

35 YEARS OF INTERNET, 10 YEARS OF ISPRS ONLINE

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ABSTRACT:

The Internet and the most known part of it, the World Wide Web, are one of the greatest inventions of our time. The formation and the growth of these big Net has changed the way we do business, communicate, entertain, retrieve information, and even educate ourselves. This worldwide medium allows interaction with people without regard for geographic location and it is a great exchange and source of data, information and software. Inside this electronic world, ISPRS is present since 1994 with the goal of providing information, coordination and operations structure of its activities. In this paper, at first a short history of the WWW is presented, with its main facilities and possibilities. In the second part, after a short introduction on the web site of the society, are presented history, presence, and future plans about the use of Internet by ISPRS, and how ISPRS can make use of existing technologies to improve what it now offered, including the educational strategy. The ISPRS Events Calendar is also presented.

INTRODUCTION

The Internet is big and global collection of networks connected together in different ways to form a single entity. The Internet is at once a broadcasting capability in the entire world, a mechanism for information dissemination and a medium for collaboration or interaction between individuals and their computers without regard for geographic location. Sometimes called simply "the Net," it is a public, cooperative, and self-sustaining facility accessible to hundreds of millions of people, a worldwide network of networks in which a user with his computer can get information from any other computer.

Nobody owns the Internet but there are some no-profit organisations that define how we use and interact with the Internet. The most widely used part of it is the World Wide Web, created in 1990 as user-friendly face of the information available on the Internet and, together with e-mails and search engines, provides efficient access to an increasing amount of information. Other services widely used are FTP, e-mail and telnet.

After 35 years of developments and improvements, nowadays there are more than 600 million people online. Everyday more people use an online computer to find information, learn, educate and communicate. But the presence and the access to the Internet are not well distributed in all the countries as there are still part of the world where the use of Internet has yet to grow because it was politically repressed or the infrastructures are still in development.

Inside this big electronic world, ISPRS is present since 1994 with the goal of providing information, coordination and activities of its structure.

The goal of this work is to review the history of the Internet and the WWW, as well as give an overview over the global network, its services and its growth. Then is also described how ISPRS is

inserted since 10 years in this network and which initiatives are taken to present the society to the world-wide public.

INTERNET AND WWW

2.1 The history [ISOC]

The precursor of the Internet is called ARPANet (Advanced Research Projects Agency Network). The US Department of Defence in fact developed it in the late 60's an experiment in wide-area-networking that would survive to nuclear war. ARPA was the answer to the rising American Cold War fear about military inferiority, fuelled not least by the Russian Sputnik success. In the autumn of 1969 the first ARPANET computer was connected to the ARPANET's IMP node at the University of California at Los Angeles (UCLA) and by the end of the year, the network included four computers (the University of California, Santa Barbara and the University of Utah). All the computers used different operating systems and they were able to talk to each other across the network.

During the 1970's, the ARPANET grew to connect research institutes and laboratories supported by the Department of Defence in various parts of the USA. Many of these were university laboratories studying data processing and computer networks, which developed the TCP/IP network protocol and its applications for the Internet.

During the 1980's, the Internet was still considered to be a temporary system designed for the research world while in the 1984 the TCP/IP data transmission protocol was adopted as the US Department of Defence's official network standard. At the same time that the Internet technology was being experimentally validated and widely used amongst a subset of computer science researchers, other networks and networking technologies were being pursued: USENET, based on a UNIX communication protocols; BITNET (Because It's Time NETwork), started as a cooperative network at the City

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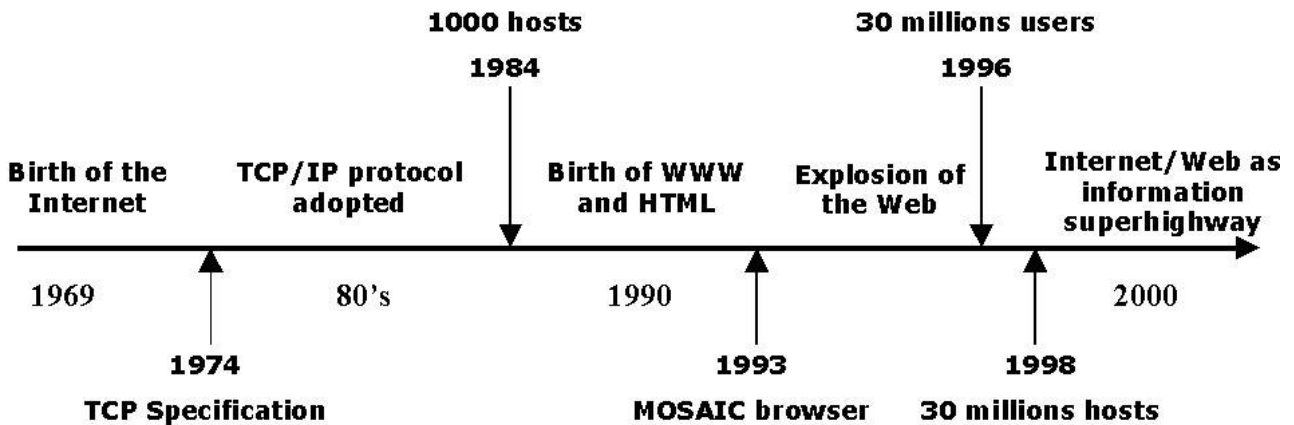


Figure 1: The history of the Internet, summarise in few key points.

University of New York; NSFNET, initiated by the U.S. National Science Foundation (NSF); NSINET, developed by NASA; CSNET (Computer Science NETWORK), developed by a group of computer scientists and some university. By that time Internet was an essential tool for communications, however it also began to create concerns about privacy and security in the digital world and new words, such as "hacker" or "cracker" were created.

In 1990 ARPANET ceased to exist while the country already connected to NSFNET were 28 with ca 300.000 hosts. The NSFNet soon connected to the CSNET, which linked Universities around North America, and then to the EUnet, which connected research facilities in Europe.

Tim Berners-Lee, researcher at CERN of Geneva, noticed that many people were having difficulties in sharing information due to a range of different network information retrieval protocols and a range of workstation types with widely varying display capabilities. For this reason he proposed an Internet-based hypertext system which would have linked together behind a single and easy-to-use interface the various information spread around the Internet. He produced a WWW browser-editor which reads HyperText Markup Language (HTML) documents from Uniform Resource Locator (URL) addresses: i.e. the Web was born [Berners-Lee, T., 1990].

In the next years the Internet Society (ISOC) was founded (1991); the World Bank goes on-line (1992); Mosaic, the first commercial graphical Web browser was released by Eric Bina and Mark Andreessen (1993); "Yahoo" (Yet Another Hierarchical Officious Oracle) was invented by two PhD students from Stanford University (1994); NSFNET reverted back to a research project and left the Internet in commercial hands. And in 1995, The Federal Networking Council (FNC), in consultation with the leadership of the Internet and Intellectual Property Rights Communities, unanimously passed a resolution defining the term *Internet* [FNC Resolution, 1995].

Figure 1 shows a brief history of the Internet, from its origin to our time. As the Internet celebrates its 30th anniversary, the military strategies that influenced its birth become historical footnotes. Approximately 500 million people (in almost 250 countries around the world) were already connected to the global net and the traffic on it expanded at a 340% annual growth rate. The number of computer hosts approached 100 million and the Internet passed from a Cold War concept to the Information Superhighway. All the rest is no more history: as new generation will grow up accustomed to communicate using a keyboard, life on the Internet will become an increasing important part of our life.

2.2 How does the Internet work?

Since 1969, the Internet has grown from four host computers in U.S. to millions of computer worldwide. However, even if nobody owns the Internet, it is monitored and maintained in different ways. There are organisations that define how we use and interact with the Internet. The ISOC, Internet Society [ISOC], oversees the formation of the policies and protocols. The World Wide Web Consortium [W3C, 2004], created in 1994, tries to lead the World Wide Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability. The Internet Corporation for Assigned Names and Numbers [ICANN, 2004], a non-profit corporation formed in 1998 to assume responsibility for the IP address space allocation, protocol parameter assignment, domain name system management and root server system management, all functions previously performed under U.S. Government contract by IANA (Internet Assigned Number Authority) [IANA, 2004] and other organisations. They all assume responsibility for technical function, provide reliable information about the Internet and develop interoperable technologies (specifications, guidelines, software and tools) to lead the Web to its full potential as a forum for information, commerce, communication, and collective understanding.



Figure 2: A visualization of the Internet traffic in north America. The colored lines represent virtual connections from the network sites to the backbone [NCSA].

In general, all the machines on the Internet can be divided in two types: servers and clients. Those machines that provide services (like Web servers or FTP servers) to other machines

are servers. And the machines that are used to connect to those services are clients. When a html page is requested to a server, the browser forms a connection to a Web server, requests a page and receives it. In detail (Figure 3), the browser breaks the URL into 3 parts: the protocol ("http"), the server name ("www.isprs.org") and the file name ("isprs.html"). The browser communicated with a domain name server (DNS) to translate the server name "www.isprs.org" into an IP numerical address, which it uses to connect to the server machine. The browser then forms a connection to the server at that IP address on port 80 and following the HTTP protocol, it sends a GET request to the server, asking for the file "http://www.isprs.org/isprs.html". The ISPRS server then sends the HTML text to the browser, which formats the page onto your screen.

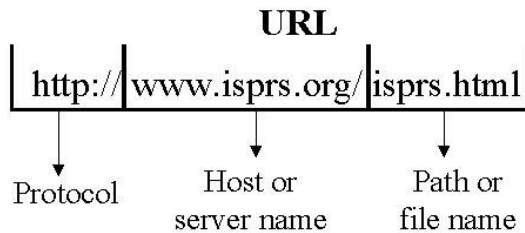


Figure 3: An Internet address (or URL) subdivided in its main parts.

This big network is design in a way that each information can reach its destination using many different paths. When the information is sent through the network, it is split into tiny packets and each packet use a different path to reach its destination. When all the packets reach the destination, they are regrouped to form the original information. If one packet does not reach the destination, the receiving site asks for another copy of this packet. The routes covered by the Internet information are not always the shortest ones, but usually the fastest one (Figure 4).



Figure 4: A graphical trace-route of a Internet path covered between a server in Switzerland and the server hosting ISPRS Commission 7 in India. The request passes through US as faster route compared to a Middle East route. Source: [VisualRoute].

2.3 Internet Domain

A domain is a name which identify a web site on the Internet. Domain names have always two or more parts, separated by dots, e.g. 'www.commission5.isprs.org'. The part on the left is the most specific ('commission5'), the part on the right the more general ('isprs'). The extension .org identifies the kind of domain and together with the previous generic part, they are often called *Top-Level Domains* (TLD). There are two types of top-level domains:

- Generic Top-Level Domains (gTLDs), created for use by the Internet public. The most common generic TLD, available since 1984, are: .COM (Commercial), .EDU (Educational), .GOV (US Government), .INT (International Organisations), .MIL (US Dept. of Defence), .NET

(Networks), .ORG (Organisations). On November 2000, ICANN passed a resolution to add seven new generic top-level domains. These new generic Top-Level Domains (gTLDs) are: .BIZ (Business Organisations), .MUSEUM (Museum Organisations), .NAME (Personal), .INFO (Open TLD), .PRO (Professionals as Accountants, lawyers, and physicians), .AERO (Air-transport industry), .COOP (Cooperatives). These were activated in 2001 and 2002. Four of them (.biz, .info, .name, and .pro) are unsponsored while the other three (.aero, .coop, and .museum) are sponsored.

- Country Code Top-Level Domains (ccTLDs), created to be used by each individual country. The Country Code TLD are designed to be assigned to each individual country: it, .fr, .uk, .jp, .ch, .co, .er, They almost follow the ISO 3166 standard that provides codes for the names of countries and dependent areas, even if there are some exceptions. The ISO codes EH (Western Sahara), KP (North Korea), TL (East Timor), CS (Serbia and Montenegro) and AX (Aland Islands), although theoretically available as ccTLDs have never been assigned and do not exist in DNS. On the other hand, eight ccTLDs are currently in use despite not being ISO two-letter codes, namely AC (Ascension Island), GG (Guernsey), IM (Isle of Man), JE (Jersey), SU (Soviet Union), TP (East Timor), UK (United Kingdom) and YU (Serbia and Montenegro). As April 2004, there are 243 country code domains (see [IANA] for an updated list). CcTLD managers, who are also responsible for the operation of the domain, develop the rules regarding who is entitled to domains the ccTLD. But in some cases, anyone in the world can acquire a domain in the ccTLD list, like in the case of Armenia (.AM), Austria (.AT) Cocos Islands (.CC), Germany (.DE), Niue (.NU), Samoa (.WS), Tonga (.TO), Tuvalu (.TV) and Turkmenistan (.TM). This allows domains names like I.am, start.at and go.to.

In addition to gTLDs and ccTLDs, there is a special TLD, .ARPA, which is used for technical infrastructure purposes. ICANN administers this domain name in cooperation with the Internet technical community under the guidance of the Internet Architecture Board.

According to some Internet statistics, the maximum number of characters in one component of a domain name is 63 while the average number of characters in a domain name is 11.

2.4 Wired Internet Connection

The network allows all the computers to communicate with one another and to send and receive data through a network of transmission lines (Figure 5).

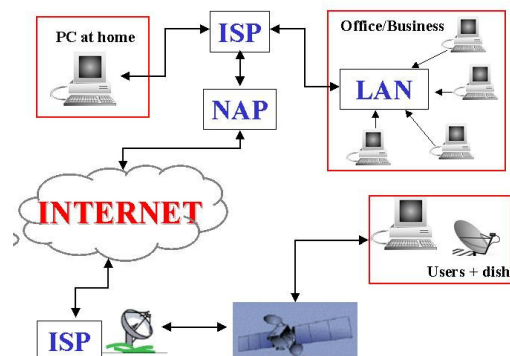


Figure 5: The Internet connection from a home or office computer using wired or satellite mode.

A home computer is usually linked to the Internet using a normal phone line and a modem that talks to an Internet Service Provider (ISP). A computer in a business or university is usually connected to a Local Area Network (LAN) inside the business through a higher-speed connection, like ADSL, ISDN. Usually switches are also used, to provide the different nodes of a company's LAN different connection. The LANs are then attached to an ISP. ISP can be connected to bigger ISP or, using high-bandwidth connections, directly to NAPs (Network Access Point) through communications networks called 'backbones'. The backbones are provided by companies such as AT&T, GTE, IBM, MCI, Netcom, Sprint or UUNET and consist of high-speed links in the T1, T3, OC1 or OC3 ranges (Figure 6). Backbones around the world are connected through world-wide fibre-optic lines, undersea cables or satellite links. In this way, every computer on the Internet is connected to every other computer on the Internet all over the world.

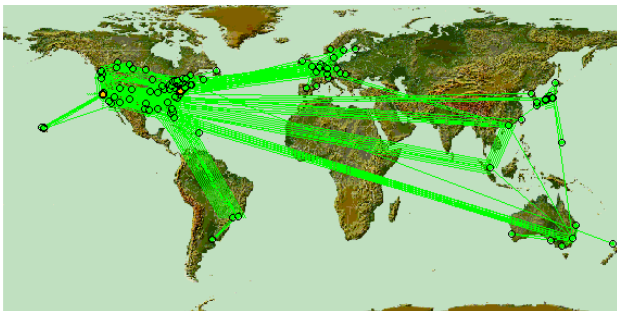


Figure 6: The world-wide backbones provided by UUNET [UUNET].

The Internet connections can be divided in low, medium and high-bandwidth. As reported in Table 1, old modems were very common in the 70's and they were considered high-speed connection (<10 Kbps). Actual modems operate between 14.4 Kbps and 56.6 Kbps, with mild success, at least in one direction. They are very common for Internet connections at home. Recently there has been a lot of effort to develop a higher speed connection for residential users and small office by using an Integrated Services Digital Network (ISDN). ISDN operates at a minimum speed of 64 Kbps on normal copper phone line. For this reason, it is equally available to home and business customers and provides a huge improvement in access speed at only a fractional increase in cost. Data are transmitted in a digital format and the "Integrated" part of ISDN's name refers to the combining of voice and data services over the same wires. A T1 connection is a form of digital, leased private line, which means that a company can lease a point-to-point circuit at a flat rate with a telephone company. A T1 connection allows using the line in the form of 24 channels, running at 64 Kbps each. T1 runs on fibre optic or copper wires. ADSL (Asymmetric Digital Subscriber Line) uses a common phone line and can transfer data using a particular modem with a maximal speed of 6 Mbps. ADSL is getting very common, it does not require new wiring and the phone line for voice call can be used even if a Internet connection is still open. The word *Asymmetric* is used because these modems send data faster in one direction than they do in another. ADSL (and in general DSL technology) exploits the 'extra capacity' of copper wires to carry the information, without disturbing the voice conversation and matching particular frequencies to specific tasks. Following ADSL, the speed jumps to T3, OC1 (Optical Carried level 1) and to the newer version of ISDN, called Broadband ISDN (B-ISDN) which can run at 155 Mbps. Many people who have cable TV can now get a high-speed connection to the Internet from their

cable provider. Cable modems compete with technologies like ADSL and, unlike these, its performance doesn't depend on distance from the central cable office. Another new type of Internet connection can be realised using satellite. Satellite connection can reach a download speed up to 10X faster than dial-up connection and work using normal antenna for Sat-TV.

	Connection	Speed	Time
Low Bandwidth	Old modem	2400 bps	≅ 1 hour
	'Home' modem	< 56.6 Kbps	≅ 4 min.
Medium Bandwidth	ISDN	64 Kbps	≅ 2 min.
High Bandwidth	T1, HDSL2	1.5 Mbps	≅ 5 sec.
	ADSL	6 Mbps	≅ 1.3 sec.
	T3, OC-1	45 Mbps	≅ 0.2 sec.
	B-ISDN	155 Mbps	≅ 0.05 sec.
	OC-XX	> 1 Gbps	< 0.01 sec.

Table 1: Mostly used Internet connections with respective speed and approximately time for downloading the same document.

Despite all these name and speeds, the connection is still a problem for many Internet users: many ISPs that should maintain the "backbones" for an entire nation still work with medium bandwidth connections. And this fact can create many 'stall' problems for local users or for persons who wants to view HTML documents from these countries but has to fight with download speed of 20 Kbps!

2.5 Satellite Connection

As Internet traffic continues to grow world-wide at exponential rates, many Internet Services Providers (ISPs) are facing the problem to keep high-speed connections for their users. The satellite connection between a Network Access Point (NAP) and the Internet backbone can solve this problem. In fact, Internet satellite connections, started at the end of the '90, can assure Internet access whatever the traffic. Moreover, it doesn't matters where the customers are as satellite communication has can deliver bandwidth exactly where and when it is required, without geography and local infrastructure limitations. The satellite connection does not use telephone lines or cable TV systems and, depending on the user's location and requirements, is the best method for skip or extend the terrestrial fibre optic network. In particular, the satellite service is aimed for ISPs or businesses located in areas poorly served by the wired Internet infrastructure. It is the case of the central Asia of Africa, where it could be the (high-speed) transport medium for information and data (Figure 7).

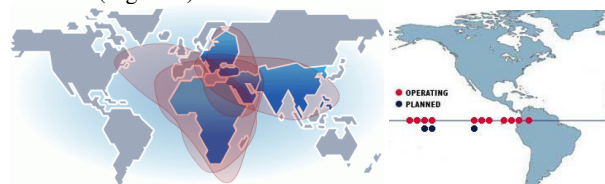


Figure 7: SkyVision World Coverage Map [Sky-Vision] (left). Ses American Internet satellite fleet [SES American] (right).

There are two ways to have an Internet satellite connection: the first possibility is to perform a connection using the same dish that allow you to receive the satellite television; this solution requires you to have an ISP for a dial-up or cable modem for the data you send to the Internet. The second possibility to have a satellite Internet connection is to use a two-way satellite dish (upload and download). Upload speed is about one-tenth of the

500 kbps download speed. Cable and DSL have higher download speeds, but satellite systems are about 10 times faster than a normal modem. The dish must have a clear view to the south, since the orbiting satellites are over the equator area. Moreover, like satellite TV, trees and heavy rains can affect reception of the digital signal.

Global satellite capacity isn't being used fully. There is enough satellite capacity in the sky to meet the health and education objectives and requirements of every country on earth.

The use of satellite resources for Internet Backbone and other Internet related applications would improve the connections and the capacities of many domains, in particular in developing countries.

2.6 Wireless Internet

Wireless simply means the use of radio-frequency spectrum to transmit and receive voice, data, and video signals for communications.

Regarding wireless Internet, we have to distinguish between laptops and mobile devices (like cell-phone or PDAs). The latter use Wireless Application Protocol (WAP) to access the information on the web. A web site accessible with mobile devices is created with text-only or with low-graphics version and it is generally written in Wireless Markup Language (WML). Only the new generation of PDAs allow the full access to HTML pages [ThunderHawk, 2004]. During the transmission, the data is sent in HTTP form from a web server to a WAP gateway. This system includes the WAP encoder, script compiler and protocol adapters to convert the HTTP information to WML. The gateway then sends the converted data to the WAP client on your wireless mobile device.

Laptops with wireless Internet connection can have Internet access through a Wireless Internet Service Provider (WISP) organization, e.g. an Internet provider that allows subscribers to connect to a server at designated access points (called 'hot spot') using a wireless connection such as Wi-Fi (short for "wireless fidelity"). Wi-Fi is the common term for a high-frequency wireless local area network (WLAN). The Wi-Fi technology is rapidly gaining acceptance in many companies as an alternative to a wired LAN.

The WISPs offer high-speed communication and allow subscriber computers to access the Internet and the web from anywhere within the zone of coverage (several km) provided by the server antenna.

A wireless Internet connection is usually faster than cable or DSL mode, the user is always-on connection and he has the freedom to move around without losing the connection.

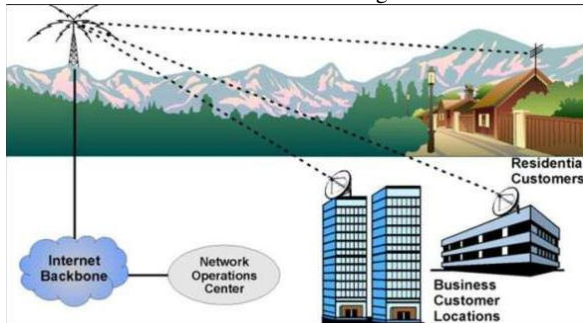


Figure 8: Wireless Internet connection. Source: [Logical Net's].

2.7 Services on the Internet

The World Wide Web is often identified with the Internet, but it is only the most known part of it. Inside the Internet 'live' many other services developed to facilitate the sharing of information through the net. In the following, the main and mainly used services are shortly described.

FTP: the File Transfer Protocol (FTP) is a common format for transmitting and moving data (files) on the Internet.

GHOPER: a system that pre-dates the World Wide Web for organising and displaying files on Internet servers.

TELNET (and **SSH**): a terminal emulation program used to connect to remote Internet servers.

E-MAIL: short for electronic mail, it is a transmission of electronic messages over networks.

NEWSGROUP (or mailing list): a very big number of people that receive simultaneously an e-mail.

USENET: it is an international network of newsgroups, which are discussion forum that cover many interest groups.

ICQ: it stands for "I-see-you" and it is a revolutionary, user-friendly Internet tool to communicate with other people in real time. It includes the **IRC** (Internet Relay Chat), system developed in the late 80's as a virtual meeting place where people from all over the world could meet and talk.

WORLD WIDE WEB: it is the most known and used part of the Internet where the users look for information, read articles or see animations.

2.8 Firewall

A firewall is a system or group of systems that enforces an access control policy between two networks. The actual means by which this is accomplished varies widely, but in principle, the firewall can be thought of as a pair of mechanisms: one that exists to block traffic, and the other that exists to permit traffic. Some firewalls place a greater emphasis on blocking traffic, while others emphasize permitting traffic. Probably the most important thing to recognize about a firewall is that it implements an access control policy. If you don't have a good idea of what kind of access you want to allow or to deny, a firewall really won't help you. It's also important to recognize that the firewall's configuration, because it is a mechanism for enforcing policy, imposes its policy on everything behind it. Administrators for firewalls managing the connectivity for a large number of hosts therefore have a heavy responsibility.

2.9 The information on the Web

One of the main problems of Internet users is where to find the right information they are looking for in the less time. Since the 80's, special websites have been created to help the users finding all the information hidden in million of web pages. These sites contain research systems that work with different mechanisms and can be divided in search engines and online directories. Another common resources used to stored information are the Internet "Yellow Pages" Books, which list Internet addresses by categories and can be found in computer and bookstores.

2.9.1 Internet Search Engines

Internet search engines are special web sites designed to help people find information stored on other sites. Before the Web became the most visible part of the Internet, there were already search engines in place to help people find information on the Net. Programs with names like "gopher" and "Archie" kept indexes of files stored on servers connected to the Internet, and

dramatically reduced the amount of time required to find programs and documents. Early search engines held an index of a few hundred thousand pages and documents and received maybe one or two thousand inquiries each day. Today, a top search engine will index hundreds of millions of pages and responds to tens of millions of queries per day. There are differences in the ways various search engines work, but they all perform three basic tasks (Figure 9):

1. they search the Internet or select pieces of the Internet, based on keyword;
2. they keep an index of the words they find and where they are;
3. they allow users to look for words or combinations of words found in that index.

To find information on the hundreds of millions of Web pages that exist, a search engine employs special software robots, called *spiders or crawl*, to build lists of the words found on Web sites. When a spider is building its lists, the process is called Web crawling. In order to build and maintain a useful list of words, a search engine's spiders have to look at a lot of pages. When a typical search engine spider looks at an HTML page, it took note of the words within the page and also where the words were found. Words occurring in the title, subtitles and other positions of relative importance were noted for special consideration during a subsequent user search. Each spider takes different approaches but they are always crawling, because of the constantly changing nature of the Web.

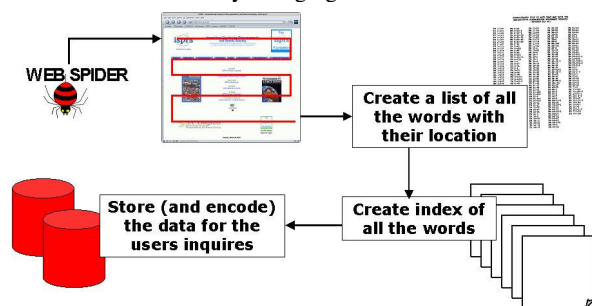


Figure 9: The tasks performed by a good search engine.

These different approaches usually attempt to make the spider operate faster, allow users to search more efficiently. Once the spiders have completed the task of finding information on Web pages, the search engine must store the information in a way that makes it useful. Most search engines store more than just the word and URL. An engine might store the number of times that the word appears on a page and might assign a "weight" to each entry. Each commercial search engine has a different formula for assigning weight to the words in its index. This is one of the reasons that a search for the same word on different search engines will produce different lists, with the pages presented in different orders.

Searching through an index involves a user building a query and submitting it through the search engine. The query can be quite simple, a single word at minimum. Building a more complex query requires the use of Boolean operators that allow you to refine and extend the terms of the search. Each query is analysed and searched in the database of the system. The result of the research is a collection of URL with an associate score (determined by the number of times the search criteria is found in each page), and it is displayed in order from the highest score to the lowest. Some of the most popular search engines are Google (<http://www.google.com>), Altavista (<http://www.altavista.com>), Yahoo (<http://www.yahoo.com>), HotBot (<http://www.hotbot.com>), Lycos (<http://www.lycos.com>), Excite (<http://www.excite.com>), MSM (<http://search.msn.com/>). Some of these search engine entries

present also a main menu organised with directories that can help a user in his research. Elsevier Science has developed a powerful Internet search tool called Scirus (<http://www.scirus.com>). Scirus distinguishes itself from existing search engines by concentrating on scientific content only and by searching both Web and membership sources (articles, presentations, reports). It enables scientists, students and anyone searching for scientific information, locate university sites, and find reports and articles in a clutter-free, user-friendly and efficient manner. Furthermore there are sites, called meta crawler, that use at the same time more search engines to search for a query, as Mamma (<http://www.mamma.com>), Metacrawler (<http://www.metacrawler.com>), Search Engine Guide (<http://www.searchengineguide.com/>).

The qualities of a good search engine web site should be fast answer to the queries, user-friendly, often updated, it should have an advanced research options and a nice display of the results. Few years ago, the search engines were not able to spider all the net and a part of it were hidden to the Internet users. Today this "Invisible Net" is very small as the search engines are more powerful, their databases are often updated and they can recognise also non-text files such as pdf, postscript and other formats.

2.9.2 Online Internet Directories

They are webpages where the information are stored and displayed to the users in thematic channels or categories. Each link is listed with a short description and its URL and these lists can be updated automatically or manually. It is also possible to search inside the web site as a normal search engine. Useful URL are Galaxy (<http://www.galaxy.com/>), Yahoo (<http://www.yahoo.com>), the WWW Virtual Library (<http://www.vlib.org/>), the Educational Virtual Library (<http://www.csu.edu.au/education/library.html>), the Earth Science Portal (<http://webserv.gsfc.nasa.gov/ESD/>). The Earth Science Portal is a searchable links directory together with a web crawler search engine that spans all the web-based information of the NASA Earth Sciences Directorate. AllConferencesNet (<http://www.allconferences.net/>) instead provides interesting links for all kind of events. It is a directory focusing on conferences, conventions, trade shows, exhibits, workshops, events and business meetings. This is a unique search directory that serves users looking for specific information on conference or event information.

2.10 Educational resources on the Web

The possibility to find scientific articles, reports, journals or entire books on the Web is very high. These electronic documents contain nothing different in comparison with the same text and picture of the paper version, except some occasional hyperlink. They are quickly disseminated on the net and everybody can read them. Real e-zines or e-journal have no paper equivalent and are not always free. A big problem of electronic documents is they are not permanent and they can be lost from the permanent record, as subject to changes in positions and unpredictable removal. Instead document on paper or electronic format (CD-ROM) are not transient and can be available and legible for many years, in particular the paper one, which do not require special equipment or knowledge to be read. Therefore to preserve for a longer period also the Internet publication, a timely and active intervention at all stages is required. Educational resources on the web are without limits. A general database of educational material is provided by the "Gateway to Educational Materials" project

(<http://www.thegateway.org>), a consortium effort created to provide easy access to the substantial, but uncataloged, collections of educational materials available on various federal, state, university, non-profit, and commercial Internet sites. Another Internet portal full of resources of relevance to faculties, students, and research staff at the university level is Infomine (<http://infomine.ucr.edu>). It is a huge database including electronic journals, electronic books, bulletin boards, listservs, online library card catalogues, articles and directories of researchers and many other types of information. More specific resources in Remote Sensing, just to mention few good links, are provided by NASA (<http://rst.gsfc.nasa.gov>), ASPRS (<http://research.umbc.edu/~tbenja1>), CCRS (http://www.ccrs.nrcan.gc.ca/ccrs/learn/learn_e.html) and CEOS CD-ROM (<http://ceos.cnes.fr:8100/>).

Concerning articles, publications and presentations available on the net, they can be easily found using a powerful search engine or through CiteSeer (<http://citeseer.ist.psu.edu/>), a scientific digital library.

2.11 E-Learning

E-learning is the education via Internet, network or standalone computer. E-learning uses electronic applications and processes to teach and learn as the network enables easily transfer of skills and knowledge between users. E-learning applications and processes include Web-based learning, computer-based learning, virtual classrooms and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV and CD-ROM.

An e-learning web sites collection is provided by the University of Leicester (<http://www.le.ac.uk/cc/rjml/isp/ele.html>).

2.12 Internet growth and its statistics

It is very difficult to determine how many users and how many domains or hosts are on the net, besides making guesses and estimates. There are many companies that do surveys to estimate the number of users, but we can consider the numbers presented in these surveys to be fairly good estimates of the minimum size of the Internet. And often the results are also in disagreement. Moreover the geographical location of an Internet host is somewhat problematic since a host need not to be located in the country which correspond to its ccTLD; and gTLD has never an explicit geographic designation (e.g. ISPRS, with the server in Zurich, the Headquarter in London and the President in Sidney!). For these reasons is not possible to determine the exact size of the Internet, where host are located or how many users there are.

The growth of the available information can be estimated from the number of registered host (e.g., a computer or machine with a unique IP address on a network). According to the Internet Software Consortium [ISC, 2004], the number of registered hosts states 80,000 in January 1988, 1.3 million in January 1993, 16.1 million in January 1997 and 109.7 million in January 2001 (Figure 10). Internet hosts include network elements such as routers, Web servers, mail servers, workstations in universities and businesses, and ports in modem banks of Internet Service Providers (ISPs). The number of hosts is considered one of the most accurate measures of the size of the Internet, even if their distribution is concentrated mainly in the most developed countries (Figure 11).

In 1997, the OCLC Office of Research started a project aimed at answering fundamental questions about the Web, like how big is it? what does it contain? how is it evolving? The project's objective was to develop and implement a methodology for

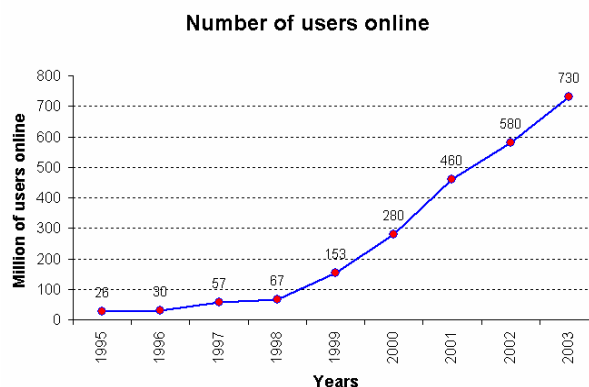


Figure 10: Internet growth represented by the number of Internet hosts. Source: [ISC, NUA].

characterizing the size, structure, and content of the Web, making the results available to both the library community and the public at large. The strategy adopted for characterizing the Web was to harvest a representative sample of web sites, and use this sample as the basis for compute an estimate and make an inference about the Web [O'Neill et al., 1997]. According to OCLC, the web sites can be divided in three categories: (1) public, sites that provide free and unrestricted access to all or at least a significant portion of its content; (2) private, sites whose content is intended for a restricted audience; the restriction can be explicit (e.g., fee payment or authorisation) or implicit (obvious from nature of content); (3) provisional, sites in transitory or unfinished state (e.g., "under construction"), and/or offers content that is, from a general perspective, meaningless or trivial. In the most recent survey (2002) of the OCLC Web Characterization Project [OCLC, 2004], the web contains 9.04 millions of web sites (with 8.7 millions of unique web sites, i.e., the count is adjusted to account for sites duplicated at multiple IP addresses). The growth of unique web site between 1998 and 2002 is ca 231%. OCLC found that 15.5% of the web sites provides information services, 14.2% provides professional, scientific and technical services, 11.8 retail trade and 6.6% provides educational services.

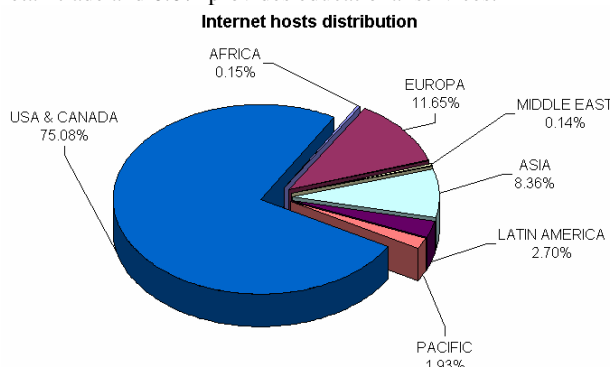


Figure 11: Distribution of Internet hosts. Source [ITU].

Considering the million of users online (Figure 12), the number of people is constantly increasing. In 1995 the Internet population was only 16 million people (app. 0.35% of the world population) while at the middle of 2003 there were more than 730 million people online (11.5% of world population) [NUA]. The number is expected to increase again in the next years and a CIA (Computer Industry Almanac) document reports that in 2007 there will be more than 1400 millions, with 56% of wireless users [CIA].

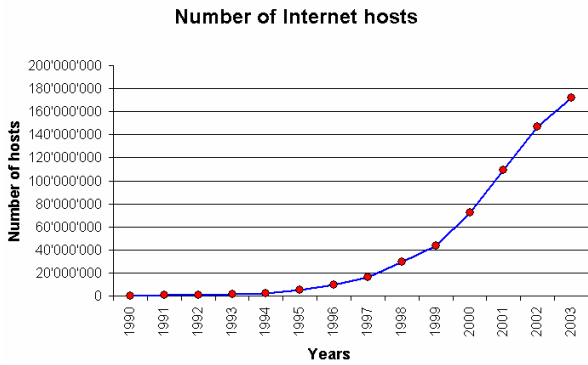


Figure 12: Internet growth represented by the number of users online. Source [ISC, NUA].

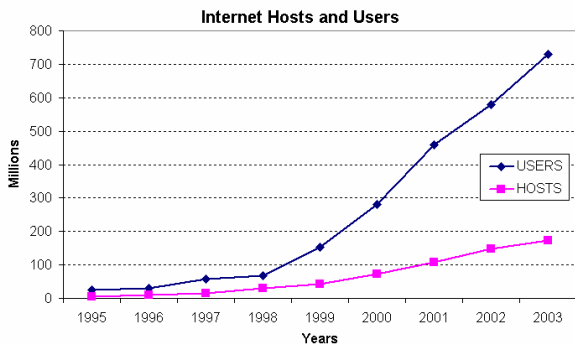


Figure 13: Number of Internet users compared to number of Internet hosts. Source: [ISC, NUA].

Comparing the number of users and host (Figure 13), in 2003 there was an average of 4.2 users per host. With the high quality of service in the United States, there are approximately 1,5 Internet users per host, whereas in some developing there are more than 100 Internet users per host!

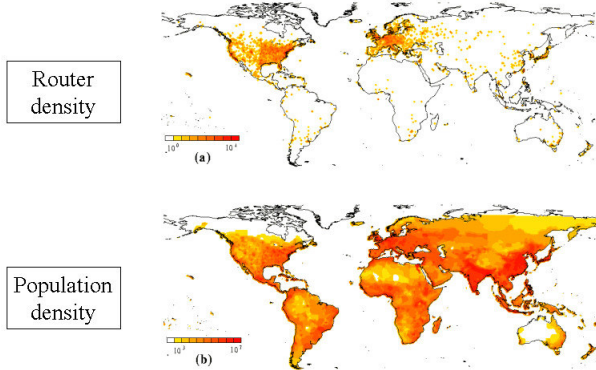


Figure 14: Geographic distribution of Internet routers (device to forward data along networks) against the global distribution of population as in 2001 [Yook, S. et al., 2001].

Despite these number which are just great estimates of the real values, it is widely expected that the Internet population and the number of domains will continue to growth, at least for other few years. But the presence and the access to the Internet is not well distributed in all the country (Figure 14 and Figure 15). As reported by Nua [NUA], the top 10 countries account more than 80% of the world-wide population; moreover, as shown in Table 2, there are country with 0.01% of the country population who has an Internet access while there are European country with more that 60%.

	Max %	Min %
Africa	11.2 % (Seychelles)	0.01% (Liberia, Congo)
Asia	59.5% (Hong Kong)	0.11% (Bangladesh)
Pacific	54.8% (Australia)	2.58% (Vanuatu)
Europe	69.8% (Island)	0.34% (Albania)
Middle East	36.8% (UAE)	0.05% (Iraq)
Canada & USA	59.1% (USA)	39.7% (Bermuda)
Latin America	34.1% (Aruba Island)	0.42% (Haiti)

Table 2: Percentage of users online according to the different parts of the world. Source: [NUA].

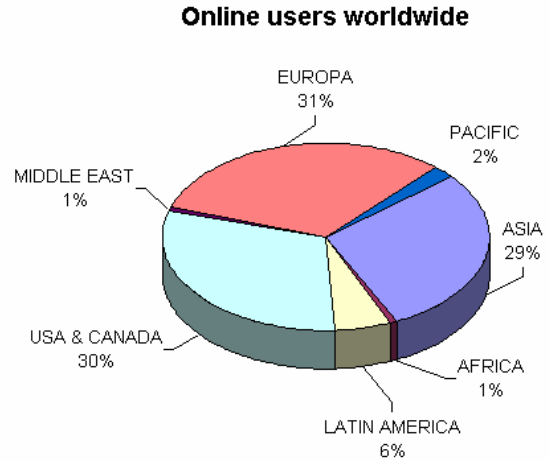


Figure 15: World-wide online population. Source: [NUA].

Considering the demographics of the Internet users, different sources report an average age of the users around 38 years old, with a percentage of female users of 35% and male users of 65%. Furthermore, the Internet usage habits state that 93% of the users use a web browser more than once a day, for personal information (75%), work (65%), education (60%), shopping (50%), while 28% of the users buy online once a month. Moreover, 35.8% of the online population has English as native language, 14.1% Chinese, 9.6 Japanese and 9% Spanish [GR]. Considering the content of the web sites (Figure 16), English language is the most used (72%), followed by German (7%) and Japanese (6%) [OCLC].

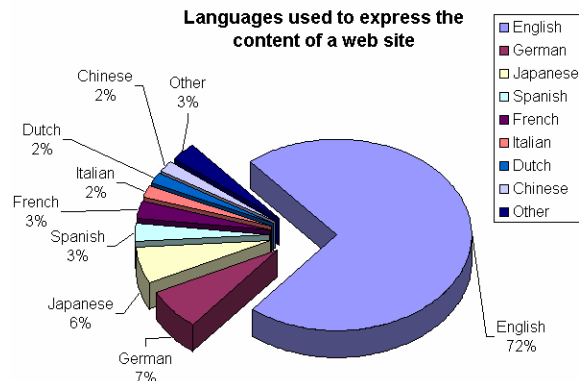


Figure 16: Languages used in the web sites. Source: [OCLC].

2.11 The SPAM messages

“In a single day of May 2003, No. 1 Internet service provider AOL Time Warner (AOL) blocked 2 billion spam messages from hitting its customers' e-mail accounts. Microsoft (MSFT), which operates No. 2 Internet service provider MSN plus e-mail service Hotmail, says it blocks an average of 2.4 billion spams per day” [Buseinness Week Magazine].

SPAM messages or 'bulk e-mails' are becoming one of the most critical problem for anyone who receives e-mails. They are annoying messages containing advertisements and unwanted information that every day fill our mailbox.

The name comes from "SPAM (Shoulder Pork and hAM, SPiced hAM) Luncheon Meat", canned ham produced by Hormel Foods [SPAM, 2004]. For many users, the history of SPAM is very short, but according to some persons, the first SPAM was sent on May 1978, during the Arpanet period, inviting people to a reception. The term got really popular in 1994, when two messages with subject "Global Alert for All: Jesus is Coming Soon" and "Green Card Lottery - Final One?" were posted to every single newsgroup on USENET, the world's largest online conferencing system at that time. There were several thousand such newsgroups, and each one got the advertisement. Soon people called it SPAM and the word started to be used for these kinds of unwanted and multiple posted messages [Templetons, 2004]

Spammers use software to extract names and e-mail addresses automatically from newsgroups or chat rooms; moreover program called *spambots* spider the web looking for the @ sign, that represents an e-mail address. The largest of these companies are able to send billions of spam messages per day. Spam filtering software is available on the market to stop unwanted e-mails. They search keywords like "viagra", "sex", "win", etc., in the text or subject of the e-mails and stop them. Unfortunately these filters can sometimes delete messages that we really want to receive.

The strongest war against spam messages is the elimination of e-mail address: then, if you want to send an e-mail, you have to fill out an online form. Many business companies and the White House of the United States itself, were forced to use this way.

ISPRS ON THE INTERNET

The International Society for Photogrammetry and Remote Sensing is a non-governmental organization devoted to the development of international cooperation for the advancement of photogrammetry and remote sensing and their applications. The Society operates without any discrimination on grounds of race, religion, nationality or political philosophy. It was created in 1910 as International Society for Photogrammetry (ISP), under the leadership of its first President, Eduard Dolezal. After 70 years of functioning under its original name, the Society changed its name in 1980 to the International Society for Photogrammetry and Remote Sensing (ISPRS). Since 1994, ISPRS is online, inserted in the global network to provide information about its activities. In 1996, an ISPRS Working Group (WG VI/4) was established especially for the Internet, and was chaired by Tuan-chih Chen (1996-2000).

3.1 ISPRS Homepage

The ISPRS homepage has turned out to be one of the most important components of ISPRS communications. It provides up-to-date information about the society and links its the various activities.

The first html pages regarding ISPRS were inserted on the Internet by Andre' Streilen in December 1994, on a server hosted at ETH Zurich, under the URL <http://www.geod.ethz.ch/isprs>. In September 1999, with the reservation of the international domain name 'isprs.org', all the information were moved to a meaningful URL and nowadays all different ISPRS activities can have an Internet address ending on the suffix 'isprs.org'. After a short period in T.U. Delf,

in September 2000 the ISPRS server moved back to ETH Zurich where it is actually hosted.

In April 2004, all the information regarding ISPRS are listed in ca 700 HTML pages with approximately 25'000 lines of code; moreover there are ca 1000 PDF files, i.e. a total of ca 2 GB of data available.

3.2 ISPRS Publications

The publications of ISPRS are divided in seven categories: The International Archives of Photogrammetry and Remote Sensing and Spatial Information Sciences, The ISPRS Journal of Photogrammetry and Remote Sensing, the ISPRS Highlights, the Annual Report, the Silver and Blue Book and the ISPRS Brochure.

An updated list of the International Archives is available at <http://www.isprs.org/publications/archives.html>, with links to the online proceedings.

Full articles published in the ISPRS Journal are instead available at Elsevier Science web pages back to 1965 (<http://www.elsevier.nl/locate/isprsjprs>). Online access to full text articles is available to those readers whose library has subscribed to ISPRS Journal via ScienceDirect Digital Collections, or has a current print subscription to ISPRS Journal and has registered for ScienceDirect Web Editions.

3.3 Educational Resources and Job Opportunities through ISPRS web site

The ISPRS educational page tries to collect the wide gamma of educational material and software for Photogrammetry, Remote Sensing and GIS available on the Internet (<http://www.isprs.org/links/tutorial.html>).

It is not a complete list, but some pointers are listed about:

- *Free software*, in particular from CATCON, the Computer Assisted Teaching contest organised by WG VI/2 (<http://www.isprs.org/catcon>). The main objective of the CATCON contest is to promote the development and dissemination of multimedia products, educational information and simulation packages for computer assisted teaching. In general, material submitted by contestants should be non-commercial and provided free of charge for not-for-profit use.
- *Education, training, research and fellowship opportunities in Remote Sensing, GIS and its applications*. (<http://www.ltid.inpe.br/dsr/tania/Rsdir/>). It is an educational Directory that has been developed in the period 1996-2000 as a task of ISPRS TCVI/WG1 on education and as part of the ISPRS Educational Opportunities Program. It is a first attempt to providing a comprehensive directory of education and training services in the remote sensing and spatial information sciences. The Directory was developed from an original document prepared some years ago by the UN Office of Outer Space Affairs in Vienna. In this directory it is possible to get information from all members states that are involved in Space Science. The information contained in this directory for each institution includes its areas of specialisation, the educational and research programmes offered, the facilities available, the prerequisite qualifications, financial information, fellowship opportunities and opportunities for international cooperation. This Directory is necessarily incomplete because of the difficulty in obtaining accurate and timely information about all education institutions around the world in a range of languages. Therefore education

institutions are encouraged to provide their new or updated details of education and training programs in the remote sensing and spatial information sciences.

- *Tutorials* in Photogrammetry, Remote Sensing and GIS
 - *News* about satellite missions and launches
 - *Glossaries and Acronyms* used in Remote Sensing, GIS, Radar and Cartography
 - *Journals* of Photogrammetry, Geodesy and Remote Sensing Working Group VI/1 provides also a big database of education-related links, including training opportunities, online publications and journals, continuing education courses, educational institutions, free software, missions and instruments information (<http://www.commission6.isprs.org/wg1/>).
- The ISPRS web site contains also a list of job opportunities. The *Employment Opportunities archives* is a jobs listing intended to provide offers for people who are seeking an employment (http://www.isprs.org/job_opportunities/). Messages are posted via e-mail and last until when the position is taken. Employers and universities are encouraged to submit advertisement in the ISPRS archive. Educational resources and job opportunities can also be found in the *Academic Sites for Geomatic Engineering*, maintained by Robert Kauper. It is a collection of links to international academic institutions that provide education in the field of Geodesy, Photogrammetry, Surveying, Cartography and GIS (<http://www.lrz-muenchen.de/~t5831aa/WWW/Links.html>).

3.5 ISPRS Events Calendar

The ISPRS Events Calendar (www.isprs.org/calendar.html) is one of the most important parts of ISPRS web pages. The Calendar contains a list of all ISPRS and Sister Societies (FIG, ICA, IAG, IHO, IGU, etc.) sponsored and co-sponsored workshops, symposia, tutorials, conferences, congresses, and other meetings. It also contains details of all international and national events on topics related to the activities of spatial information, photogrammetry, remote sensing, geomatics, surveying, mapping, machine vision, image processing and similar areas. One of the purposes for this Calendar is to allow people of WGs, Commissions and Sister Societies to identify open dates or events, which they may link up with or avoid conflicting with. This Events Calendar was compiled manually by previous editors and contained some incorrect information, or missed some important events. The current Editor (2000-2004) has established an automatic system [Chen, 2002] to search the events information of geo-spatial information, photogrammetry, remote sensing, surveying, geomatics, and GIS on the Internet.

3.6 ISPRS Server statistics

Since the beginning (1995), the ISPRS server statistics are available to analyse the interest of the community. The logfile of the Apache server is examined with Analog [Analog, 2004], a program that analyses servers' files. Figure 17 (upper) shows a monthly report of the number of requests to ISPRS server, in the period January 1995 - April 2004. The increasing interest of the community for the ISPRS homepage is evident. The graph gives a reasonable estimate of the use of the server as only the request for single HTML documents are counted and requests for images, graphics, icons etc. are not taken into account. Moreover these statistics refer only to requests made outside ETH domain, which excludes all the accesses during the maintenance of the documents. The data missing from the figure in the period July-August 2000 is due to the movement of the server from Delft to Zurich.

Figure 17 (lower) shows instead the average request per year. The steady increase of the use of the HTML documents over the years and especially after the registration of ISPRS domain is obvious.

In 1995 the average of monthly requests were 424, in 1998 the average was 5780 while at present ISPRS server has an average of 190 000 requests per month.

The different domain (~country) served at least one by the server were 160 (ca 65% of the registered country code domains); the distinct hosts served (~users) were ca 228 000 with an average of 20Mb of data transferred per day. More than 20 000 different organizations have contacted the ISPRS server with ca 4000 successful requests per day.

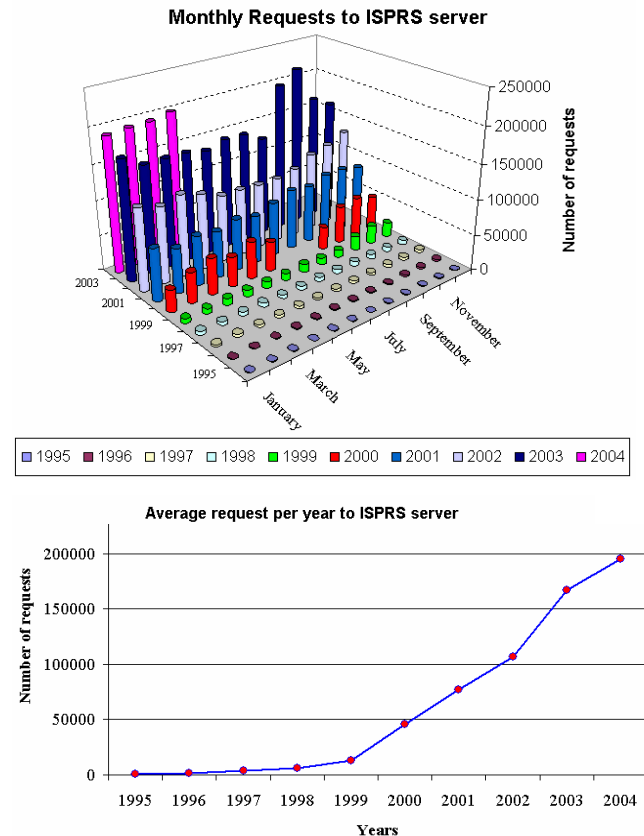


Figure 17: Monthly report (upper) and average requests per year (lower) in the period January 1995-April 2004 on ISPRS server

Another interesting statistic provided by Analog concerns the words and queries used in the search engines to find ISPRS and its related pages: between ca 30 000 search terms, the most used are remote, 'sensing', 'photogrammetry' and 'isprs'. Considering all the queries, the most requested are 'photogrammetry', 'isprs', 'remote sensing', 'International Archive of Photogrammetry and Remote Sensing', 'isprs journal of photogrammetry and remote sensing' and 'orange book'. The browser most used to find information related to ISPRS is Microsoft Internet Explorer followed by Netscape. The majority of the users (67%) has Windows as operating systems; then Unix (Sun + Linux) and Macintosh (Figure 18). The information (directories) more requested contain the publications, the events calendar and the technical commissions while 73% of the consulted files are PDF articles.

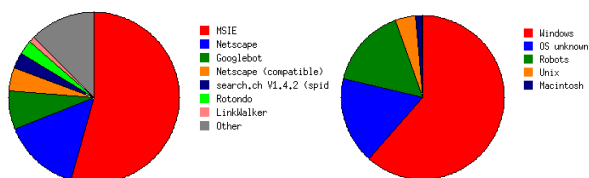


Figure 18: Most used browsers (left) and users operating systems (left) to access the ISPRS web site.

4. INTERNET2 AND NGI

As the Internet grows larger and more crowded, government, scientists, and universities are looking for new ways to send information quickly and powerfully. And for the next generations, many new technologies and developments inside Internet world are ready to be launch. In the future common operation and more interactive applications will be done at home, using an online computer. Two projects have grown out of these needs and are already working: Internet2 [Internet2] and the Next Generation Internet [NGI].

Internet2 is a consortium being led by over 180 universities working in partnership with high-tech companies and government to develop and deploy advanced network applications and technologies, accelerating the creation of tomorrow's Internet. Internet2 is recreating the partnership among academia, industry and government that fostered today's Internet in its infancy. The primary goals of Internet2 are to: (1) create a leading edge network capability for the national research community; (2) enable revolutionary Internet applications; (3) ensure the rapid transfer of new network services and applications to the broader Internet community. Internet2 is not a separate physical network and will not replace the Internet.

The NGI Program is a government project and has been successfully completed and Federal agencies. They are currently coordinating advanced networking research programs under the Large Scale Networking (LSN) Coordinating Group. More than a faster Web or e-mail, both new Internets should develop new and faster technologies to enhance research and communication, and it is expected that both projects will eventually improve the current commercial Internet. Moreover they will enable completely new applications for digital libraries, virtual laboratories, distance-independent learning and tele-immersion.

5. CONCLUSIONS AND OUTLOOK

After 35 years of innovation, data transferring and exchanging, will the Internet with its number of hosts and domain still grow? Which kind of operations or interactive application will we do with an Internet browser? Since 1969, the Internet has grown from a Cold War idea to a superhighway of information. Nowadays we are in the age of the Internet: people communicate, work and plan the holidays over the Internet. Schools use the Internet as a vast electronic library, with untold possibilities. Doctors use the Internet to consult with colleagues half a world away. And even as the Internet offers a single global village and it can create a second class citizenship among those without access. As a new generation grows up as accustomed to communicating through a keyboard as in person, life on the Internet will become an increasingly important part of life on Earth.

There are still part of the world were the use of Internet has yet to grow substantially. These include much of the Asian part of Russia, parts of the Middle East and those part of South East Asia and Africa where it has politically repressed or were the infrastructure are still in development. In this area, satellite connections are really necessary. The absence of Internet from the life of a country is also a lack for the education of the people. Therefore it is expected a growing demand for satellite capacity and links from those parts of the world that may never have full access to international fibre such as most of central Africa. One of the mostly expected explosions is the use of via satellite connection also for residential users, while cable-modem is already common, in particular in US.

Many companies are already using the Internet for Sales, Advertising and Marketing while many web sites are specialized in on-line marketing (e.g. Ebay, Amazon).

It is estimated that the Internet will double in size every year while the WWW will double every 2 months. The World Wide Web and the e-mail service are the greatest success of the Internet. The WWW is an example of a system that started slowly but has grown to huge proportions. For many, it is the user friendly face of the information available on the Internet and has been at least partly responsible for the explosive growth of the Net. The Web, together with the search engines, provides efficient access to an increasing amount of information. But create archives of publications and data is not enough: they must be maintained, updated and managed in a way that users can easily discover and access.

The rapid growth and interest for the WWW introduced many innovations but it has embedded or amplified many problems like security concerns for commercial applications, bandwidth and server saturation, demand for faster access in particular for multimedia data, controlling access to certain types of data, protecting the work of authors (copyright issues), not enough IP addresses to meet the demands. The Internet has opened the access to information to everybody and has changed the way we see the world. But newer and more efficient protocols and ideas are needed to meet the demands for faster access to resources and to solve the problems mentioned before.

A part from any future technological development of the Net, the main source of the Internet remains the people, who use and contribute to make it always bigger. Everyday more people use an online computer to find information, learn, educate and communicate. We have to keep ourselves continuously up-to-date about all new developments and innovations of the Net to really exploit all its capabilities and possibilities.

ISPRS is online since 10 years. Many pages have been created and now there are approximately 2 GB of data available. ISPRS will remain inside the e-world, always improving its appearance. The main board and the web master will continually strive to refine and expand ISPRS online material to provide always more information and services for its users.

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