Ophthalmology on the Information Superhighway: An Introduction to the Internet

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Internet, e-mail, world wide web and the information superhighway have fast become part of the modern human vocabulary. How are we as ophthalmologists affected by this revolution and how can we utilise the enormous potential of this revolution? This article provides an overview of the practicalities and possibilities of this new medium.

Key Words: Internet, e-mail, world wide web

Imagine a world where you could:

- Get opinions from experts and colleagues from all over the world about a clinical problem almost instantly.

- Liase with a co-author half a world away, many times a day.

- Read dozens of journals, as your fancy dictates, without paying a single subscription charge.

- Hold real-time discussions with researchers from Asia, America, Europe or Australia

- Consult a colleague anywhere in the world and transfer information regarding difficult cases, even transmit photos for grand round type discussions.

- Browse through a bookshop's catalogue, then order and pay for your favourite textbook, all from your desk.

- Get a daily summary of a continuing ophthalmic discussion, with opinions from all over the world at your desk, free of cost.

- Communicate with colleagues as often as you like, for the cost of a local phone call.

- Obtain illustrations and references for a presentation at the click of a mouse.

- Receive meeting announcements and register for various meetings and conferences instantaneously.

- Easily obtain information regarding various fellowships, research facilities and opportunities.

Also, imagine a world where:

- Patients are able to communicate with doctors all over the world and seek a second opinion.

- Doctors can have their own home pages and let patients and colleagues have access to their expertise in various fields at the press of a button.

All this is already possible, the technology and facilities are already in place - it is called the Internet. The Internet is a sprawling collection of computer networks that spans the globe, connecting government, military, educational and commercial institutions, as well as private citizens to a wide range of computer services, resources and information linked often by regular phone lines and also by microwave and satellite links.

It all started in 1969 when the US Defence department financed a network for doing civilian research called Arpanet. This led to the move of linking different networks of computers so that libraries of information could stay safe from the fear of a nuclear weapon wiping out all the data stored at a fixed place. This idea gained so much currency that Arpanet could not be sustained by itself and this spawned a much more global network called the Internet.

Once you are connected, this has immense potential. Some doctors see it as the way forward, while others are intimidated by the technology, jargon and customs 'netiquette'. However the advantages of using this are growing exponentially and the costs and learning times are plummeting. The ever increasing benefits arise from

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the rapidly increasing ophthalmological presence on the internet and the mushrooming of ophthalmic sites and resources available. Using the information superhighway it is possible to send and receive in a matter of minutes or seconds clinical images, graphs, charts and other patient data. By conventional mail ('snail mail') this would have taken days or even weeks.[1]

The Internet is already the preferred medium of publication in certain fields (for example, high energy physics) and may soon be so in medicine.[2] The Internet is increasingly serving as an essential tool for much medical research, and is an increasingly important resource for 'Continuing Medical Education', teaching,[3] and clinical practice.[4]

There were an estimated 5 million computers linked to the Internet in early 1995.[5] The links are through different means, satellite links, optical fibres, ISDN (integrated services digital network) and most commonly ordinary phone lines. All of these exchange information using the same set of protocols, TCP/IP (Transmission Control Protocol/ Internet Protocol). Back in 1994 an estimated 13.5 million people were in the 'core Internet' and another 14 million in the periphery, also called 'the matrix', with access available through e-mail. This number is growing exponentially.

How to Connect: The Essentials

To connect to the Internet you need access to a computer to visualise and store the incoming and outgoing data, a modem - the instrument which is used to dial up and connect (usually via your phone line) to your local server - an agency which acts as a middleman for the transfer of information. a computer, On the other end is also a similar assortment of modem and a local server connected via the national/international telephonic lines (Figure). More powerful computers and faster modems are useful to enable quicker transfer of information.

E-mail

E-mail has many advantages over conventional mail. It is fast, easy to use, and cheap. The sender and receiver do not have to be available at the same time as for a phone call. E-mail is useful to keep in touch with your colleagues or to participate in the growing number of discussion groups (Table 1). Mostly one can subscribe to these groups at no additional cost, however access to some is restricted to those with certain specialised training, or special interests. After subscribing to these groups one can seek the opinion of group members on a difficult case or on any relevant topic.
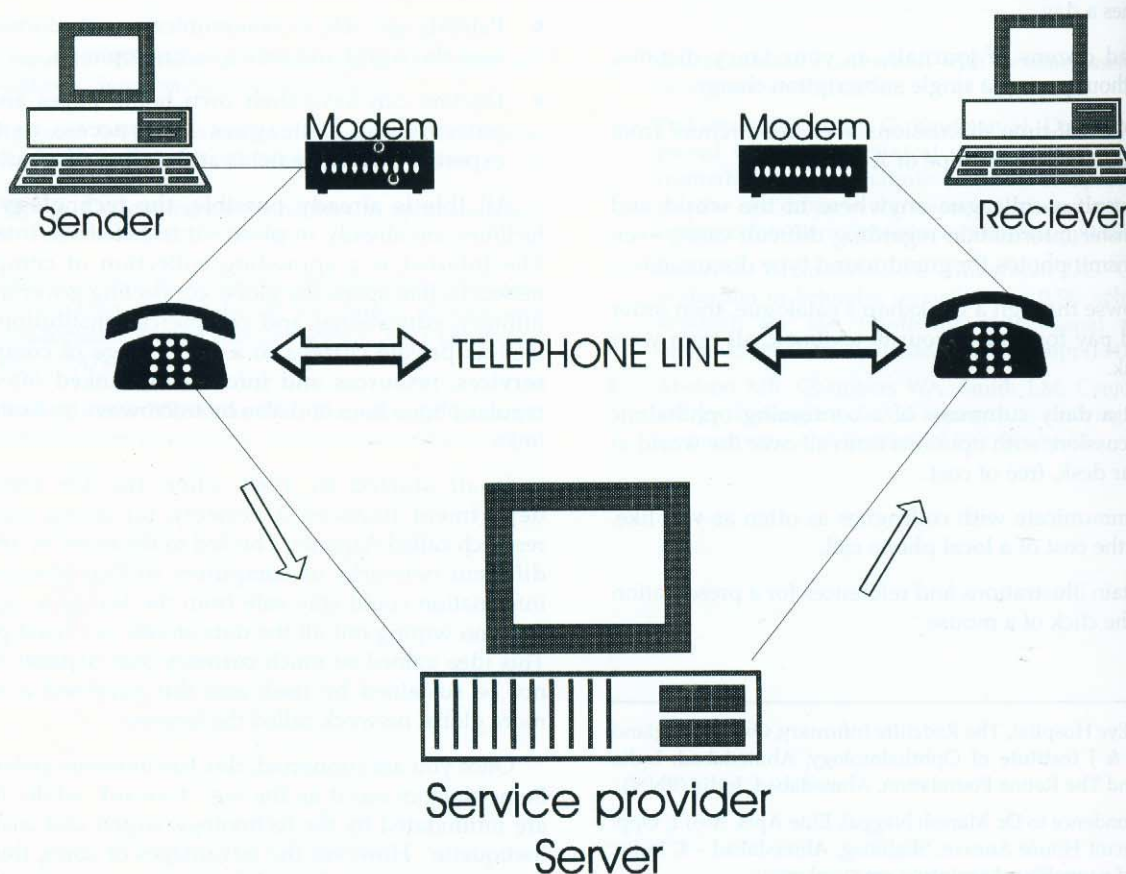

Figure. E-mail network

Table 1. Useful e-mail contacts

OPHTHAL	General Clinical Ophthalmology	ophthal@ubvm.cc.buffalo.edu http://wings.buffalo.edu/medicine/oph/subscrib e.shtml
RETINA NET	Retina List	joinretina@vision.eei.upmc.edu
EYEPLAST	Oculoplastics List	gweinstn@pop.pitt.edu
GLAUCOMA NET	Glaucoma List	weinreb@eyecenter.ucsd.edu
KERA NET	Cornea List	listproc@ucdavis.edu OR mjmannis@ucdavis.edu
OPRS NET	Oculoplastics List	kikkawa@eyecenter.ucsd.edu
PED-OPHTH	Paediatric Ophthalmology List	dgranet@ucsd.edu
CVNet	Color and Vision Researchers Network	evnet@skivs.ski.org
MYOPIA-NET	High Myopia List	jrada@vision.eei.upmc.edu
NANOSNET	North American Neuroophthalmology Society List	pcalvert@gwis2.circ.gwu.edu
OPH-GEN	Ophthalmology Genetics List	oph-gen-request@nic.surfnet.nl
OPTIMAL	Ophthalmic Photography List	jwar@vision.eei.upmc.edu
REFSURG	Refractive Surgery List	feldman@eyecenter.ucsd.edu
	Western New York Ophthalmology Discussion Group	solitsky@ubmede.buffalo.edu
WNYEYE-L		
ESCRS	European Society of Cataract and Refractive Surgeons	escrs@homenet.ie
AAO	American Academy of Ophthalmology	aaoips@ix.netcom.com
Internet Ophthalmological Society*		farmac@vax.cnuce.cnr.it http://www.vol.it/OCULISTICA

*Internet Ophthalmological Society conducted its first congress 15-30 September 1996; short papers were published on various subjects on the World Wide Web. Contact address: Internet Ophthalmological Society, Umberto Benelli, MD, Institute of Ophthalmology, University of PISA, Via Roma, 67 56 126 PISA - ITALY. Phone : +39-50-59-2976

An e-mail message consists of a header and a body.[6] The header provides information about the message, containing some or all of the following lines:

- From: Who the message is from

- Date: The date when it was sent

- To: Showing the email address(es) of the intended recipient(s)

- Subject: Containing a short description of the subject matter of the message. Most email programs automatically preface the subject line of a follow up or forwarded message with "Re:"

- CC: Showing those receiving the message besides the addressee(s)

- Message-ID: the number assigned to the message by the mail program at the host machine

- A series of received lines: Showing details of the systems through which the e-mail has passed (useful for troubleshooting if mail bounces back)

- Reply-to: The preferred address for replies (usually but not always the same as the sender's address).

E-mail is usually less formal than conventional letter and often contain acronyms and features peculiar to the internet such as smileys [:-) is a smile, ;-) is a wink, :-(is a frown - the trick is to look at it side on].[7] E-mail lacks fancy letterheads and logos and as turnaround time is fast it tends to be more spontaneous leaving little time or inclination for formalities. It is helpful to quote some of the original message; this may be done automatically by the e-mail software. Quoted lines are usually prefaced by a ">" or a ":". Prolonged use of capital letters is the on line equivalent of shouting. Key words are best emphasised by surrounding them with asterisks (for example, *on time*) or underscores (for example, _before_).

The Internet and the World Wide Web - WWW

This is the graphic, user friendly face of the Internet, presenting interlacing text and pictures in an attractive way. The web is made up of tens of thousands of 'home pages' maintained by universities, eye departments, publishers, researchers, industrial firms, government agencies and individuals amongst others, the addresses are recorded as uniform resource locators (URLs),

transmitted by hypertext transfer protocol (HTTP) and written in hypertext mark up language (HTML).These are connected to each other by 'links', these appear as underlined highlighted text on your screen (hypertext) clicking on one of these takes you to a different page. You can explore ('browse') the WWW in this way. Another way to access information is to use one of the 'search engines'. Among the better ones are Yahoo {http://www.yahoo.com} and Webcrawler {http://webcrawler.com}. The seeker types in one or more topics, as wide as ophthalmology or more specific such as trabeculectomy. Once the search is initiated, the search engine comes up with a list of related sites each with its own links to many more sources of information on the subject.

In following a series of the web's hypertext links, you trace a path through "information space". A click of your mouse on a web `link' in India might take you to a page in Asia, Africa, the Americas, or Australia. Hypertext encourages you to follow paths through information; metaphorically you explore a web, also termed `netsurfing'.

URLs are the identifying tags of each page. The software used to interpret and display the incoming web pages from servers are called browsers, the two most common ones are Netscape Navigator and Microsoft Internet Explorer. Browsers are available for all platforms and vary in complexity and ease of use. A server on the Web contains many sites, which in turn are composed of pages. Web sites offer text, pictures, graphics, sound and the movies. The web servers use the internet expressways to deliver data through a process called the packet switching. Each file is broken into small packages, tagged with its origin and the destination and sent through routers, the computers which function like mail handlers, sending each package it recieves through various routes. The client browser program on the other end re-constitutes the pieces. You can easily revisit interesting sites on the web by using your history list or bookmark list. The history list is a temporary log of all the sites that you have visited since you opened the program; you can choose to revisit any of the sites listed, or go back to the most recent site with a "go back" command. The bookmark list is similar to this, but it contains only those sites where you have previously placed a bookmark and it is maintained through different sessions till you alter it.

Even if you have only an e-mail connection you can still access the web by using a "WebMail" server to retrieve the text of WWW pages.[8] Send an e-mail to webmail@curia.ucc.ie with the command GO in the body of the message and the URL of the document you wish to retrieve. There is no easy way to use this system to follow links embedded in the web page. You have to repost any URLs found in the retrieved document back to the web server.

FTP stands for "File Transfer Protocol" and is a means of accessing files that are stored on remote computer systems. In internet lingo, these remote computers are called "sites". Files at FTP sites are typically stored in a tree-like set of directories, each of which pertains to a different subject. When visiting an FTP site using a "live" internet connection, one would specify the name of the site, login with a user ID and password, navigate to the desired directory and select one or more files to be transferred back to their local subject.

Using FTP by e-mail is very similar, except that the desired site is reached through a special "ftp mail server" which logs in to the remote site and returns the requested files to you in response to a set of commands in an e-mail message (Table 2).

Table 2. List of FTP mail servers

ftpmail@ccc.uba.ar	Argentina
ftpmail@cs.uow.edu.au	Australia
bitftp@vm.gmd.de	Germany
ftpmail@ftp.uni-stuttgart.de	Germany
ftpmail@ieunet.ie	Ireland
bitftp@plearn.edu.pl	Poland
ftpmail@archie.inesc.pt	Portugal
ftpmail@ftp.luth.se	Sweden
ftpmail@NCTUCCA.edu.tw	Taiwan
ftpmail@sunsite.unc.edu	USA
ftpmail@decwrl.dec.com	USA
ftpmail@ftp.Dartmouth.EDU	USA
ftpmail@census.gov	USA
ftp-request@netcom.com	USA
ftpmail@src.doc.ic.ac.uk	United Kingdom

Let us say you know the name of a file, but you have no idea at which FTP site it might be lurking. Or maybe you're curious to know if files matching a certain naming criteria are available via FTP. "Archie" is the tool you can use to find out these files. Archie servers can be thought of as a database of all the anonymous FTP sites in the world, allowing you to find the site and/or name of a file to be retrieved. And using Archie by e-mail can be convenient because some Archie searches take a long time to complete, leaving you to tap your toes in the meantime. All one needs is a list of Archie servers which can be accessed (Table 3).

Table 3. List of Archie servers

archie@archie.rutgers.edu	USA
archie@archie.sura.net	USA
archie@archie.unl.edu	USA
archie@archie.doc.ic.ac.uk	UK
archie@archie.au	Australia
archie@archie.luth.se	Sweden
archie@archie.kuis.kyoto-u.ac.jp	Japan

"Gopher" is an excellent tool for exploring the Internet and is the best way to find a resource if you know what you want, but not where to find it. Gopher systems are menu based, and provide a user-friendly front end to Internet resources, searches and information retrieval. It knows where things are, thanks to the many volunteers who spend time creating pointers to useful collections of "Net resources". When visiting a Gopher site using a "live internet" connection, one would specify the name of the site, navigate through a series of hierarchical menus to a desired resource, and then either read or transfer the information back to their home system (Table 4).

Table 4. List of Gopher mail servers

gopher@info.lanic.utexas.edu	USA
gophermail@ccc.uba.ar	Argentina
gophermail@cr-df.rnp.br	Brazil
gophermail@eunet.cz	Czech Republic
gopher@ftp.technion.ac.il	Israel
gopher@ncc.go.jp	Japan
gopher@nig.ac.jp	Japan
gopher@nips.ac.jp	Japan

Table 5. Some Ophthalmology journals available on the Internet

Archives of Ophthalmology. {http://www.ama-assn.org/journals/standing/opht/ophthome.htm}

DJO: Digital Journal of Ophthalmology. {http://www.meei.harvard.edu/meei/DJOhome.html}

Investigative Ophthalmology and Visual Science. {gopher://eyesite.optometry.ohio-state.edu:70/1content}

Journal of Refractive Surgery. {http://www.slackinc.com/eye/jrs/jrshome.htm}

Molecular Vision: a peer-reviewed journal of molecular and cellular vision research. {http://www.emory.edu:80/MOLECULAR_VISION/}

Ophthalmology Online, a digital publication of case reports and short papers published by the Department of Ophthalmology and Visual Sciences at Texas Tech University Health Sciences Center. {http://www.eye.ttu.edu/opt_ol.html}

Optometry and Vision Science.{gopher://eyesite.optometry.ohio-state.edu/1content}

Vision {gopher://eyesite.optometry.ohio-state.edu:70/1content}

Ophthalmology World News - clinical newspaper of the American Academy of Ophthalmology.{http://www.lrpub.com/own/own.html}

American Journal of Ophthalmology - Authors of articles in this peer-reviewed journal answer questions and comments on-line about their scientific work. {http://www.ajo.com/}

Eyecare Technology Magazine - journal offering the latest technology for eye professsionals. {http://www.etonline.com/etonline/}

Review of Ophthalmology - A peer-review monthly journal for ophthalmologists. {http://www.chiltonco.com/revophth/}

The web provides an attractive and powerful medium for electronic publishing. Many Ophthalmic journals are now available on the web (Table 5).

Service Providers in India

E-mail services are provided in India by SPRINT which is run by the RPG group and the ACCESS NET which is part of the Business India group of houses. These do not at present have direct internet facilities. They are planning to have internet access within a years time provided the telecommunications ministry permits them.

ERNET is the network which has been formed to connect the entire educational institutions in the country but so far it has been able to link only the elitist institutions, for example, IIT, IIM, and some others. Through this some level of access has been available for the last five years at some of these institutes. NICNET is the ERNET equivalent for linking all the government agencies and institutes. But both of them are not interconnected directly.

Full access to the internet is operated through VSNL (Videsh Sanchar Nigam Ltd.) through GIAS (Gateway Internet Access Service) which operates in the seven metros: Delhi, Calcutta, Madras, Bangalore, Pune, Hyderabad and Bombay. VSNL has its lease lines to America where the Indian network is connected to main internet network. VSNL gives three types of membership for any user:

- Shell account: It is normally used for students and other members who want to access technical information in any branch of knowledge. The information is available only in text mode and no graphics or pictures are available. This account is cheap. One only needs a computer and a modem and the fee is Rs. 500 for students, Rs. 5,000 for professional and Rs. 25,000 for a company. This fee entitles the member to access the internet for 250 hours per year.

- TCP/IP account: TCP/IP is name of the protocol used by internet to connect the computers. It gives similar advantages that of the shell account plus it provides unlimited access to internet. TCP/IP accounts provide full internet access the users may to need to use their own software for internet access and TCP/IP. Common available operating systems on PC's such as IBM-Warp and Windows '95 can be used for these types of access. Access to GIAS is available via dial up lines or via leased lines. It provides access to graphics, games, movies and other multimedia products.

- Website: While both the above accounts make a user a member of internet, a website makes the user a node of internet. The website is extremely important

for a company or person to give 24 hours service and a continuous on line presence to international clients and colleagues. Making a website is an expensive proposal as far as hardware and other costs accounted. As of now there are no set rules for website granting by VSNL.

Appendix. Service provider contacts in India

1. VSNL

In Bombay queries regarding GIAS subscription can be made on +91-22-2624020. Application forms can be obtained from GIAS office, First floor, VSNL building, Fort, Bombay, within working hours.

VSNL Customer Service Centres:

Bombay	: (022) 2624001, 2624020, 2655031
Madras	: (044) 5611994, 566740, 568696
Bangalore	: (080) 5587533, 5587420
New Delh	: (011) 3747337, 3746769
Calcutta	: (033) 2253266, 2253218
Pune	: (0212) 666744, 660562

Help-Desk contact email addresses and telephone numbers:

Bombay	: helpdesk@giasbm01.vsnl.net.in; 2624020, 2622250
New Delhi	: helpdesk@giasdl01.vsnl.net.in; 3747310, 3745315
Calcutta	: helpdesh@giascl01.vsnl.net.in; 3218766, 3216201
Madras	: helpdesk@giasmd01.vsnl.net.in; 566740, 564025

2. ACCESS

Access Net Head Office: Bombay

Unit 3-10 Phoenix Mills Compound
462 Senapati Bapat Road
Bombay - 400 013
Maharashtra
Phone : 8219605, 8219534
Fax : 91 22 4936578
Delhi Office : 91 11 6883226

3. SPRINT RPG INDIA LIMITED

Gulmohar House, 161/b-4 Gautam Nagar
Yusuf Sarai
New Delhi - 110049
Phones : 011 669669, 6863172
Fax : 91 11 6858308, 6867324
Telex : 031 - 61423 KTL IN

Help Desk 24 hours service

Delhi	: 011 - 6862562
Bombay	: 022 - 2841992
Calcutta	: 033 - 3596030
Madras	: 044 - 6423783
Bangalore	: 080 - 2223680
Hyderabad	: 040 - 811876
Ahmedabad	: 079 - 421028
Pune	: 0212 - 328497

Discussion

The information revolution, long predicted, seems to be on us at last. Most of us in the medical professions are ill equipped to participate and unable to foresee its consequence for clinical practice. There are downsides to this technology, patients may join discussion groups on, and seek information by using, the worldwide web.[9] They obtain advice that sometimes seems to be given on the basis of little information or on questionable clinical grounds.[10] The vast amount of information available is often of variable quality, from the most up to date practice guidelines produced by leading clinical bodies to out of date or inaccurate recommendations. Clinicians may be exposed to more frequent legal challenge. While patients may be motivated to seek out the most recent literature for their condition and can invest considerable effort in that search, most practicing doctors cannot.

The earlier we embrace this technology and exploit it, the sooner we will be able to face these challenges. To quote Bill Gates, chief of Microsoft Corporation, "The Internet is like a tidal wave which will wash over the computer industry and many others, drowning those who don't learn to swim in its waves. Developing nations including India and China stand to gain a great deal, because they will be able to draw on the world's talent and knowledge while making the intellectual resources of their own people available to the people around the globe".

It provides a timely information source with global reach and the opportunity to join in the lively discussions in the various news groups. It is true that until now this new medium has been dominated by computer technophiles, but with the simple and effective worldwide web browsers that are currently available it is increasingly easier to join and participate.[11] You can safely ignore the jargon, net etiquette, and acronyms in the beginning. On balance the advantages and possibilities far outweigh the possible problems.

This article was entirely written with the authors liasing over the Internet through e-mail. The first two authors came in contact through the net, and have never met in real life!

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Glossary

Address: Like any postal address, to reach a person via internet/email, there is a unique mixture of letters, numericals and punctuation marks that identify a mailbox on a computer network. For example, take the following address: vinod kumar@sril.sprintrpg.ems.vsnl.net.in. Now let us try to read it. The @ symbol ("at") separates the person's mails box identifier (vinod kumar, to the left) from the name of the organisation (sril, to the right). The word "sprintrpg .ems.vsnl" is the name of the internet service provider and "in" is nothing but India. Note that there are no spaces at all between any letters or characters and a full stop separates at times. This address will reach us from anywhere in the world.

Archie, Jughead, Gopher, Veronica: Archie is a system that helps find files located anywhere on the Internet. Jughead is a program that helps you find information in gopher, a system where you find information using menus. Veronica is a friend of Archie and she helps you find things in the gopherspace.

Bandwidth: It is the capacity of a cable or a phone line, measured in bits per second.

Baud: The rate at which the medium (usually a modem) can transfer groups of data. Multiple bits are transferred in each group, so the rate of data transfer may exceed the actual data rate.

Bits per second: It is the speed at which bits are transmitted over a communication medium.

Browse: The client programs designed to work with Web servers are called browsers.

FTP: It is File Transfer Protocol, or any application moving files using the File Transfer Protocol.

Hacker: A computer expert who enjoys exploring and developing computer system and tinkers for fun.

HTML: It is Hypertext Markup Language, the language in which World Wide Web documents are written.

Hypermedia and Multimedia: A hypermedia has a broader domain and apart from the text it can also contain pictures, sound and video. A multimedia is a combination of these features. You can see an animated film with sound or any other such combination.

Hypertext: Hypertext is a system of documents that contain links to the other documents; selecting a link automatically calls up the other document.

Infobahn: Synonym for information superhighway.

Internet: The global network of computers linked by exclusive and regular phone lines and microwave and satellite signals.

ISDN: Integrated Services Digital Network; a digital telephonic service. If your local phone company supports it, if you can have the appropriate hardware and software, and if your local central office provides ISDN service, it can provide you with high speed home access to the Internet (56 kilobytes per second).

Jawa: The language can run on any computer architecture and operating system and can be downloaded straight from the Internet. On the Internet the programs written on Jawa are called Applets.

Modem: A piece of equipment that connects a computer to a data transmission line. Today's fastest modems transmit data at 28800kps, up from 2400kps just a couple of years ago.

Packet: It is a bundle of data. Packet sizes can vary from roughly 40 to 32,000 bytes, depending on network hardware and media.

Protocol: A protocol is a set of rules governing the formatting of data transmitted between computers and/or terminals. A protocol is actually how computers will talk to each other. Protocol definitions range from how bits are placed on a wire to the format of a electronic mail message. Standard protocols allow computers from different manufacturers with different operating systems to communicate.

TCP/IP: Transmission Control Protocol/Internet Protocol, which allows all computers to speak the language of the Internet and other networks.

World Wide Web (WWW): A big part of the network of networks - the Internet - is called the WWW. It's an interlinked collection of the hypermedia system residing on web servers, that lets you browse through lots of information.