow_large.gif

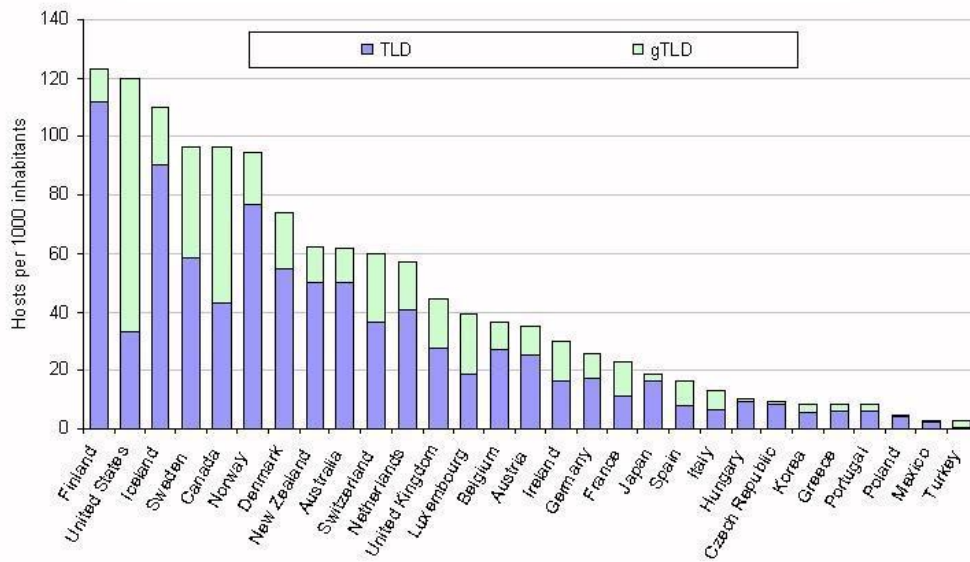
¹⁷ http://www.geog.ucl.ac.uk/casa/martin/atlas/pinger_large.gif

connection problem. In Fig. 4 it is unsurprised that there are connection problem in less developed area such as South America and South East Asia. Nevertheless it also record a great connection problem in Europe. This may probably due to the fact there are too many internet users in Europe and result in great internet traffic congestion. As the result, the connectivity is adversely affected, resulting in the pattern in Fig. 4.

Host counts

“Host counts” here will show the global distribution of host, i.e., the number “uniquely reachable connected computer¹⁸” in the internet in all countries.

Regardless of the difference of top-level domains (TLD) and generic top-level domains (gTLD) in Fig. 5, it shows disparity of the number of computers hosted to the net among individual cities. Most of the countries showing large number of computers connected to the internet are from Northern Europe and North America, such as United States, Finland, Iceland, Sweden, Norway and Denmark. There are fewer computers connected in cities from Asia, such as Japan and Korea, as depicted from Fig. 5. It again, shows global diffusion of internet in the world.



Source: OECD (www.oecd.org/dsti/sti/it/cm) based on Internet Software Consortium (www.isc.org/)

Fig. 5: Internet Hosts in OECD Countries per 1000 inhabitants, July 1999¹⁹

¹⁸ http://www.ngi.org/trends/trends-200008_files/trends-200008.zip

¹⁹ <http://som.csudh.edu/cis/lpress/netstate/selected/oecdhosts.jpg>

Number of web sites

“Number of web sites” here will show the global distribution of web server in all nations.

The pattern observed in Fig. 6 was similar to the pattern observed in Fig. 5 – most of the servers are distributed in North America and North Europe with fewer number of server in the other part of the world. The number of web sites here again, show global diffusion of internet.

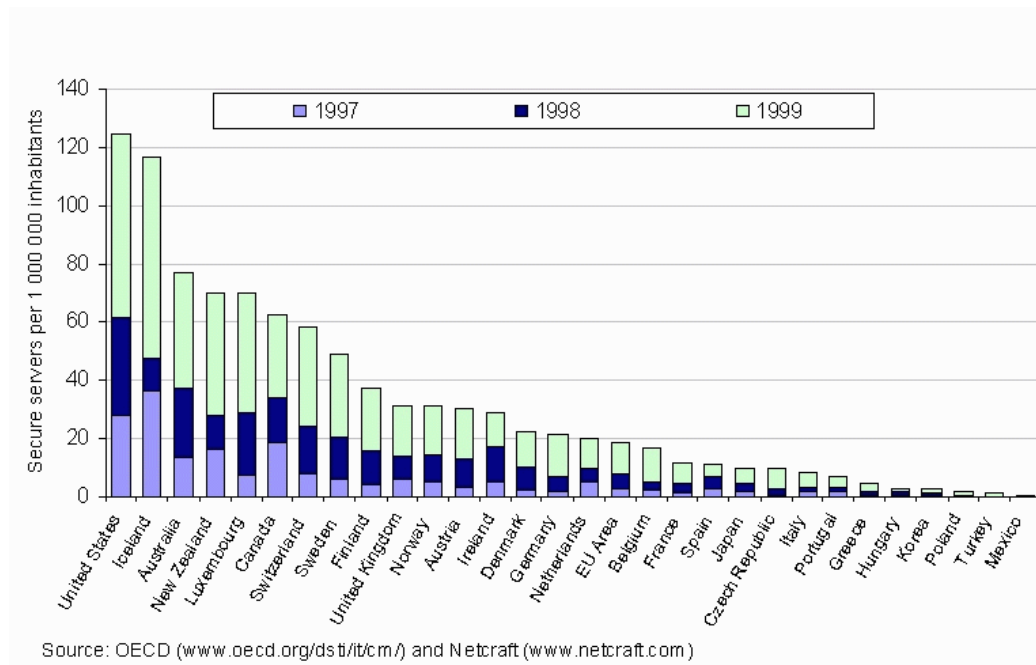


Fig. 6: Secure Servers per Million Inhabitants²⁰

Number of users

“Number of users” here will show the global distribution of the number of internet user in each individual country.

From Fig. 7 we observe diffusion of internet user in the world. Most of the internet users are clustered in advanced country like United State, Europe, Australia and Japan. Over 26.5% of population of these countries is getting online. Especially for United States, it shows a great share of world’s internet users. In the other parts of the world, there are fewer number of internet users. Countries in Africa, South America and South East Asia show relatively small proportion of

²⁰ <http://som.csudh.edu/cis/lpress/netstate/selected/oecdserver.gif>

their population are using the internet. Table 1 further substantiates the situation. Most of the Internet population is from Canada, United States, Europe and Asian Pacific region. And from Fig. 8, we always see the bigger circles (i.e. locations with more internet population) are clustered in United States, Europe, Japan and Australia. So in conclusion, though the use of internet may be prevalent in advanced countries, it is not the full story of the world. In some less developed countries, the popularity of internet is still limited. It results in low proportion of their population using the internet. The statistic of number of internet population in the world, again, shows diffusion of global internet.

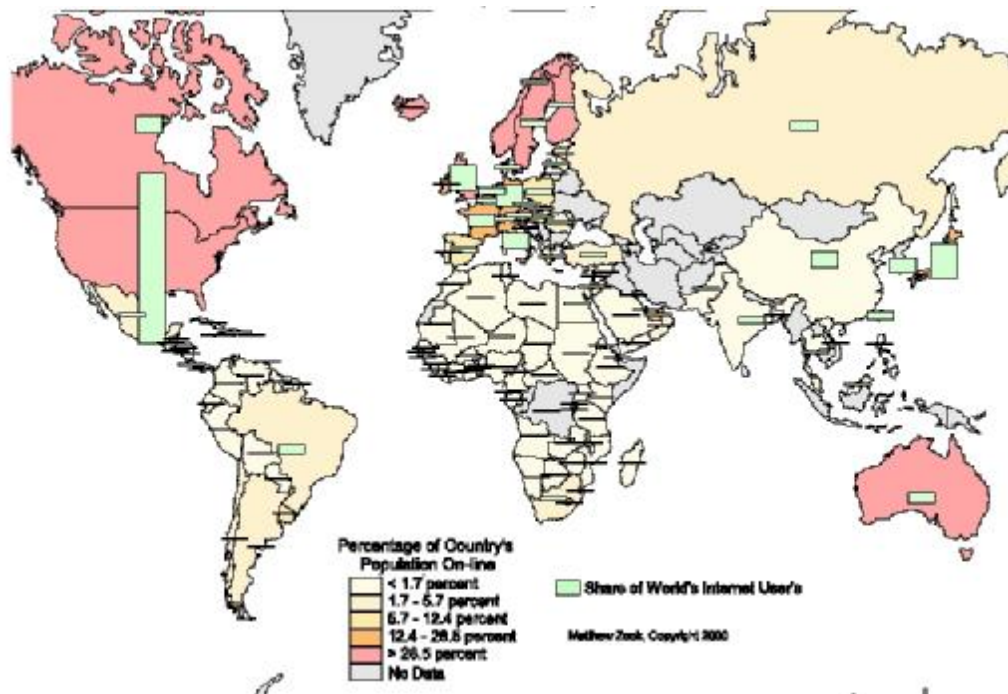


Fig. 7: Internet users worldwide²¹

World Total Internet Population: 407.1 million	
Africa 3.11 million	Asia/Pacific 104.88 million
Europe 113.14 million	Middle East 2.40 million
Canada & USA 167.12 million	Latin America 16.45 million

Table 1: The internet population figure in the world²²

²¹ http://socrates.berkeley.edu/~zook/domain_names/Users/world_users.gif

²² http://www.nua.ie/surveys/how_many_online/index.html The art of estimating how many are online throughout the world is an inexact one at best. Surveys abound, using all sorts of measurement parameters. However, from observing many of the published surveys over the last two years, here is an "educated guess" as to how many are online worldwide as of November 2000. And the number is 407.1 million.

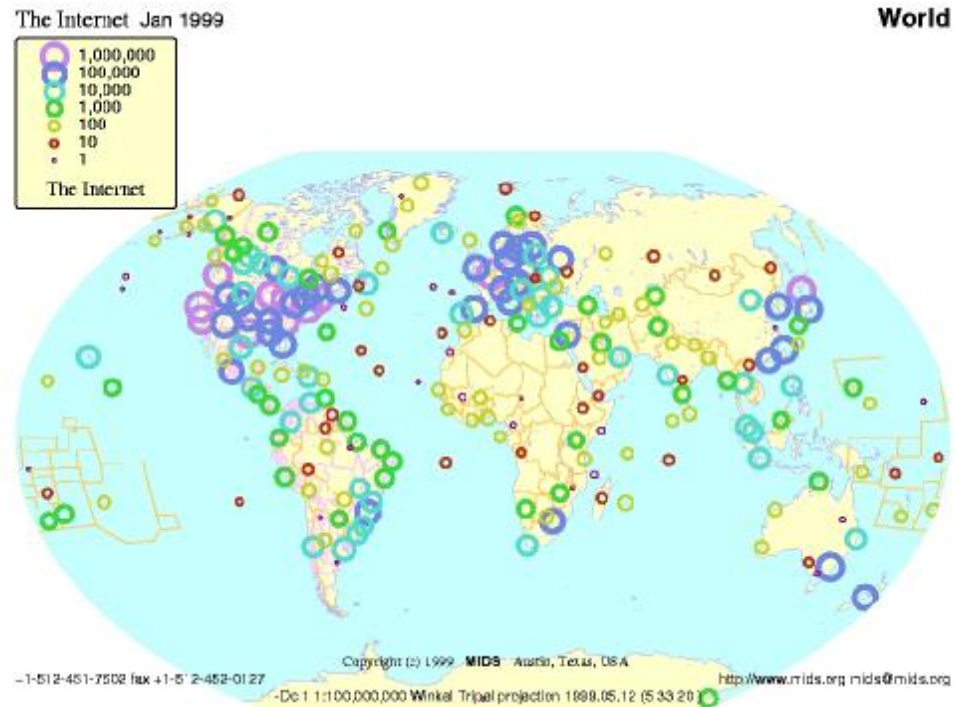


Fig 8: The number of internet users, Jan 1999²³

National diffusion of internet

Similar to the global diffusion of internet, in the section of the report we will try to examine the geographical diffusion of internet within a country – is internet unevenly distributed within a country? In the following paragraphs, the situation of PRC will be cited to explain the national diffusion of internet, using the same criteria as global diffusion do.

Number of users

“Number of users” here means the number of internet users in PRC, as well as its geographical distribution.

According to the newest report by CNNIC released in Jan 2001, there are totally 89.2 millions of computers connected to the internet. The approximate internet population in PRC was estimated as 225 millions. The geographical distribution of internet population is illustrated as follows:

²³ http://www.geog.ucl.ac.uk/casa/martin/atlas/mids_intrworld9901_large.gif

Beijing	12.39%	Shanghai	8.97%	Tianjin	2.53%	Chongqing	2.03%
Hebei	2.47%	Shanxin	1.34%	Nei Monogolia	1.21%	Liaoling	4.66%
Jilin	2.41%	Heilongjiang	2.46%	Jiangsu	5.43%	Zhejiang	6.62%
Anhui	2.43%	Fujian	3.59%	Jiangxi	2.07%	Shandong	5.33%
Henan	2.33%	Wubei	3.52%	Wunan	3.97%	Guangdong	9.69%
Guangxi	2.02%	Hainan	0.31%	Sichuan	5.03%	Guizhou	0.80%
Yunnan	1.46%	Xizang	0.03%	Shaanxi	1.47%	Gansu	1.13%
Qinghai	0.31%	Ninghar	0.48%	Xinjiang	1.51%		

Table 3: The percentage of internet population in each province in PRC, Jan 2001²⁴

In the report, it is argued that Beijing is the area with majority of internet user in PRC (12.39%). The city with second largest internet population is Guangdong (9.69%) and the third is Shanghai (8.97%)²⁵. Cities with significant internet users trend to cluster in the east. Cities in the west, on the other hand, suggest that internet is not very popular in Western China. As we can see cities like Xingjiang (1.51%), Qinghai (0.31%), Yunnan (1.46%) etc, which is situated in the West of China, they generally show a relatively fewer amount of internet users. The number of users does not only highly uneven in global scale, but also within a nation.

Connectivity

“Connectivity” here will present the national connectivity of internet in China in term of the network infrastructure. The example of CERNET, one of PRC’s major ISP, will be adopted to see the connectivity of PRC.

Similar to “*number of users*” of PRC as mentioned earlier, it shows disparity between the Eastern and Western region of China. From Fig. 9 we observe that the major connection occurs in Eastern China. The internet backbone is linked among more developed cities such as Beijing, Shanghai, Chongdu, Wuhan, Guangzhou and Shengyang in the east. Less developed cities in the west, on the other hand, is just fairly connected by internet. In some cities such as Rikaze, Naqu and Helian etc there are even no internet connection. The lack of infrastructure and network facilities becomes an obstacle to the use of internet in Western China. Therefore, similar to global scale, the internet in term of “connectivity” in China, also unevenly diffused as there is disparity between the East and the West in term of infrastructure.

²⁴ <http://www.cnnic.net.cn/develst/cnnic200101.shtml>

²⁵ *ibid.*

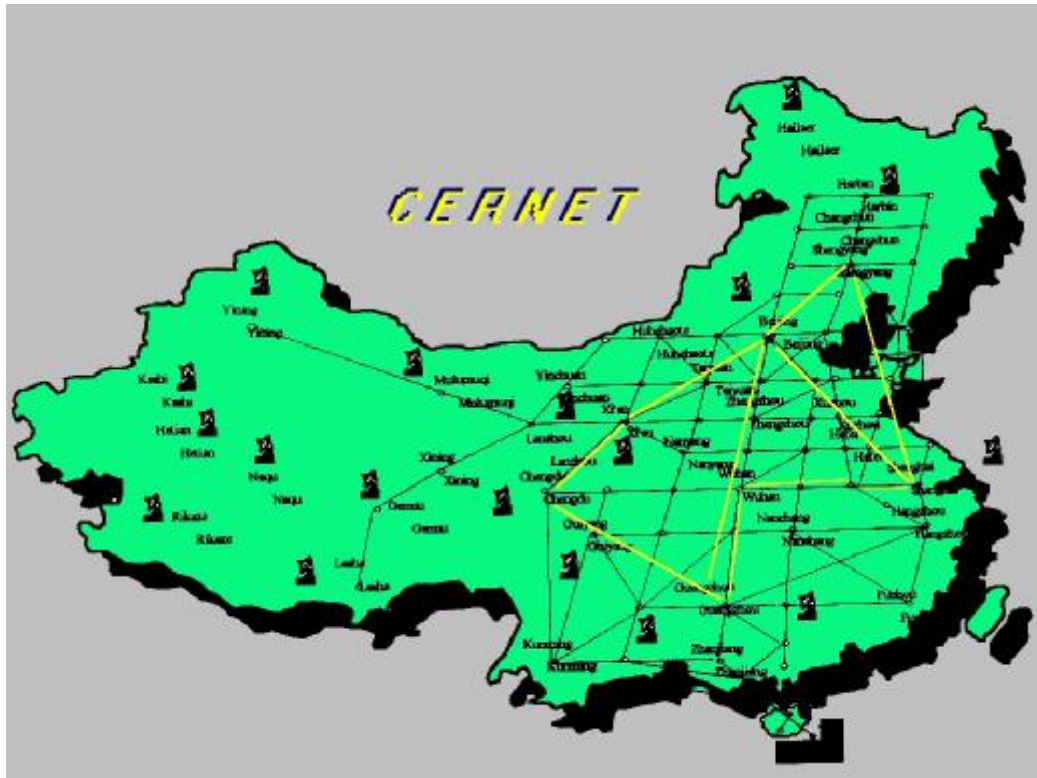


Fig. 9: CERNET network infrastructure in China²⁶

Number of web sites

“Number of web sites” here will show the national distribution of web sites in all cities in PRC. The report by CNNIC will again be used to illustrate the situation.

Similar to the previous findings as expected, the web site in PRC again prove geographical diffusion of internet in China. From Table 4, cities with greatest number of web site are from the more developed cities in the east, such as Beijing (62158), Guangdong (37783) and Shanghai (28173). Less developed cities in the West possess least web site, such as Xizang (59), Qinghai (133) and Ninghar (562). It again shows geographical diffusion of internet within a country.

²⁶ <http://www.chinavista.com/chimat/cernet.gif>

City	Beijing	Shanghai	Tianjin	Chongqing	Hebei	Shanxin	Nei Monogolia
Total no.	62158	28173	3947	2312	5337	2608	971
Total %	23.42%	10.61%	1.49%	0.87%	2.01%	0.98%	0.37%
City	Liaoling	Jilin	Heilongjiang	Jiangsu	Zhejiang	Anhui	Fujian
Total no.	6420	1686	2773	17790	25627	2807	15878
Total %	2.42%	0.64%	1.04%	6.70%	9.66%	1.06%	5.98%
City	Jiangxi	Shandong	Henan	Wubei	Wunan	Guangdong	Guangxi
Total no.	1499	12215	5062	6566	2732	37783	2152
Total %	0.56%	4.60%	1.91%	2.48%	1.03%	14.24%	0.81%
City	Hainan	Sichuan	Guizhou	Yunnan	Xizang	Shaanxi	Gansu
Total no.	2872	5647	763	3174	59	2949	1043
Total %	1.08%	2.13%	0.29%	1.20%	0.02%	1.11%	0.39%
City	Qinghai	Ninghar	Xinjiang				
Total no.	133	562	1707				
Total %	0.05%	0.21%	0.64%				

Table 4: The distribution of web site in each province in PRC, Jan 2001²⁷

Reasons for diffusion

From the various figures and table above, it seems shows that there are global and national diffusion of internet. What actually cause such diffusion? The following are some of the suggested reasons in short form:

(1) Government policies, laws, and practices

Government financial incapability to build internet network (internet backbone); Strong government controls on electronic communication for security, political and revenue generating reasons (such as China); legal constraints such as in Singapore, fails to reconcile its anti-pornography laws to make internet widely available²⁸; high charge of internet such as PNETS etc.

(2) Technical impediments

Poor physical telecommunications; lack of technical expertise and training programs; user unfriendly interfaces etc.

(3) Local and "cultural" factors

Muslim and Middle East nations restrict external communications.

²⁷ <http://www.cnnic.net.cn/develst/cnnic200101.shtml>

²⁸ <http://som.csudh.edu/cis/lpress/sy.htm>

Conclusion

In this report we have discussed the definition of internet as well as some of the history. Most important, a preliminary survey on the diffusion of internet has been carried out either in global scale and national scale. For the national scale, the example of PRC has been adopted.

The figures and tables obtained for this report generally suggest there are significant disparities between developing and industrialized nations²⁹. The global diffusion of the Internet has been extraordinarily rapid and extensive³⁰. Globally, internet is clustered in North America, Europe, Australia and Japan. Nevertheless it is interesting to see that the performance of internet in the European continent is not very good. Probably we believe the less advanced the country the poorer the connectivity (due to bad infrastructure). But in developed countries like in Europe, the connectivity is also a problem due to large volume of internet traffic. Therefore one should bear in mind that connectivity problem is not the sole problem of less developed nations.

The situation of PRC also shows national diffusion of internet. Internet is popular in the East, while in the West, due to technical difficulties, such as lack of internet connection, internet is not popular. This results in national diffusion of internet in China.

And the reasons for diffusion of internet are mainly due to government control and technical difficulties. Concerning the global level, due to financial difficulties, African and South American countries simply are not rich enough to build a new internet connection. The countries in Middle East, on the other hand, due to Muslim and dislike against United States, they refused the use of internet. All these factors account for internet diffusion in global level.

For national level in PRC, the lack of construction of internet infrastructure simply due to government policy of preventing the spread of independence of Tibet. Moreover, it is an area with little development. All these factors account for the geographical diffusion of internet globally and nationally.

²⁹ http://www.isoc.org/inet2000/cdproceedings/8e/8e_4.htm

³⁰ <http://mosaic.unomaha.edu/GDI1998/8CONCLUS.PDF> p. 1