HOW TO USE NETWORK SERVICES

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How to Use Network Services document has been prepared by User Support Group of METU-CC (Middle East Technical University - Computer Center), in order to help users for getting familiar with Network Tools. Please send your comments to metucc@metu.edu.tr.

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PREFACE

The purpose of preparation of this booklet is to inform the users of METU Computer Center about campus network services and further what is currently available on the whole Internet.

This booklet is mainly based on TCP/IP (Transmission Control Protocol/Internet Protocol) on Unix, Microsoft DOS and Windows and it offers enough information for users to learn the specifics of what their local system offers.

TCP/IP is today’s widely used networking protocol. It can be easily run on any type of machine and operating system without making a big investment. So, we discussed much about TCP/IP in this booklet.

Welcome to Internet!

Computer Center
Middle East Technical University
July, 2000

NOTE:  The fonts used in this booklet can be classified as follows:

commands to be entered to the system : Courier
answers of the system : Arial
emphasized words : bold
variables : <italic>
whole document : Times New Roman
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1 ABOUT THE INTERNET

1.1 History of the Internet

The origin of the Internet is rooted in the ARPANET (Advanced Research Project, Agency NETwork), which was established to aid in the sharing of information and resources among researchers. The ARPANET, which was made operational in 1969, became an essential tool for remote login, file transfer, electronic mail and the sharing of information by interest groups. The Internet first became operational in 1983, when the ARPANET was split into two separate networks, MILNET and ARPANET, which together formed the Internet. Each was given a network number and gateways were installed to provide packet forwarding between them. Since its creation in 1983, the Internet has grown exponentially in terms of numbers of networks connected to it. The Internet started with ARPANET, but now includes networks such as NSFNET, NEARNet and others. Many other networks such as BITNET, UUCP and FidoNet are tied to the Internet but are not an integral part of it.

1.2 What is the Internet?

The Internet is a worldwide network of computer networks. It is comprised of thousands of separately administered networks of many sizes and types. Each of these networks is comprised of as many as tens of thousands of computers; the total number of individual users of the Internet is in the millions.

Users of any of the Internet networks can reach users on any of the other networks. This high level of connectivity fosters an unparalleled degree of communication, collaboration, resource sharing and information access. METU is a part of the Internet since April 12, 1993.

2 NETWORK BASICS

2.3 TCP/IP

For an Internet to exist, there must be connections between computers, and furthermore, agreements on how they are to communicate. For disparate computers (from personal computers to mainframes) to communicate with other computers over a network, there must be agreements on how that should occur. These agreements are called communication protocols. At present, the Transmission Control Protocol/Internet Protocol (TCP/IP) suite of protocols defines how Internet computers are to communicate. These protocols define how certain applications are to be accomplished: electronic messaging, on-line connections and transfer of files.

2.3.1 TCP (Transmission Control Protocol)

TCP (Transmission Control Protocol) is a method (protocol) used along with the Internet Protocol (IP) to send data in the form of message units between computers over the Internet. While IP takes care of handling the actual delivery of the data, TCP takes care of keeping track
of the individual units of data (called packets) that a message is divided into for efficient routing through the Internet.

For example, when an HTML file is sent to you from a Web server, the Transmission Control Protocol (TCP) program layer in that server divides the file into one or more packets, numbers the packets, and then forwards them individually to the IP program layer. Although each packet has the same destination IP address, it may get routed differently through the network. At the other end (the client program in your computer), TCP reassembles the individual packets and waits until they have arrived to forward them to you as a single file.

TCP is known as a connection-oriented protocol, which means that a connection is established and maintained until such time as the message or messages to be exchanged by the application programs at each end have been exchanged. TCP is responsible for ensuring that a message is divided into the packets that IP manages and for reassembling the packets back into the complete message at the other end. In the Open Systems Interconnection (OSI) communication model, TCP is in layer 4, the Transport Layer.

2.3.2 IP (Internet Protocol)

The Internet Protocol (IP) is the method or protocol by which data is sent from one computer to another on the Internet. Each computer (known as a host) on the Internet has at least one address that uniquely identifies it from all other computers on the Internet. When you send or receive data (for example, an e-mail note or a Web page), the message gets divided into little chunks called packets. Each of these packets contains both the sender's Internet address and the receiver's address. Any packet is sent first to a gateway computer that understands a small part of the Internet. The gateway computer reads the destination address and forwards the packet to an adjacent gateway that in turn reads the destination address and so forth across the Internet until one gateway recognizes the packet as belonging to a computer within its immediate neighborhood or domain. That gateway then forwards the packet directly to the computer whose address is specified.

Because a message is divided into a number of packets, each packet can, if necessary, be sent by a different route across the Internet. Packets can arrive in a different order than the order they were sent in. The Internet Protocol just delivers them. It's up to another protocol, the Transmission Control Protocol (TCP) to put them back in the right order.

IP is a connectionless protocol, which means that there is no established connection between the end points that are communicating. Each packet that travels through the Internet is treated as an independent unit of data without any relation to any other unit of data. (The reason the packets do get put in the right order is because of TCP, the connection-oriented protocol that keeps track of the packet sequence in a message.) In the Open Systems Interconnection (OSI) communication model, IP is in layer 3, the Networking Layer.

The most widely used version of IP today is Internet Protocol Version 4 (IPv4). However, IP Version 6 (IPv6) is also beginning to be supported. IPv6 provides for much longer addresses and therefore for the possibility of many more Internet users. IPv6 includes the capabilities of IPv4 and any server that can support IPv6 packets can also support IPv4 packets.
2.3.2.i Ipv4 (Internet Protocol Version 4)

Each host using Ipv4 on the Internet is assigned a unique 32-bit address, normally written as 4 bytes (in decimal) separated by dots (e.g. 144.122.99.11), called its **Internet number** or **IP Address**. A host can be a PC, a workstation or a mainframe. Distribution of these addresses is centrally controlled by the Internet Network Information Center (NIC) in United States and RIPE Network Coordination Center (RIPE-NCC) in Europe. Conceptually, each address is a pair (net-id, host-id), where net-id identifies a network and host-id identifies a host on that network. There are majorly 3 classes of addresses: A, B and C.

**Class A**
In these classes, the first octet of the address is used for net-id and can have the value of 1 to 126. Thus remaining 24 bits are available for hosts. These numbers are usually assigned to very large networks, and can accommodate more than 65536 hosts in each network.

**Class B**
These are intermediate size networks, where net-ids are represented by the 14 bits of the first two octets. Thus net-ids are 128.1 through 191.254. The last two octets are available for host addresses (host-id), giving 16 bits of host address. This class allows for 64516 hosts. METU was assigned a B-class address (144.122.0.0) by the Internet Network Information Center (NIC).

**Class C**
These addresses allocate 21 bits of the first three octets for net-id in the range 192.1.1 to 223.254.254. These allow only 254 hosts on each network, but there can be lots of these networks. Addresses above 223 are reserved for other uses.

<table>
<thead>
<tr>
<th>CLASS</th>
<th>Address or Range</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A</strong></td>
<td>0.0.0.0</td>
<td>Reserved</td>
</tr>
<tr>
<td></td>
<td>1.0.0.0 through 126.0.0.0</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>127.0.0.0</td>
<td>Reserved</td>
</tr>
<tr>
<td><strong>B</strong></td>
<td>128.0.0.0</td>
<td>Reserved</td>
</tr>
<tr>
<td></td>
<td>128.1.0.0 through 191.254.0.0</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>191.255.0.0</td>
<td>Reserved</td>
</tr>
<tr>
<td><strong>C</strong></td>
<td>192.0.0.0</td>
<td>Reserved</td>
</tr>
<tr>
<td></td>
<td>192.0.1.0 through 223.255.254</td>
<td>Available</td>
</tr>
<tr>
<td></td>
<td>223.255.255.0</td>
<td>Reserved</td>
</tr>
</tbody>
</table>

2.3.2.ii IPv6 (Internet Protocol Version 6)

IPv6 (Internet Protocol Version 6) is the latest level of the Internet Protocol (IP) and is now included as part of IP support in many products including the major computer operating systems. IPv6 has also been called "IPng" (IP Next Generation). Formally, IPv6 is a set of specifications from the Internet Engineering Task Force (IETF). IPv6 was designed as an evolutionary set of improvements to the current IP Version 4. Network hosts and intermediate nodes with either IPv4 or IPv6 can handle packets formatted for either level of the Internet Protocol. Users and service providers can update to IPv6 independently without having to coordinate with each other.
The most obvious improvement in IPv6 over the IPv4 is that IP addresses are lengthened from 32 bits to 128 bits. This extension anticipates considerable future growth of the Internet and provides relief for what was perceived as an impending shortage of network addresses.

IPv6 describes rules for three types of addressing: unicast (one host to one other host), anycast (one host to the nearest of multiple hosts), and multicast (one host to multiple hosts). Additional advantages of IPv6 are:

- Options are specified in an extension to the header that is examined only at the destination, thus speeding up overall network performance.
- The introduction of an "anycast" address provides the possibility of sending a message to the nearest of several possible gateway hosts with the idea that any one of them can manage the forwarding of the packet to others. Anycast messages can be used to update routing tables along the line.
- Packets can be identified as belonging to a particular "flow" so that packets that are part of a multimedia presentation that needs to arrive in "real time" can be provided a higher quality-of-service relative to other customers.
- The IPv6 header now includes extensions that allow a packet to specify a mechanism for authenticating its origin, for ensuring data integrity, and for ensuring privacy.

2.4 DNS (Domain Name System)

While using the facilities of the network, Internet addresses in dotted decimal form are quite impractical to be used by a network user. More meaningful names should be used for higher level entities (i.e. machines, file servers etc.). There are a few different approaches for assigning symbolic names to machines. In the Internet, hierarchical machine names are assigned according to the structure of organizations that obtain authority for parts of the name space, not according to the structure of the physical network interconnections.

Internet uses a hierarchical naming scheme known as domain names. A domain name consists of a sequence of sub-names separated by the delimiter character ‘.’ (period). The domain naming system simply calls each sub-name as a label. Thus, the domain name ‘cc.metu.edu.tr’ contains four labels: tr, edu, metu and cc. Any suffix of labels in a domain name is called a domain. Domain tells you the name of a system or location, and what kind of organization it is.

Top level country domain label is assigned by ISO (International Standards Organization) to countries. For example, ‘.tr’ for Turkey, ‘.jp’ for Japan and so on. Second level labels may be classified as:

- **com** a company or commercial institution, e.g. INFO A.Ş., ‘info.com.tr’
- **edu** an educational institution, e.g. Middle East Technical University, ‘metu.edu.tr’
- **gov** a government site, e.g. TUBITAK, ‘tubitak.gov.tr’
- **mil** a military site, e.g. Genel Kurmay Baskanligi, ‘genkur.mil.tr’
- **net** Network Organizations, e.g. TR-NET, ‘tr-net.net.tr’
- **int** International Organizations, e.g. WHO, UN, ‘who.int’
- **bbs** an institution that offers BBS service, e.g. BBS-TURK, ‘bbsturk.bbs.tr’
- **gen** a personal/institutional site which is assigned using the “fist come first served” principle, e.g. INET-TR, ‘inet-tr.gen.tr’
In the above example, the lowest level domain is ‘cc.metu.edu.tr’ (Computer Center), next to the lowest level is ‘metu.edu.tr’ (METU), the second level domain is ‘edu.tr’ (Education and Research Network), and the top level domain is ‘tr’ (Turkey). The Internet scheme for mapping names to IP addresses consists of independent cooperative systems, called name servers. A name server is a server program that supplies name-to-address translation, mapping from domain names to Internet addresses.

The Domain Name System (DNS) is a hierarchical, distributed method of organizing the global name space of the Internet. The DNS administratively groups hosts into a hierarchy of authority that allows addressing and other information to be widely distributed and maintained. A big advantage to the DNS is that, using it eliminates dependence on a centrally maintained file that maps hostnames to addresses.

2.5 FQDN (Fully Qualified Domain Name)

A Fully Qualified Domain Name (FQDN) is a domain name that includes all higher level domains relevant to the entity named. If you think of the DNS as a tree-structure with each node having its own label, an FQDN for a specific node would be its label followed by the labels of all the other nodes between it and the root of the tree. For a host, an FQDN would include the string that identifies the particular host, plus all domains of which the host is a part up to and including the top-level domain (the root domain is always null). For example, ‘orca.cc.metu.edu.tr’ is a Fully Qualified Domain Name for the host at ‘144.122.199.20’. In addition, ‘cc.metu.edu.tr’ is the FQDN for the METU-Computer Center domain.
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CHAPTER 2

BASIC TCP/IP SERVICES
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There are three basic services that run on top of TCP/IP protocols. These are:

1. Simple Mail Transfer Protocol (SMTP)
2. File Transfer Protocol (FTP)
3. Telnet Virtual Terminal Protocol (TELNET)

Below is a brief figure, showing the TCP/IP Communication Architecture. The network information retrieval tools such as WWW (World Wide Web), rlogin (remote login) appearing in the figure will be explained in the following chapters.

Before going any further keep one point in mind. If you will use these TCP/IP services from a PC, which is connected to the Internet by a modem, you have to install the software(s) necessary to run TCP/IP applications on your computer. These software(s) are explained in detail for Windows 3.x in Appendix A and for Windows 9x in Appendix B.

3 TELNET: REMOTE LOGIN TO INTERNET RESOURCES

3.1 What is Telnet?

The telnet program runs on top of TCP and IP protocols. It allows you to remotely login to another host computer, which supports the same protocol. It gives the user the opportunity to be on one computer system and do work on another, which may be across the street or thousands of miles away. If you have an account on another system that you want to get into, all you have to do is to use telnet to get the login prompt. You may then type in your username (login on Unix systems) and password to use the remote system.

3.2 Establishing a Telnet Connection

Connecting to a remote system needs knowing its ‘domain name’ or ‘internet address’. The format of the telnet command is:

```
telnet <FQDN>  or  telnet <Ipnumber>
```

If telnet is invoked without the hostname or Ipnumber, it enters command mode, indicated by its prompt (note that this prompt differs from system to system). At this time, you have to enter the command:

```
open <FQDN>  or  open <Ipnumber>
```
from this prompt.

After specifying the hostname or Ipnumber that you want to connect to, either with telnet command or in command mode, you have to enter your username (login on Unix systems) and password. Once you are logged in, you simply use the remote system as if you were working on a direct terminal.

If the connection to the remote host is not established within a predetermined time limit, ‘telnet’ will respond with the message:

Foreign host did not respond within OPEN timeout.

If the remote host is not prepared to handle the connection, ‘telnet’ will respond with the message:

Foreign host rejected the open attempt.

If you get the following message;

Unknown host

please check your spelling of the hostname.

When you are connected to a remote host via ‘telnet’, you use the commands and facilities supplied by the remote host.

4 FTP: FILE TRANSFER PROTOCOL

4.1 What is FTP?

Thousands of systems connected to Internet have file libraries, or archives, accessible to the public. Many of these consist of free shareware programs, files and so on. The way to get these files is through File Transfer Protocol (FTP). With FTP, a user from any Internet system can get into another system, as ‘telnet’ does. However, FTP is quite different from telnet. While telnet allows the user to use the computer system as if they were sitting at a direct terminal, FTP allows the user to transfer files between his own computer system and the remote one, the one that he is connected to.

4.2 What is Anonymous FTP?

Many systems throughout the Internet offer files through Anonymous FTP. This means that you can access a machine without having to have an account on that machine. These anonymous FTP servers contain software, documents of various sorts, and files. Anonymous FTP permits you to log in with the user name anonymous. When prompted for a password, type your complete e-mail address (this is a courtesy for those sites that like to know who is making use of their facility). You may then look around and retrieve files.
4.3 Finding Network Resources and ‘Archie’

FTP sites are commonly known as resources, and that is exactly what they are. They are the major resources for all of the programs and information that you need. Your first step in using the FTP system is to find a resource that you want to tap into. Finding these resources can be easily done by a tool known as Archie.

Archie is an electronic database of all of the files contained within almost every anonymous FTP site on the world wide Internet. What Archie does is to accept your search parameters, then search all of the files and directories that it has available and return to you any matches. When Archie sends you back the reply, it lists all the sites at which the files and/or directories are located. It tells you this site in two manners: domain name and Internet address. Now you have to actually connect to the resource by using FTP.

4.4 Basic Commands of FTP

When you connect to a computer system, after typing FTP command in proper syntax, you can get the list of available commands by typing help or ? (a question mark). Some useful commands available on most systems include:

<table>
<thead>
<tr>
<th>COMMAND</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>cd &lt;directory-name&gt;</td>
<td>change the directory</td>
</tr>
<tr>
<td>cd ..</td>
<td>move one directory back</td>
</tr>
<tr>
<td>dir / ls</td>
<td>list the files in the current directory</td>
</tr>
<tr>
<td>get &lt;filename&gt;</td>
<td>copy a file from the remote computer to yours</td>
</tr>
<tr>
<td>pwd</td>
<td>shows the present working directory</td>
</tr>
<tr>
<td>mget &lt;filename&gt;</td>
<td>copy multiple files from the remote computer to yours</td>
</tr>
<tr>
<td>put &lt;filename&gt;</td>
<td>copy a file from your computer to remote one</td>
</tr>
<tr>
<td>mput &lt;filename&gt;</td>
<td>copy multiple files from your computer to remote one</td>
</tr>
<tr>
<td>ascii</td>
<td>switch to ascii mode (ascii mode is the default mode and used for transferring text files)</td>
</tr>
<tr>
<td>binary</td>
<td>switch to binary mode (for transferring binary files which has extensions like .exe, .ZIP, .Z etc.)</td>
</tr>
<tr>
<td>quit</td>
<td>close connection</td>
</tr>
</tbody>
</table>

4.5 File Naming Conventions

Files are often stored in compressed form. By that way they take up less space. There are a wide variety of compression methods in use. You are able to recognize the compression method by looking at the last one to three letters of the filename. These letters are called extension of the file.

According to the extension of the file, you may decide how to decompress it. Here, some of the compressed file extensions are explained with the necessary environments, software and command formats to open the files:
### 4.6 Establishing an FTP Connection

There are two ways to connect to a system, using its ‘domain name’ or its ‘internet address’. You must first know the domain name or Internet address of the system you want to connect to. The format of the FTP command is:

```
ftp <hostname>    or    ftp <Ipnumber>
```

Here in this example, ‘ftp.metu.edu.tr’ will be used. On your system, type:

```
ftp ftp.metu.edu.tr
```

If you have a userid on the system you connect, type your userid and password respectively. But, if you are doing anonymous FTP, that is, if you have no userid at that system, type:

```
anonymous         or       ftp
```

as userid, and send your complete e-mail address as password, e.g.

```
c042078@rorqual.cc.metu.edu.tr
```

During FTP, you will get some information messages after each command. To ignore these information messages, put ‘-’ (minus sign), at the beginning of your complete e-mail address, e.g.

```
-c042078@rorqual.cc.metu.edu.tr
```

After you established the connection, you can try any of the FTP commands. To see the directory you logged into, enter:
pwd

To get the list of that directory, enter;

dir

You will get some data like:

200 PORT command successful.
150 Opening ASCII mode data connection for /bin/ls.
drwx-rw-rw- 10 2098 100 2274 Feb 18 1993 pub
drwx-rw-rw- 1 512 100 1245 Jan 11 1994 archie
226 Transfer Completed.
ftp>

After each successful command, you will receive the ‘ftp’ prompt. To change the directory, for example to ‘pub’, enter;

cd pub

You will get some data like:

200 PORT command successful.
150 Opening ASCII mode data connection for /bin/ls.
-rwx-rw-rw- 1 1023 100 3974 May 7 1993 README
-rwx-rw-rw- 1 1024 100 1245 Dec 22 1992 intro.txt
226 Transfer Completed.
ftp>

To retrieve a file named ‘intro.txt’, enter;

going intro.txt

After this command, wait for a while. When the file transfer is completed, you will get the message:

226 Transfer Completed.
ftp>

Now, to close the connection, you have to enter the command:

quit

After closing the connection, you will return to your local system prompt.

If you get a,

host unavailable
message, this means the FTP site is down for some reason. Try again later.

If you get a,

```
host unknown
```

message, check your spelling of the hostname.

## 5 ELECTRONIC MAIL

**Electronic mail** or **e-mail** is your personal connection to the world of networking. Everyone around the world who uses the network has his/her own e-mail address.

### 5.1 E-mail Addresses

Whenever you send mail to someone, the format of the e-mail address is in the form of:

```
username@hostname
```

You send e-mail to people by using their e-mail addresses. An address is either a **Fully Qualified Domain Name** (FQDN) of a host or an FQDN of a domain. In turn, they write to you through your e-mail address. With this address, you can also subscribe to mailing lists. Your e-mail address provides all of the information required to get a message from anywhere in the world. An address does not necessarily have to identify a human being. It could be an FTP or archie server or a list of people.

### 5.2 Sending and Receiving E-mail

All topics included in this section are based on Unix. The quickest way to start learning e-mail is send a message to yourself. Most public-access sites actually have several different types of mail systems, all of which let you both send and receive mail. We will start with the simplest one, known as ‘mail’ and then look at another interface. At your host system’s command prompt, type;

```
mail username@hostname
```

and then press ENTER. In some systems you will be responded with **Subject**: and in some systems not. If the system does not respond with asking subject, start typing your actual message. But if the system responds with;

```
Subject:
```

type the subject of your mail (but you’ll have to press ENTER before you get to the end of the screen) and press ENTER. The cursor will drop down a line. You can now begin writing the actual message. Type a sentence, anything at all. You have to press ENTER before you get to the very end of the line. Just like typewriters, many Unix programs do not have the word-wrapping feature.
When done with your message, press ENTER. Now press Ctrl+D (the control and the D keys at the same time). This is a Unix command that tells the computer you have finished writing and that it should close your ‘envelope’ and mail it off (you could also press ENTER once and then, on a blank line, type a ‘period’ at the beginning of the line and press ENTER again).

Normally, when you log on, your public-access site will tell you whether you have new mail waiting. To open your mailbox and see your waiting mail(s), type;

```
mail
```

and press ENTER. To get available commands of this software, type ? (a question mark) at the prompt.

One way to send and receive mail is to use `mailx` command instead of `mail` (if installed on your system). This is a little more powerful tool than `mail`. Formats of sending and receiving mail is the same as `mail` command as we explained above. But `mailx` command has some new features such as replying mail. You can type ? (a question mark), to get a list of the available commands, after typing the `mailx` command.

Although the `mail` and `mailx` programs are actually very powerful and a Netwide Standard, at least on Unix computers, fortunately, there are a couple of other mail programs that are easier to use. Below, one of them named `pine` is explained.

**PINE**

Use `Pine` program to read your incoming e-mails and send e-mails to other people. After login to a Unix host, enter the command;

```
pine
```

to run the program. After issuing this command, the screen shown below will appear.

```
PINE 4.21 MAIN MENU  Folder: INBOX  2 Messages

?  HELP            - Get help using Pine
C  COMPOSE MESSAGE - Compose and send a message
I  MESSAGE INDEX   - View messages in current folder
L  FOLDER LIST     - Select a folder to view
A  ADDRESS BOOK    - Update address book
S  SETUP           - Configure Pine Options
Q  QUIT            - Leave the Pine program

```

Here, one can select among the choices by highlighting the row and then pressing ENTER or pressing the key that is shown as a character on the left of the row.
In this menu; you can take help about Pine by pressing ?, send a message by pressing C, read the incoming mails by pressing I, select among the folders by pressing L, record the e-mail addresses of people by pressing A, configure your Pine program by pressing S and quit from Pine program by pressing Q character, from your keyboard.

At the bottom of the screen, there are some useful information about the commands that you can use. You can go to some additional commands by pressing O, change between the commands shown in this menu by pressing P or N respectively for previous and next, get release notes for the Pine system by pressing R and finally lock your keyboard by pressing K and then setting a password.

Now, assume that you want to take help about the Pine program. Press ? on your keyboard or press ↑ (up arrow) or ↓ (down arrow) keys to highlight that choice and press ENTER. You will take the information, which is shown below.

Again, at the bottom of the screen there are some additional information. One can return to main menu by pressing M, exit from reading help by pressing E, go backward and forward between pages by pressing - and space key, print the current page by pressing Y and print the whole document by pressing Z. For example; press M and return to main menu. Then, select the choice Compose Message by pressing C in order to send a message. You will see the screen shown below.
In this screen, **To** field is the e-mail address of the person which you want to send the e-mail to. If you want to send the copy of this mail to someone else, write the e-mail address of that person to **CC** field. After writing the subject of the mail to ‘Subject’ field, place your cursor at space area, under the **Message Text** row by pressing ENTER key or down arrow key. Now, you can start to write your mail.

Again, there exist some useful information at the bottom of this screen. Let us look at some of them.

- If you want to give up writing this mail, press ‘^C’ (Ctrl+C) and then confirm with ‘y’ to cancel it.

- If you want to insert a file (e.g. text file) in your body message which is written before, press ‘^R’ (Ctrl+R) and then write the directory and name of that file. If you do not remember the file name or where the file is placed, you can see your files by pressing ‘^T’ (Ctrl+T).

- If you have no time to continue your mail and want to complete it at another time, you can postpone the mail by pressing ‘^O’ (Ctrl+O). And when you want to complete the postponed message, select ‘Compose Message’ by pressing ‘C’ from Main Menu then confirm with ‘y’.

- When you finish writing your e-mail and are ready to send it, press ‘^X’ (Ctrl+X) to send it and confirm with ‘y’.

- If you want to send a file (e.g. word document) with your e-mail, you can attach this file to your mail. To do this, press ^J (Ctrl+J) and write the name of the file. Or you can see your files by pressing ^T (Ctrl+T) and then select the file you want from there.

Now, let us assume that you want to read the e-mails, which are sent to you. From the Main Menu, choose **Folder Index** by pressing I.
All e-mails, which are sent to you, are placed in your ‘INBOX’ folder, unless stated otherwise. And the Folder Index option, placed in Main Menu enters your INBOX to list your incoming e-mails. Then you can read your incoming mails by highlighting them and then pressing ENTER or V key to view the contents.

While reading an e-mail, you may want to write the answer of the e-mail by keeping the contents of it. To do this, choose the Reply option by pressing R while reading the e-mail. Another thing you may want to do is to Forward the e-mail. If you want to send the e-mail you read to someone else, press F and write the e-mail address of that person.

When you select the Folder List option from the Main Menu by pressing L, you will see a screen like below.

```
PINE 4.21 FOLDER LIST
Folder: INBOX 2 Messages

INBOX  sent-mail  Saved-messages

? Help  < Main Menu  P PrevFldr  r  PrevPage  D Dele
O Other Cmds  > [View Fldr]  N NextFldr  r  NextPage  A Dele
                    t  R Rename
                    e
```

As we said before the incoming mails are stored in the ‘INBOX’ folder. And the mails you sent are placed in the 'sent-mail' folder. If you save any e-mail while reading, it is saved into the 'saved-messages' folder and marked as deleted. So, in this menu you can go with right and left arrow keys on your keyboard (‘→’, ‘←’), highlight the folder you want, and see the contents of it by pressing ENTER.

By the help of the Address Book option in the Main Menu, you can record e-mail addresses. Here, to record a data you have to fill in a nickname field (which must be as short as possible), a full-name field, and an e-mail address field. After filling these fields in a correct way, you can compose a message and write the ‘nickname’ you supplied instead of the e-mail address, at ‘To’ field. The Address Book also lets you set up a mailing list. This feature allows you to send the same message to a number of people at once.

You can also configure your pine program, by selecting the Setup from the Main Menu. For example; you can setup printer and new password, configure the files which pine uses and soon.

Always refer to the help keys, which are placed at the bottom of the screen. This will be very helpful for you. When you finish your work with pine program, press ‘Q’ to quit from pine and then confirm with ‘y’. You will return to Unix prompt and go on your work.

Sometimes, after you send an e-mail, you can get back a message from MAILER-DAEMON containing up to several dozen lines followed by your message. Somewhere in those lines you can often find a clue about what went wrong. You might have made a mistake in spelling the e-
mail address. The site to which you are sending e-mail might have been down for maintenance or a problem. You may have used the wrong ‘translation’ for mail to a non-Internet network.

5.3 Discussion Lists

Discussion Lists represent a way to interact with other Internet users. Lists are organized according to certain subjects. You can communicate and discuss with other people about these subjects. But first of all you have to be a member of the list.

You can learn the available lists by sending an e-mail to the listserv/listproc present at your site. For METU users, one may use one of the following addresses.

    listproc@metu.edu.tr    or    listserv@metu.edu.tr

The e-mails you send must have no subject, only the command line in the body of the e-mail. For example, if you want to learn which lists are available in METU, you have to send an e-mail to ‘listserv/listproc@metu.edu.tr’, containing the lists command in the body of the e-mail. You will get a message from listserv/listproc containing the list names and definitions.

If you decide to be a member of a list, i.e. to subscribe to a list, again send an e-mail to listproc/listserv containing the following command.

    sub <list-name> name surname

If you succeed in joining a list, you will get a message from listserv/listproc saying that you have been added to the specified list. In order to unsubscribe from the list, send an e-mail to listserv/listproc, again with only one line in the body of the e-mail containing the following command.

    unsub <list-name>

After that, you will get a message from listproc/listserv saying that you have been removed from the specified list.

To learn the other commands, which are available for listproc/listserv, send an e-mail containing the command help.

More information about listserv can be reached from the following address:

    http://www.metu.edu.tr/list_server/

6 VARIOUS INTERNET TOOLS

6.1 Ping

The ping command allows the user to check if another host on the Internet is currently running and the network connection between hosts is ‘up’. That is, this command is used for checking the status of the connection with another host. The general form of the command is:
ping <hostname>  or  ping <Ipnumber>

To prematurely end a ping command, send break characters e.g. Ctrl+D or Ctrl+C (may differ on different systems).

6.2 Finger

This command yields information about each user that is currently logged into a host. To see who are currently logged on a host, use the form:

    finger @hostname

To find out detailed information about a certain user, they can be fingered specifically (and need not to be logged in). Use the form:

    finger username@hostname

If you are using this command in your local host, you do not have to write the hostname.

6.3 Write and Talk

Sometimes e-mail is clumsy and difficult to manage when one really needs to have an interactive conversation.

Write command can only be used with people on your system. To invoke write, all you need to do is simply to type:

    write username

The prompt will disappear, as always, and you will be given the opportunity to type whatever you want. After every sentence press ENTER to send your message and when you finish, type Ctrl+D to quit from writing session.

You can also talk to someone on the Internet. This means that you can write back and forth to each other almost instantaneously. To initiate talk, type:

    talk username@hostname

After this command, system will go searching to see if that person is on their site and a message similar to the following will be displayed on that person’s terminal:

    Message from Talk_Deamon@hostname at 21:20 ...
    talk : connection requested by username1@hostname1
    talk : respond with : talk username1@hostname1

That person would respond by typing talk username1@hostname1. You and that person could then chat about whatever you wish. To leave the talk session, type Ctrl+D or Ctrl+C (may differ on different systems).
CHAPTER 3

NETWORK TECHNOLOGIES
7 NETWORK COMPONENTS

A network is a collection of interconnected computing devices. In order for the network to function, these devices (both hardware and software) must work together and communicate in a common language. Communication would be a simple task if a single manufacturer created all of the components of a network. However, thousands of companies offer networking hardware and software products.

The communication between the computers remains consistent through the OSI (Open System Interconnection) Model developed by the ISO (International Standards Organization) in the late 1970s. This model defines a universal standard for designing data communication protocols so that equipment from different manufacturers can communicate. It divides data communication into 7 functions, or layers, which describe how information flows from one end-user to another. Each layer prepares information for and communicates with the one above or below. The higher layers of the model are software oriented, whereas the lower layers are more hardware dependent. Most network equipment manufacturers now build their networking products in compliance with the OSI Model.

Layer 7: Application Layer Interfaces with the software running on the computer.
Layer 6: Presentation Layer Translates data to a language the user can understand.
Layer 5: Session layer Synchronizes communication between computers; controls when users can send and receive data.
Layer 4: Transport Layer Makes sure that if data reaches to its destination completely; and asks for retransmission if data does not reach completely.
Layer 3: Network Layer Translates addresses and routes data from one node to another.
Layer 2: Data Link Layer Consists of two sublayers: Logical Link Control (LLC) defines how data is transferred over the cable and provides a data link service to the higher layers. Medium Access Control (MAC) defines who can use the network when multiple computers are trying to access it simultaneously (i.e. Token passing, Ethernet [CSMA/CD]).
Layer 1: Physical Layer Deals with the properties of the cable and connectors; responsible for transmitting data across a cable.
7.1 Computers

The first and most obvious component of a network is the computer. The computer connects people to the network, letting them share information and resources such as printers and servers. When purchasing computers for a network, it is important to consider such performance requirements of the people who will be using them as the applications they currently use and the applications they might be using in the future.

7.2 Network Adapters

The network adapter is the physical link between the computing device and the network cable. Typically, a network adapter is a card that slides into a computing device's expansion slot, providing a connector for attaching the network cable. Network adapters can also be external units or built directly onto a device's motherboard.

7.3 File Server

The file server is a high-speed, large capacity computer that acts as a central repository of data and/or application programs for the network. In client/server network environments, the file server does not perform computations. Instead, upon request, the file server sends data to the workstations and the workstations execute the programs. A file server can also serve as a mail server and/or print server. In larger installations these functions are performed on separate, specialized servers. A mail server stores all electronic mails (e-mails). When a person picks-up his/her e-mail messages, he/she retrieves them from the mail server. A print server spools (stores) the print jobs en route to the printer, freeing the user's computer faster so that he/she can continue to work, even if his/her job has not been yet printed.

7.4 Network Operating System

The network operating system (NOS) is a supervisory software program that resides on the server. It controls how the network operates by defining who can use the network and how information and resources (printers, modems, etc.) are shared among users. Without a NOS, computing devices would remain isolated even when physically linked. NOSs run on top of and depend on the server's operating system. Common NOSs include Novell® NetWare®, Microsoft® Windows NT Network®, AppleShare® and Banyan® Vines®.

7.5 Hubs/Concentrators/Repeaters

A hub, also called a concentrator or repeater, is found in star and star-wired ring topology networks (further information will be given about networks in later sections). It serves as a central meeting place for cables from computers, servers and peripherals. The hub can be a non-intelligent repeater, which simply retimes and reamplifies signals. It can offer intelligence, via network management software, to monitor and control the network traffic.
7.6 Bridges

As the number of nodes and amount of traffic on a network increases significantly, data transfer can become slow and inefficient. Bridges divide these overloaded networks into smaller segments to ensure better traffic control and more efficient use of bandwidth. The segments remain as part of a single logical network. Bridges can also connect a high-performance 100Base-T network with a standard 10Base-T network, while maintaining the services such as mailing or printing.

Bridges have access only to physical address information. They replicate and transmit all packets destined for another segment, regardless of protocol.

7.7 Routers

Routers are similar to bridges in that they link two or more physically separate network segments. The network segments linked by a router, however, remain logically separate and can function as independent networks.

Routers have access to more network level knowledge than is available to bridges. With this knowledge, routers can perform advanced functions such as calculating the shortest, most economical path between source and destination nodes.

Routers are generally more expensive than bridges and require more management expertise. They are best suited for large, enterprise networks where traffic must be segmented and isolated based on protocol. Bridges, on the other hand, require minimal configuration and are best suited to small, simple networks. Since they are protocol independent, bridges do not require additional software to accommodate different protocols.

7.8 Ethernet Switch

A switch builds on your existing network infrastructure, increasing bandwidth dramatically. Essentially, an Ethernet switch is a multi-port bridge that provides a dedicated 10 Mbps Ethernet connection between ports. With switches, multiple 10 Mbps connections can be established simultaneously, increasing the aggregate bandwidth of the network. Switches also allow for a high bandwidth Fast Ethernet link to servers or the backbone by interconnecting workgroups with high-speed links.

8 NETWORK TOPOLOGIES

The physical layout of a network is its topology. Three well-known types of network topologies are bus, star and ring. The topology of a network depends on the media access method(s) it uses and type(s) of cables that are installed. Whereas small networks with clusters of network devices tend to employ only one topology, large networks that span a wide physical area or several floors of a building may use a combination.
8.1 Bus Topology

In a bus topology, each node (computer, server, peripheral etc.) attaches directly to a common cable. This topology most often serves as the backbone for a network. In some instances, such as in classrooms or labs, a bus will connect small workgroups. Since a hub is not required in a bus topology, the set-up cost is relatively low. However, this topology's wiring scheme is unstructured -meaning without a central point of concentration- making it difficult to troubleshoot.

The bus cable carries the transmitted message along the cable. As the message arrives at each workstation, the workstation computer checks the destination address contained in the message, to see if it matches its own. If the address does not match, the workstation does nothing more.

If the workstation address matches the address contained in the message, it processes the message. The message is transmitted along the cable and is visible to all computers connected to that cable.

8.2 Star Topology

A star topology, compared to bus topology, is relatively easy to troubleshoot due to its structured wiring scheme. With this topology, each node has a dedicated set of wires connecting it to a central network hub or switch. The failure of one connection does not usually affect the others. Since all traffic passes through the hub, the hub becomes a central point for isolating network problems and gathering network statistics.
This topology has the greatest cable lengths of any topology, and thus uses the largest amount of cable.

8.3 Ring Topology

A ring topology features a logically closed loop of cable, a ring. Workstations connect to the ring and faulty workstations can be bypassed. More cabling is required in ring topology than required in bus topology. The connectors used in ring topology tend to cause a lot of problems. Ring topology is commonly used for token ring and FDDI networks.

9 TRANSMISSION MEDIA (CABLING)

"Cable" is what physically connects network devices together, serving as the conductor for information traveling from one computing device to another. The type of cable you choose for your network will be dictated in part by the network's topology, size and media access method. Small networks may employ only a single cable type, whereas large networks tend to use a combination.

9.1 Coaxial Cable

Coaxial cable includes a copper wire surrounded by insulation, a secondary conductor that acts as a ground, and a plastic outside covering. Due to the coaxial cable's two layers of shielding, it is relatively immune to electronic noise, such as motors, and can thus transmit data packets over long distances.
Local area networks (LANs) primarily use two sizes of coaxial cable, commonly referred to as thick and thin. Thick coaxial cable can extend over longer distances than thin cable and was a popular backbone (bus) cable in the 1970s and 1980s. However, thick cable is more expensive than thin cable and is difficult to install. Today, thin cable (which looks similar to a cable television connection) is used more frequently than thick cable.

9.2 Twisted-Pair Cable

Twisted-pair cable consists of pairs of insulated wires that are twisted around each other and are covered with a plastic casing. It is available in two varieties, unshielded and shielded.

Unshielded twisted-pair (UTP) is similar in appearance to the wire used for telephone systems. Since many buildings are pre-wired (or have been retrofitted) with extra UTP cables, and because UTP is inexpensive and easy to install, it has become a very popular network media over the last years.

Shielded twisted-pair cable (STP) adds a layer of shielding to UTP. Although STP is less affected by noise interference than UTP and can transmit data further, it is more expensive and more difficult to install.

9.3 Fiber-Optic Cable

Fiber-optic cable is constructed of flexible glass and plastic. It transmits information via light. Being totally resistant to electronic interference, fiber-optic is ideal for environments with a considerable amount of noise (electrical interference). Furthermore, since fiber-optic cable can transmit more signals than coaxial and twisted-pair, more and more institutions are installing it as a backbone in large facilities and between buildings. The cost of installing and maintaining fiber-optic cable remains too high, however, for it to be a viable network media connection for computers.

9.4 Cable Specifications

In the network infrastructure project 802, the Institute of Electrical and Electronics Engineers (IEEE) established specifications for cables carrying Ethernet signals. 10Base5, 10Base2, 10Base-T and 10BaseF (FOIRL [Fiber Optic Inter Repeater Link]) refer to thick coaxial, thin coaxial, unshielded twisted-pair and fiber-optic cables respectively.

The "10" refers to the Ethernet transmission speed - 10 Mbps. The "Base" refers to baseband (single communications channel on each cable). Originally, the last character referred to the maximum cable distance in hundreds of meters. This naming convention changed, however, with the introduction of 10BaseT and 10BaseF (FOIRL). In these instances, the T and F refer to the cable types (twisted-pair and fiber-optic).
"Link Integrity" and "Auto-partition" are part of the 10Base-T specification. This means that all network equipment claiming compliance with 10BaseT must support Link Integrity and Auto-partitioning. Link Integrity is concerned with the condition of the cable between the network adapter and the hub. If the cable is broken, the hub will automatically disconnect that port. Auto-partitioning occurs when an Ethernet hub port experiences more than 31 collisions in a row. When this happens, the hub will turn off that port, essentially isolating the problem.

10 MEDIA ACCESS METHODS

A media access method defines how computing devices access the network cable and send data. Ethernet, Token Ring®, LocalTalk® and WLAN media access methods are used primarily for connecting desktop machines (computers, printers etc.) to the network, whereas FDDI, CDDI, Fast Ethernet, Gigabit Ethernet and ATM are used primarily for high-speed backbones, high-speed network access (e.g. file servers) and very high-speed workgroup applications.

<table>
<thead>
<tr>
<th>Topology</th>
<th>Cable Used (Most Common)</th>
<th>Maximum Transmission Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethernet</td>
<td>Star or bus, Twisted-pair, coaxial, fiber</td>
<td>10 Mbps</td>
</tr>
<tr>
<td>Fast Ethernet</td>
<td>Star, Twisted-pair, fiber</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>Gigabit Ethernet</td>
<td>Star, Fiber</td>
<td>1 Gbps</td>
</tr>
<tr>
<td>Token Ring</td>
<td>Ring, Twisted-pair, fiber</td>
<td>4 and 16 Mbps</td>
</tr>
<tr>
<td>LocalTalk</td>
<td>Bus, Twisted-pair</td>
<td>230 Kbps</td>
</tr>
<tr>
<td>WLAN</td>
<td>Star, -</td>
<td>11 Mbps</td>
</tr>
<tr>
<td>ATM</td>
<td>Star, Twisted-pair, fiber</td>
<td>155+ Mbps</td>
</tr>
<tr>
<td>FDDI</td>
<td>Dual Ring, Star-wired ring, Fiber</td>
<td>100 Mbps</td>
</tr>
<tr>
<td>CDDI</td>
<td>Star-wired ring, Twisted-pair</td>
<td>100 Mbps</td>
</tr>
</tbody>
</table>

10.1 Ethernet, Fast Ethernet, Gigabit Ethernet

In the 1970s, Digital Equipment Corporation® (DEC), Intel® and Xerox® established the first specifications for Ethernet (DIX Ethernet). Then, in the early 1980s, the Institute of Electrical and Electronics Engineers (IEEE) - a neutral standards making body comprised of representatives from a variety of computer companies- published Project 802. IEEE 802.3 is the standard used today.

Ethernet has emerged over the last several years as the most popular media access method to the desktop. Since this non-proprietary industry standard has been embraced by network
equipment manufacturers everywhere, Ethernet network components from multiple vendors will work together and communicate effortlessly.

Ethernet media access methods are found in both small and large network environments. Being set up in star and/or bus configurations, Ethernet networks transmit data over UTP, thin-coaxial, thick-coaxial and fiber-optic cables at rates of 10 Mbps.

On an Ethernet network, each computer listens to the cable before sending a data packet. If the cable is clear, the computer will transmit; otherwise, the computer waits and tries again. When two or more computers transmit simultaneously, a "collision" occurs. In collision, the signals from two devices run into each other. Each device will then attempt to resend its data when the line is silent. This process is referred to as the CSMA/CD (Carrier Sense Multiple Access with Collision Detection) media access control mechanism. With the CSMA/CD control mechanism, it is normal to have collisions, as long as the number remains low compared to the number of signals that transmit successfully.

Fast Ethernet refers to 100Mbps Ethernet. 100BaseT which, at the MAC layer, retains many of the same characteristics as 10Base-T, runs on twisted pair cables where 100 Base FX runs on fiber optic cables.

Gigabit Ethernet at the moment only runs on fiber optic cable infrastructure at network Backbones.

10.2 Token Ring

The Token Ring media access method was developed by IBM Corporation® in the mid 1980s and subsequently defined by the IEEE in Project 802. Since Token Ring is IBM's preferred method for networking, it is found primarily in large IBM mini and mainframe installations. Due to the increasing popularity of Ethernet, the rate of growth of Token Ring networks has decreased.

Token Ring networks use a ring topology over fiber optic cable, shielded and unshielded twisted-pair wiring. Two versions of Token Ring are available: 4 Mbps and 16 Mbps.

Token Ring networks use a token passing media access control mechanism to circulate packets around the ring. An electronic token travels from station to station in a single, logical direction. If the token is free, a station can attach data to the token, change the token’s status to busy, and then send the token on to the next station. Each consecutive station then checks the destination address of the data to see if it should process the data. It then passes the token on. When the station that originated the token receives it back, it removes the data from the token and changes the token status back to free.
10.3 LocalTalk

LocalTalk is a proprietary media access method built into Apple® Macintosh® computers and LaserWriter® printers. LocalTalk networks are best suited to small networks of Macs®. With LocalTalk, computers are set up in a bus configuration using both shielded and unshielded twisted-pair wiring. Data transmits at only 230 Kbps, or about 1/40 the rate of Ethernet. For this reason, many LocalTalk Macintosh installations have been upgraded to Ethernet in order to better handle large file transfers.

LocalTalk uses the CSMA/CA (Carrier Sense Multiple Access with Collision Avoidance) media access control mechanism for transmitting data. CSMA/CA is similar to CSMA/CD in that a computer listens to the cable before transmitting data. If the computer detects no signal being transmitted, it will send out its own signal saying, "I'm about to transmit, so stay off the line."

10.4 Wireless Local Area Network

Wireless computer network devices use DIRECT SEQUENCE modulation on SPREAD SPECTRUM technology, which was originally developed to meet military needs and was then used for civil purposes as well. Direct Sequence Spread Spectrum (DSSS), is the technology of placing the RF signal on a wide bandwidth and then processing of this signal that spread around this bandwidth by the receivers and transceivers. The RF signal, which the devices use when signaling, use the frequency 2.4 – 2.5 Ghz, and this frequency is approved by General Directorate of Radiotelegraphy. The output power of the devices is at the level of 100 mw, which is not harmful to human health. (One twentieth of a mobile phone that is connected to a 900 Mhz GSM network).

Wireless Local Area Network (WLAN), which is developed along with Direct Sequence Spread Spectrum modulation and whose standards are determined by IEEE- 802.11b (DS), can go up to 11 Mbps (megabit per second) data transfer rate. A bridge with two ports (one for wireless network, and the other for ethernet) and a receiver-transceiver antenna connected that bridge; establish the connection between wireless network and local area network. The bridge, which has the properties of frame filtering and dynamic address learning, operates on Data Link level, which is a second OSI layer.

Every bridge, which can be operated via a console port or SNMP (Simple Network Management Protocol), can serve up to a maximum of 250 users. The users can connect to and work on WLAN either stationary position or roaming within the coverage area of WLAN.

Another wireless network component is the PCMCIA card, which has an internal receiver-transceiver antenna and WLAN interface that can be connected to the end users’ computer. This card has a jack to connect a powerful antenna when needed and it can be connected to either bridge or personal computers via ISA and PCI adaptors as wireless network interface.

There are two kinds of antenna that can be used in WLAN applications:
- Unidirectional antenna
- Omnidirectional antenna
Unidirectional antenna work on 14 db. Omnidirectional antenna have three kinds:
   a. 7 db omnidirectional antenna
   b. 5 db omnidirectional antenna (car kit)
   c. 5 db omnidirectional desktop antenna

WLAN security is ensured by IEEE 802.11 WEP (Wireless Equivalent Policy) Encryption. According to this, password verification by using RC4 algorithm takes place between the bridge and the users who want to connect to WLAN. The user has to know his/her WLAN code as well. IEEE 802.11 WEP standard operates on bridges and on PCMCIO cards of the end users.

There can be 3 distinct topology of Wireless Computer Network:

**Wireless Infrastructure Network**

This topology is comprised of bridges, which serve to end users and receiver-transceiver antenna, which are connected to these bridges. By creating wide coverage areas with Omnidirectional antenna, the end user that is standing stationary or roaming about is included to the network.

**Wireless LAN to LAN Network**

LAN to LAN topology is comprised of a unidirectional antenna that is connected to two bridges and two distinct LANs that are connected to each other.

**Wireless AD-HOC Network**

AD-HOC topology does not involve bridges. The wireless network interfaces, to which the receivers-transceivers that are present in the computers of end users are connected to, build a network among each other and users talk to each other on this network.

Wireless network, which operates on IEEE 802.11b (DS) standards, changes between 11 Mbps - 1 Mbps depending on the distance and the clearance of the sight in between.

<table>
<thead>
<tr>
<th>Data Rate</th>
<th>14 dbi Yagi to 14 dbi Yagi</th>
<th>14 dbi Yagi to 7 dbi Omni</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Distance</td>
<td>Line of Sight Clearance</td>
</tr>
<tr>
<td>11 Mbit/s</td>
<td>2.5 km (1.5 mi)</td>
<td>6.3 m (21 ft)</td>
</tr>
<tr>
<td>5.5 Mbit/s</td>
<td>3.5 km (2.1 mi)</td>
<td>7.5 m (25 ft)</td>
</tr>
<tr>
<td>2 Mbit/s</td>
<td>5 km (3.1 mi)</td>
<td>9.1 m (30 ft)</td>
</tr>
<tr>
<td>1 Mbit/s</td>
<td>7.1 km (4.4 mi)</td>
<td>11.3 m (37 ft)</td>
</tr>
</tbody>
</table>

To prevent the interference of two devices, sub frequency bands (channels) with a frequency interval of 2.4 Ghz – 2.5 Ghz are used. This process, which is carried out on PCMCIA card that
supports 13 channels, should be implemented by skipping 5 channels on devices standing close to each other. This process is carried out automatically on end users who established a WLAN connection by putting a PCMCIA card on their computers and it is carried out manually on bridges.

10.5 ATM

An ATM (Asynchronous Transfer Mode) network is set up in a star configuration using fiber-optic (and in some newer incarnations, twisted-pair) cables. Data transmits at 155 Mbps and higher. A switch at the center of the star establishes a dedicated circuit between the sending and receiving stations. ATM is ideal for video, voice and data transferred over the same media.

ATM is discussed in detail in the next section.

10.6 FDDI

The FDDI (Fiber Distributed Data Interface) media access method transfers data at high speeds (100Mbps) over fiber-optic cable. Like Token Ring, this access method employs a token passing media access control mechanism to transmit data. FDDI, however, uses a dual counter-rotating ring topology, meaning there are two rings of cable with two tokens circulating in opposite directions. This set-up creates a relatively fault tolerant network.

10.7 CDDI

CDDI (Copper Distributed Data Interface) is an emerging technology that uses the FDDI media access control mechanism over copper (unshielded twisted-pair) cable. It is employed in a limited fashion to connect file servers and high performance workstations directly to an FDDI backbone. A clear disadvantage of CDDI is that, the cost per port remains too high for it to be considered as a viable networking solution for the typical desktop computer.

11 ASYNCHRONOUS TRANSFER MODE

Asynchronous transfer mode (ATM) is a high-performance; connection based cell-oriented switching and multiplexing technology that utilizes fixed-length packets to carry different types of traffic. ATM is a technology which will enable carriers to capitalize on a number of revenue opportunities through multiple ATM classes of services, high-speed local area network (LAN) interconnection, voice, video, and future multimedia applications in business markets in the short term and in community and residential markets in the longer term.

ATM, which was once envisioned as the technology of future public networks, is now a reality with service providers around the world introducing and rolling out ATM and ATM-based services. The ability to successfully exploit the benefits of ATM technology within the public network will provide strategic competitive advantage to both carriers and enterprises. In addition to revenue opportunities, ATM reduces infrastructure costs through efficient bandwidth management, operational simplicity, and the consolidation of overlay networks. Carriers can no longer afford to go through the financial burden and time required to deploy a separate network for each new service requirement (e.g., dedicating a network for a single
service such as transparent LAN or frame relay). ATM technology will allow core network stability while allowing service interfaces and other equipment to evolve rapidly.

### 11.1 Definition and Advantages of ATM

Asynchronous transfer mode (ATM) is a technology, which has its history in the development of broadband ISDN in the '70s and '80s. Technically, it can be viewed as an evolution of packet switching. Like packet switching for data (e.g., X.25, frame relay, TCP/IP), ATM integrates the multiplexing and switching functions, is well suited for burst traffic (in contrast to circuit switching), and allows communications between devices that operate at different speeds. Unlike packet switching, ATM is designed for high-performance multimedia networking. ATM technology has been implemented in a very broad range of networking devices:

- PC, workstation, and server network interface cards
- Switched-Ethernet and token-ring workgroup hubs
- Workgroup and campus ATM switches
- ATM enterprise network switches
- ATM-edge switches
- ATM-backbone switches

ATM has also a capability, which can be offered as an end-user service-by-service providers (as a basis for terrifed services) or as a networking infrastructure for these and other services. The most basic service building block is the ATM virtual circuit, which is an end-to-end connection that has defined end points and routes but does not have bandwidth dedicated to it. Bandwidth is allocated on demand by the network as users have traffic to transmit. ATM also defines various classes of service to meet a broad range of application needs.

ATM is also a set of international interface and signaling standards defined by the International Telecommunications Union (ITU) Standards Sector (formerly the CCITT). The ATM Forum has played a pivotal role in the ATM market since its formulation in 1991. The ATM Forum is an international voluntary organization composed of vendors, service providers, research organizations, and users. Its purpose is to "accelerate the use of ATM products and services through the rapid convergence of interoperability specifications, promotion of industry cooperation and other activities." It does this by developing multi-vendor implementation agreements. Among the advantages of ATM are:

- High performance via hardware switching leads to high data transfer rates.
- Dynamic bandwidth for bursty traffic meeting application needs and delivering high utilization of networking resources. Most applications are or can be viewed as inherently bursty; data applications are LAN-based and are very bursty, voice is bursty since both parties are neither speaking at once nor all the time; video is bursty since the amount of motion and required resolution varies over time.
- Class-of-service support for multimedia traffic allowing applications with varying throughput and latency requirements to be met on a single network.
- Scaleability in speed and network size supporting link speeds of T-1/E-1 to OC-12 (622 Mbps). Networks which scale to the size of the telephone network (i.e., as required for residential applications) are envisaged.
- Common LAN/WAN architecture allowing ATM to be used consistently from one
desktop to another. Traditionally, LAN and WAN technologies have been very
different with implications for performance and interoperability.
- Opportunities for simplification via switched VC (Virtual Circuit) architecture. This is
particularly for LAN-based traffic which is connectionless in nature today. The
simplification possible through ATM VCs could be in areas such as billing, traffic
management, security, and configuration management.
- International standards compliance in central-office and customer-premise
environments allowing for multivendor operation.

11.2 ATM Classes of Service Qualities

ATM is connection oriented and allows the user to dynamically specify the resources required
on a per-connection basis (per SVC). There are five classes of service defined for ATM (as per
ATM Forum UNI 4.0 specification). The quality of service parameters for these service classes
are summarized in the table below:

<table>
<thead>
<tr>
<th>Service Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant bit rate (CBR)</td>
<td>This class is used for emulating circuit switching. The cell rate is constant with time. CBR applications are quite sensitive to cell-delay variation. Examples of applications that can use CBR are telephone traffic (i.e., nx64 kbps), videoconferencing, and television.</td>
</tr>
<tr>
<td>Variable bit rate-non real time (VBR-NRT)</td>
<td>This class allows users send traffic at a rate that varies with time depending on the availability of user information. Statistical multiplexing is provided to make optimum use of network resources. Multimedia e-mail is an example of VBR-NRT.</td>
</tr>
<tr>
<td>Variable bit rate-real time (VBR-RT)</td>
<td>This class is similar to VBR-NRT but is designed for applications that are sensitive to cell-delay variation. Examples for real-time VBR are voice with speech activity detection (SAD) and interactive compressed video.</td>
</tr>
<tr>
<td>Available bit rate (ABR)</td>
<td>This class of ATM services provides rate-based flow control and is aimed at data traffic such as file transfer and e-mail. Although the standard does not require the cell transfer delay and cell-loss ratio to be guaranteed or minimized; it is desirable for switches to minimize delay and loss as much as possible. Depending upon the state of congestion in the network, the source is required to control its rate. The users are allowed to declare a minimum cell rate, which is guaranteed to the connection by the network.</td>
</tr>
<tr>
<td>Unspecified bit rate (UBR)</td>
<td>This class is the catch-all &quot;other&quot; class, and is widely used today for TCP/IP.</td>
</tr>
</tbody>
</table>
The following technical parameters have been identified to be associated with a connection, which are outlined in the table below:

<table>
<thead>
<tr>
<th>Technical Parameter</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell loss ratio (CLR)</td>
<td>Cell loss ratio is the percentage of cells not delivered at their destination because they were lost in the network due to congestion and buffer overflow.</td>
</tr>
<tr>
<td>Cell transfer delay (CTD)</td>
<td>The delay experienced by a cell between network entry and exit points is called the cell transfer delay. It includes propagation delays, queuing delays at various intermediate switches, and service times at queuing points.</td>
</tr>
<tr>
<td>Cell delay variation (CDV)</td>
<td>A measure of the variance of the cell transfer delay. High variation implies larger buffering for delay sensitive traffic such as voice and video.</td>
</tr>
<tr>
<td>Peak cell rate (PCR)</td>
<td>The maximum cell rate at which the user will transmit. PCR is the inverse of the minimum cell inter-arrival time.</td>
</tr>
<tr>
<td>Sustained cell rate (SCR)</td>
<td>This is the average rate, as measured over a long interval, in the order of the connection life time.</td>
</tr>
<tr>
<td>Burst tolerance (BT)</td>
<td>This parameter determines the maximum burst that can be sent at the peak rate. This is the bucket-size parameter for the enforcement algorithm that is used to control the traffic entering the network.</td>
</tr>
</tbody>
</table>

Finally, there are a number of ATM Classes of Service. These classes are all outlined in the table below:

<table>
<thead>
<tr>
<th></th>
<th>CBR</th>
<th>VBR-NRT</th>
<th>VBR-RT</th>
<th>ABR</th>
<th>UBR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell-loss ratio</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>CTD cell-transit ratio</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>CDV Cell-delay variation</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>PCR peak cell rate</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>SCR sustained</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Burst tolerance at PCR</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Flow control</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Its extensive class of service capabilities make ATM the technology of choice for both multimedia and data communications.

11.3 ATM LAN Emulation

ATM-based Ethernet switches and ATM workgroup switches are being deployed by end users at various corporate sites. The most widely used set of standards in local ATM environments is ATM LAN emulation (LANE). ATM LAN emulation is used to make the ATM SVC network appear to be a collection of virtual-Ethernet/IEEE 802.3 and tokenring/IEEE802.5 LANs. The replication of most of the characteristics of existing LANs means that LAN emulation enables existing LAN applications to run over ATM transparently, this latter characteristic leading to its wide deployment. In ATM LAN emulation, most unicast LAN traffic moves directly between
clients over direct ATM SVCs, while multicast traffic is handled via a server functionality. Bridging is used to interconnect real LANs and emulated LANs running on ATM, while routing is used to interconnect ATM-emulated LANs and other WAN or LAN media for purposes of routing scalability, protocol spoofing, or security firewalls.

The LAN-emulation service may be implemented in the same devices as clients or involve other ATM network devices. The communications interface, LAN emulation user-network interface (LUNI), is the sequence and contents of the messages that the clients ultimately use to transfer traffic of the type expected on IEEE 802.3/5 LANs. The component of the LAN-emulation service that deals with initialization (i.e., emulates plugging the terminal into a LAN hub), is the LAN emulation configuration server (LECS). It directs a client to connect to a particular LAN emulation server (LES). The LES is the component of the LAN-emulation service that does the address registration and resolution. The LES is responsible for mapping IEEE 48-bit MAC addresses and token-ring route descriptors to ATM addresses. One very important MAC address for clients is the MAC-layer "broadcast" address that is used to send traffic to all locations on a LAN. In LAN emulation, this function is performed by the broadcast and unknown server (BUS). ATM LANE is a comprehensive set of capabilities, which has been widely deployed in ATM networks.

ATM LANE is an element of the multiple protocols over ATM (MPOA) architecture that is being defined by the ATM Forum. This work is addressing encapsulation of multiple protocols over ATM, automatic address resolution, and the routing issues associated with minimizing multiple router hops in ATM networks.

11.4 Voice Over ATM

Since real-time voice services have been traditionally supported in the WAN via circuit-based techniques (e.g., via T-1 multiplexors or circuit switching), it is natural to map these circuits to ATM CBR PVCs using circuit emulation and ATM adaptation layer 1 (AAL1). However, there are significant disadvantages in using circuit emulation in that, the bandwidth has to be dedicated for this type of traffic (whether there is useful information being transmitted or not), providing a disincentive for corporate users to implement circuit emulation as a long-term strategy. This does not downplay its importance as a transitional strategy to address the installed base.

As technology has evolved, the inherent burstiness of voice and many real-time applications can be exploited (along with sophisticated compression schemes) to significantly decrease the cost of transmission through the use of VBR-RT connections over ATM.

VBR techniques for voice exploit the inherently bursty nature of voice communication, as there are silence periods which can result in increased efficiency. These silence periods (in decreasing levels of importance) arise:

- When no call is up on a particular trunk; that is, the trunk is idle during off-peak hours (trunks are typically engineered for a certain call-blocking probability: at night, all the trunks could be idle);
- When the call is up, but only one person is talking at a given time;
- When the call is up, and no one is talking;

Work is on going in the ATM Forum on ATM adaptation for VBR voice.
The addition of more bandwidth-effective voice coding (e.g., standard voice is coded using 64 kbps PCM) is economically attractive particularly over long-haul circuits and T-1 ATM interfaces. Various compression schemes have been standardized in the industry (e.g., G720 series of standards). Making these coding schemes dynamic provides the network operator the opportunity to free up bandwidth under network-congestion conditions.

A further enhancement to the support of voice over ATM is to support voice switching over SVCs. This entails interpreting PBX signaling and routing voice calls to the appropriate destination PBX. The advantage from a traffic management perspective is that, connection admission controls can be applied to new voice calls; under network congestion conditions, these calls could be re-routed over the public network and therefore do not cause additional levels of congestion.

11.5 Video over ATM

While circuit-based videoconferencing streams (including motion JPEG running at rates around 10 Mbps) can be handled by standard circuit emulation using AAL-1, the ATM Forum has specified the use of VBR-RT VCs using AAL-5 for MPEG2 on ATM for video-on-demand applications as this approach makes better use of networking resources.

MPEG is a set of standards addressing coding of video and surround-sound audio signals and synchronization of video and audio signals during the playback of MPEG data. It runs in the 2 Mbps to 15 Mbps range (with bursts above these rates) corresponding to VCR and broadcast quality respectively. The initial MPEG standard (MPEG1) was targeted at VHS-quality video and audio. MPEG2 targets applications requiring broadcast-quality video and audio and HDTV. MPEG2 coding can result in one of two modes:

- **Program streams**: Variable-length packets which carry a single program or multiple programs with a common time base
- **Transport streams**: 188-byte packets that contain multiple programs

In both cases, time stamps are inserted into MPEG2 packets during the encoding and multiplexing process. MPEG2 assumes a constant-delay model across the network, thus allowing the decoder to exactly follow the original encoder source clock. Due to the cost of coding, MPEG2 is primarily used in a non-interactive broadcast mode as would be the case for a point-to-multipoint broadcast in residential video on demand applications and in a business TV application for training or employee communications.

11.6 ATM Applications

ATM technologies, standards, and services are being applied in a wide range of networking environments as described briefly below:
- **ATM services**: Service providers are globally introducing or already offering ATM services to their business users.

- **ATM workgroup and campus networks**: Enterprise users are deploying ATM campus networks based on the ATM LANE standards. Workgroup ATM is more of a niche market with the wide acceptance of switched-ethernet desktop technologies.

- **ATM enterprise network consolidation**: A new class of product has evolved as an ATM multimedia network-consolidation vehicle. It is called an ATM enterprise network switch (ATM ENS). A full-featured ATM ENS offers a broad range of in-building (e.g., voice, video, LAN, and ATM) and wide-area interfaces (e.g., leased line, circuit switched, frame relay, and ATM at narrowband and broadband speeds) and supports ATM switching, voice networking, frame-relay SVCs, and integrated multiprotocol routing.

- **Multimedia virtual private networks and managed services**: Service providers are building on their ATM networks to offer a broad range of services. Examples include managed ATM, LAN, voice and video services (these being provided on a per-application basis, typically including customer-located equipment and offered on an end-to-end basis), and full-service virtual private-networking capabilities (these including integrated multimedia access and network management).

- **Frame relay backbones**: Frame-relay service providers are deploying ATM backbones to meet the rapid growth of their frame-relay services to use as a networking...
infrastructure for a range of data services and to enable frame relay to ATM service interworking services.

- **Internet backbones:** Internet service providers are likewise deploying ATM backbones to meet the rapid growth of their frame-relay services, to use as a networking infrastructure for a range of data services, and to enable Internet class-of-service offerings and virtual private intranet services.

- **Residential broadband networks:** ATM is the networking infrastructure of choice for carriers establishing residential broadband services, driven by the need for highly scalable solutions.

- **Carrier infrastructures for the telephone and private-line networks:** Some carriers have identified opportunities to make more-effective use of their SONET/SDH fiber infrastructures by building an ATM infrastructure to carry their telephony and private-line traffic.
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12 USENET NEWS

12.1 What is Netnews?

Netnews or Usenet as it is more commonly called, is a message sharing system that exchanges messages electronically around the world. Messages exchanged on Usenet are arranged by topic into categories called newsgroups. Netnews is, thus, a huge collection of messages, being passed from machine to machine.

12.2 Using Netnews

There are many software packages available for reading and distributing Netnews on a variety of operating systems (Unix, VMS, VM/CMS, MVS, MS-DOS, OS/2) and environments (Emacs, X-Windows, MS-Windows).

Unix users may try the command;

```
tin
```

to read news.

12.3 Hierarchies

Newsgroups are organized according to their specific areas of concentration. Since the groups are in a tree structure, the various areas are called hierarchies. The major categories are:

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>comp</td>
<td>topics of interest in computer science, software sources and information on hardware and software systems</td>
</tr>
<tr>
<td>misc</td>
<td>subjects include fitness, job-hunting, law and investments</td>
</tr>
<tr>
<td>sci</td>
<td>discussions marked by special knowledge relating to research in or application of the established sciences</td>
</tr>
<tr>
<td>soc</td>
<td>groups primarily addressing social issues and socializing</td>
</tr>
<tr>
<td>talk</td>
<td>groups largely debate-oriented and tending to feature long discussions without resolution and without appreciable amounts of generally useful information</td>
</tr>
<tr>
<td>news</td>
<td>groups concerned with the news network, group maintenance and software</td>
</tr>
<tr>
<td>rec</td>
<td>groups oriented towards hobbies and recreational activities</td>
</tr>
<tr>
<td>alt</td>
<td>anything and everything can and does appear</td>
</tr>
<tr>
<td>gnu</td>
<td>groups concentrating on interests and software with the GNU Project of the Free Software Foundation</td>
</tr>
<tr>
<td>biz</td>
<td>business-related groups</td>
</tr>
</tbody>
</table>
13 WORLD WIDE WEB

13.1 What is World Wide Web?

World Wide Web (also called WWW or W3) is an interactively working network tool which is based on the client-server model. The user runs locally a client program that can communicate with a server program on a (remote) host computer. In order to access the information, the client sends the user’s request to the server, using a standardized format called a protocol. HTTP, Hypertext Transfer Protocol is the standard protocol of WWW. The server handles the request and sends the response to the user. The information appears to the user as a series of nested menus, resembling the organization of a file system.

WWW documents are written in hypertext, which offers a means of moving from document to document within a network information. Hypertext is a text, which contains ‘links’ to other texts. The WWW world consists of documents and links. Indexes are special documents, which, rather than being read, may be searched. The result of such a search is another (‘virtual’) document containing links to the documents found.

The WWW contains documents in many formats. Those documents, which are hypertext, (real or virtual) contain links to other documents or places within documents (no matter where on the Internet these documents are). It’s sort of like sitting with an encyclopedia, reading one article, seeing a reference that intrigues you and flipping the pages to look up that reference.

13.2 What is available on the World Wide Web

Most network retrieval systems use their own protocol with limited access to other protocols. In contrast, the HTTP protocols used by WWW servers and clients allow communication with other systems. Thus, WWW clients provide access to anything on:

- WWW sites
- Gopher sites
- WAIS sites
- Anonymous FTP sites
- Usenet News, etc.

13.3 How to access to World Wide Web

User access to the World Wide Web facilities via a client is called a browser. To access the WWW, you run a browser program. This interface provides transparent access to the WWW servers. The documents that the browsers display are hypertext documents. Hypermedia is a superset set of hypertext; it is any medium with pointers to other media. This means that browsers might not display a text file, but might display images, sound or animations.

Local Clients

Usage of a local client is encouraged since it provides better performance and better response time than a remote client.
Public domain clients for accessing WWW servers are available for Macintosh, MS-DOS, VMS, VM/CMS, Unix, X-Windows. The clients are available from ‘ftp.metu.edu.tr’.

13.4 Using World Wide Web

13.4.1 Using Netscape/Internet Explorer

The most popular WWW browser programs, used in Windows environment are Netscape and Internet Explorer. Browser programs are distributed hypermedia systems designed for information discovery and retrieval over the global Internet.

Browser programs make your exploration of the Internet more productive and efficient. Built-in features let you easily access information, create bookmarks to list your favorite pages, view a history of pages you have seen, and customize the applications look and operation to suit your preferences.

These programs use a client/server model for information distribution - a server sits on a machine at an Internet site fulfilling queries sent by clients, which may be located anywhere on the Internet.

Units of information sent from servers to clients are simply termed as documents. Documents may contain plain text, formatted text, inlined graphics, sound and other multimedia data, and hyperlinks to other documents that maybe in turn located anywhere on the Internet.

To use browser programs you must specify the URL address format (see section 13.5) near the ‘Location’/‘Address’ prompt. After specifying this address and get connected to the host you want, you can move on the document by pressing the mouse buttons. In particular, references are highlighted or underlined words. To follow a link, click on the associated reference.

13.4.2 Using Lynx

Lynx is a fully featured World Wide Web (WWW) client for users running cursor-addressable, character-cell display devices (e.g., vt100 terminals, vt100 emulators running on PCs or Macs, or any other ‘curser-oriented’ display). It will display hypertext markup language (HTML) hypertext documents containing links to files residing on the local system, as well as files residing on remote systems running HTTP, FTP, WAIS, and NNTP servers. One can use this utility by entering the command:

    lynx <hostname>

where hostname is an optional alternative WWW server you want to connect to.
When `lynx` command is executed, it will clear the screen and display as much of the specified file as will fit on the screen. Pressing a ↓ (down arrow) key will bring up the next screen, and pressing a ↑ (up arrow) key will bring up the previous screen. If no hostname is specified at startup, a default site will be displayed (the default is configured by the system administrator when the command is installed). Also, you will see the helpful keys placed at the bottom of your screen.

The link displayed as ‘highlighted’ text is the currently ‘selected’ link. Lynx will display the file associated with the selected link when a → (right-arrow) or a **Enter** key is pressed. To **select a particular link**, press the ↑ or ↓ keys until the desired link becomes ‘highlighted,’ and then press the → or Enter key to view the linked information. Information included in the HTML file tells Lynx where to find the linked file and what kind of server will provide it (i.e. HTTP etc.).

When a binary file is encountered, Lynx will ask the user if he/she wishes to download the file or cancel. If the user selects ‘D’ for **download**, Lynx will transfer the file into a temporary location and present the user with a list of options. The only default option is ‘save file to disk’, which is disabled if Lynx is running in anonymous mode.

Online **help** is available while viewing any document. Press the ‘?’ or ‘H’ key to see a list of help topics.

To **exit** Lynx, use the ‘q’ command. You will be asked whether you really want to quit. Answering ‘y’ will exit and ‘n’ will return you to the current document. Use ‘Q’ or Ctrl+D to quit without verification.

Two commands activate **searching** in Lynx press / or s. While viewing a normal document use the / command to find a word or phrase within the current document. The search type will depend on the search option setting in the options menu (see below). The search options are ‘case sensitive’ and ‘case insensitive’. Some documents are designated ‘index documents’. These documents can be searched to retrieve additional information from an index server. The s key allows searching of index documents. Also, pressing the o key may access the Lynx Options Menu. The current Lynx Options Menu contains the following configurable options.
An option can be changed by entering the capital letter of the option you want to change (i.e. ‘E’ for Editor). For fields where text must be entered, simply enter the text by typing on the keyboard. The Backspace and Delete keys can be used to correct mistakes, and Ctrl+U can be used to erase the whole line. When you finish entering a change, press the Enter key to get back to the command prompt. After changing the options, use the > keys to select Save options to disk field and then use ↑ arrow to select Accept Changes to save the options.

It is often useful to place a bookmark to aid in returning quickly to a document. To use the bookmark feature, you must first use the Options Menu to specify a bookmark filename. To save a bookmark to the document you wish to place in the bookmark file, press the a key and you will be asked:

Save D)ocument or L)ink to bookmark file or C)ancel? (d,l,c):

Answer d to save a link to the document you are currently viewing or l to save the link that is currently selected on the page. Selecting c will cancel without saving anything to your bookmark file.

Use the v command to view the list of bookmarks you have saved. While viewing the bookmark list you may select a bookmark as you would any other link. Other useful commands of Lynx are listed in the below table.

<table>
<thead>
<tr>
<th>KEY</th>
<th>MEANING</th>
</tr>
</thead>
<tbody>
<tr>
<td>!</td>
<td>When ! is pressed your default shell will be spawned. When you exit the shell, you will return to Lynx.</td>
</tr>
<tr>
<td>g</td>
<td>The g command allows any URL to be viewed. Pressing the g command will bring up a prompt asking for a URL. Type in the URL that you wish to view.</td>
</tr>
<tr>
<td>=</td>
<td>The = command shows information about the current document and the currently selected link (if there is one). The number of lines in the file, URL, title, owner, and type are shown.</td>
</tr>
<tr>
<td>z</td>
<td>Lynx supports completely interruptible I/O processes. Press the z key at any time during a connect or transfer process and the process will be halted. If any data was transferred before the interrupt, it will be displayed.</td>
</tr>
</tbody>
</table>
The files required to run this browser on your computer can be retrieved by anonymous FTP from ‘ftp.metu.edu.tr’.

**13.5 What are URLs?**

One of the most powerful aspects of the World Wide Web is that it allows accessing nearly any kind of data and network service. In order to locate such object on the Internet, the WWW uses Uniform Resource Locators (URLs). URLs specify the access method, the address of the host computer, the port to connect to, and the path and name of the object. The format is:

```
access method://host.domain<:port>/path/objectname
```

Examples may look like this:

- `http://test.unibas.ch:80/` provides access to a WWW server on port 80
- `ftp://guru.cern.ch/` provides access to an anonymous FTP server
- `news:embnet.net-dev` provides access to a news server
- `telnet://test.unibas.ch` opens an interactive telnet session
- `file://test.unibas.ch/file.txt` retrieves a text file from a remote machine
- `file:///localhost/device1/document.txt` opens a text file or WWW document on device1 of a local UNIX or VMS system
- `file:///disk1/document` opens a text file or a WWW document on disk1 of a local Mac
- `file:///C:\document.txt` opens a text file or a WWW document on drive C: of a local DOS machine
For example, the URL for METU-CWIS is ‘http://www.metu.edu.tr/’. The home page of this server is shown below.

WWW browsers let you specify URLs either directly or by selecting hypertext in the WWW document you are presented with. This will cause the browser to send a request to open the URL specified. Selecting hypertext in a WWW document will take you to related information, which may also have pointers to related information. So don’t worry if you don’t know the URL of the information you want, simply follow the logical chain of hypertext links to get the information.

13.6 World Wide Web Search Engines

There are ‘Search Engines’ on the world where the WWW places are indexed.
Among these addresses, some of the commonly used ones are Alta Vista, Yahoo and Lycos. The example pages can be seen below.
13.7 Introduction to HTML

Creating HTML documents is explained in this part.

HTML documents are in plain (also known as ASCII) text format and can be created using any text editor. You can preview an HTML document in progress with any browser (Netscape, Internet Explorer etc.). HTML is not case sensitive, i.e. `<title>` is equivalent to `<TITLE>` or `<TiTlE>`.

HTML uses markup tags to tell the WWW browser how to display the text. HTML tags consist of a left angle bracket (`<`), followed by name of the tag and closed by a right angular bracket (`>`). Tags are usually paired, e.g. `<H1>` and `</H1>`. The ending tag looks just like the starting tag except a slash (`/`) precedes the text within the brackets. In the example, `<H1>` tells the WWW browser to start formatting a level-one heading; `</H1>` tells the browser that the heading is complete. The names of the files you create must have `.html` or `.htm` extension.

13.7.1 Some Basic Markup Tags

HTML has six levels of headings, numbered 1 through 6, with 1 being the most prominent. Headings are displayed in larger and/or bolder fonts than normal body text. The first heading in each document should be tagged `<H1>`. The syntax of the heading tag is:

```
<Hy>Text of heading </Hy>
```

where y is a number between 1 and 6 specifying the level of the heading.

In many documents, the first heading is identical to the title. For multipart documents, the text of the first heading should be suitable for a reader who is already browsing related information. Every HTML document should have a title. A title is generally displayed separately from the document and is used primarily for document identification in other contexts. The syntax of the title tag is `<TITLE>`. A WWW browser starts a new paragraph only when it reaches a `<P>` tag. You must separate paragraphs with `<P>`, because the browser ignores any indentations or blank lines in the source text. Tags look like this:

```
<Title>An HTML example </Title>
<H1>This is Heading 1</H1>
<H2>And this is Heading 2</H2>
<H3>This is Heading 3</H3>
<H6>Lastly, Heading 6</H6>
Welcome to HTML. <P>This is the first paragraph. <P>
```

A line break will break the end of a line but it will not create a blank line below or before more text or images may appear. A line break tag looks like this: `<BR>` and a Horizontal Bar tag is created by typing: `<HR>`
13.7.2 Linking to Other Documents

The chief power of HTML comes from its ability to link regions of text (and also images) to another document. The browser highlights these regions (usually with color and/or underlines) to indicate that they are hypertext links (often shortened to hyperlinks or simply links).

HTML’s single hypertext-related tag is <A>, which stands for anchor. To include an anchor in your document:

1. Start the anchor with <A . (There’s a space after the A.)
2. Specify the document that’s being pointed to by entering the parameter HREF="filename" followed by a closing right angle bracket: >
3. Enter the text that will serve as the hypertext link in the current document.
4. Enter the ending anchor tag: </A>.

Here is an sample hypertext reference:

    <A HREF="My.html">My</A>

This entry makes the word ‘My’ the hyperlink to the document My.html, which is in the same directory as the first document. You can link to documents in other directories by specifying the relative path from the current document to the linked document. An example is shown below.

    <A HREF="doc/your.html">Yours</A>

These are called relative links. You can also use the absolute pathname of the file if you wish. Pathnames use the standard UNIX syntax.

13.7.3 Additional Markup Tags

The preceding is sufficient to produce simple HTML documents. For more complex documents, HTML has tags for several types of lists, preformatted sections, extended quotations, character formatting, and other items.

HTML supports unnumbered, numbered, and definition lists. To make an unnumbered list,

1. Start with an opening list <UL> tag.
2. Enter the <LI> tag followed by the individual item. (No closing </LI> tag is needed.)
3. End with a closing list </UL> tag.

The <LI> items can contain multiple paragraphs. Just separate the paragraphs with the <P> paragraph tags. To make a numbered list (also called an ordered list, from which the tag name derives) is identical to an unnumbered list, except it uses <OL>. The items are tagged using the same <LI> tag. A definition list usually consists of alternating a term (abbreviated as DT) and a definition (abbreviated as DD). WWW browsers generally format the definition on a new line. An example is shown below.
<UL>
  <LI> universities
  <LI> computing facilities
</UL>

<OL>
  <LI> universities
  <LI> computing facilities
</OL>

<DL>
  <DT> METU
  <DD> METU is a university which is located in Ankara.
  <DT> Computer Center
  <DD> CC is located on the campus of METU.
</DL>

The <DT> and <DD> entries can contain multiple paragraphs (separated by <P> paragraph tags), lists, or other definition information.

13.7.4 Preformatted Text

Use the <PRE> tag (which stands for ‘preformatted’) to generate text in a fixed-width font and make spaces, new lines, and tabs significant (i.e., multiple spaces are displayed as multiple spaces, and lines break in the same locations as in the source HTML file). This is useful for program listings. Also, hyperlinks can be used within <PRE> sections. You should avoid using other HTML tags within <PRE> sections, however.

13.7.5 Extended Quotations

Use the <BLOCKQUOTE> tag to include quotations in a separate block on the screen. Most browsers generally indent to separate it from surrounding text.

An example:

<pre>
  1 234 567 890 123
  1  2  3
  6
</pre>

<blockquote>
  Faculties
  Arts and Science Faculty
</blockquote>
13.7.6 Character Formatting

The tags used for character formatting are as follows:

<B> bold text
<I> italic text
<U> underlined text
<TT> typewriter text, e.g. fixed-width font.

To apply a character style,

1. Start with <tag>, where tag is the desired character formatting tag, to indicate the beginning of the tagged text.
2. Enter the tagged text.
3. End the passage with </tag>.

13.7.7 In-line Images

Most WWW browsers can display in-line images (that is, images next to text) that are in X Bitmap (XBM) or GIF format. Each image takes time to process and slows down the initial display of the document, so generally you should not include too many or overly large images.

To include an in-line image, use the following format;

<IMG SRC=image_URL>

where image_URL is the URL of the image file. The syntax for IMG SRC URLs is identical to that used in an anchor HREF. If the image file is a GIF file, then the filename part of image_URL must end with ".gif".

By default the bottom of an image is aligned with the text as shown in this paragraph. Add the ALIGN=TOP option if you want the browser to align adjacent text with the top of the image as shown in this paragraph. The full in-line image tag with the top alignment is:

<IMG ALIGN=top SRC=image_URL>

ALIGN=MIDDLE aligns the text with the center of the image.

Some WWW browsers, primarily those that run on vt100 terminals (e.g. lynx), cannot display images. The ALT option allows you to specify text to be displayed when an image cannot be.

For example:

<IMG SRC = "UpArrow.gif" ALT = "Up">

where ‘UpArrow.gif’ is the picture of an upward pointing arrow. With NCSA Mosaic and other graphics-capable viewers, the user sees the up arrow graphic. With a vt100 browser, such as lynx, the user sees the word ‘Up’.
13.7.8 **External Images, Sounds, and Animations**

You may want to have an image opened as a separate document when a user activates a link on either a word or a smaller in-line version of the image included in your document. This is considered as an external image and is useful if you do not wish to slow down the loading of the main document with large in-line images.

To include a reference to an external image, use the following format:

```html
<A HREF = image_URL>link anchor</A>
```

Use the same syntax for links to external animations and sounds. The only difference is the file extension of the linked file.

13.7.9 **Embed Anchors and Character Tags**

It is acceptable to embed anchors within another HTML element:

```html
<H1><A HREF = "Destination.html">My heading</A></H1>
```

Do not embed a heading or another HTML element within an anchor:

```html
<A HREF = "Destination.html">
<H1>My heading</H1>
</A>
```

Although most browsers currently handle this example, it is forbidden by the official HTML and HTML+ specifications, and will not work with future browsers. When an `<IMG>` tag points at an image that does not exist, a dummy image is substituted. When this happens, make sure that the referenced image does in fact exist, that the hyperlink has the correct information in the URL, and that the file permission is set appropriately (world-readable).

Here is a longer example of an HTML document:

```html
<BODY>
<H1>A Longer Example</H1>
This is a simple HTML document. This is the first paragraph. <P>
This is the second paragraph, which shows special effects. This is a word in <I>italics</I>. This is a word in <B>bold</B>.<P>
Here is an in-lined GIF image: <IMG SRC = "myimage.gif">. <P>
This is the third paragraph, which demonstrates links. Here is a hypertext link from the word <A HREF = "ftp://ftp.metu.edu.tr"> FTP </A> to the FTP Site of METU. <P>
<H2>A second-level header</H2>
This is the end of example document. You can send e-mail to the following address. <P>
<ADDRESS>User Support Group <A HREF = "mailto:hot-line@metu.edu.tr"> (hot-line@metu.edu.tr) </A></ADDRESS>
</BODY>
```
The output of the above example is shown below.

In addition to tags already discussed, this example also uses the <HEAD> ... </HEAD> and <BODY> ... </BODY> tags, which separate the document into introductory information about the document and the main text of the document. These tags don't change the appearance of the formatted document at all, but are useful for several purposes and it is recommended that you use these tags. A more complex example is shown below.
14 WHOIS

14.1 What is WHOIS?

WHOIS is a program available on many workstation/mini/mainframe computers that can connect to another computer. By supplying a person’s name, it will respond with information it has on that person. A similar program, ‘finger’, does the same type of thing, except that it only supplies information on individuals with an account on that specific computer. A WHOIS database generally contains information on most of the individuals at a university, not just on the machine you connect to.

In a larger sense WHOIS is a technique for finding a person’s e-mail address. There is no master list of e-mail addresses on the network.

14.2 Using WHOIS

A WHOIS server is accessible across the network from a user program running on local machines or via an interactive Telnet session.

14.2.1 Using a Local Client

Unix computers have a native whois command. On non-Unix machines, ask your system administrator whether your computer has it or not. This command searches the database on the specified site for entry, which contains identifier. The format is:

whois -h <sitename> identifier

where:

sitename is the domain address of the site which hosts the database you want to query (e.g. ‘whois.internic.net’)

identifier is a name (person, host, domain or network), an IP number or a handle

14.2.2 Using Telnet

To access interactively, telnet to the InterNIC site (‘whois.internic.net’). No login is required. To get the available commands, simply type ? (‘a question mark’) or for details, enter the command help.
APPENDIX A  Installing Trumpet Winsock for Windows 3.x

To get into the Internet and use network services by a PC directly connected to the network or by a modem, you have to install the Trumpet Winsock program, which will provide the TCP/IP options to your computer running Windows 3.x. To do this, first you have to get the software. It may be taken via FTP from the address ‘ftp.metu.edu.tr’ under /web_mirrors/simtelnet/win3/winsock directory named like ‘twskxx.zip’ (where xx is the version of the software). After extracting the zip file, run the program named ‘install.exe’ to install the software on your computer. Then follow the steps explained below to make the Setup.

1. Double click the icon to start Trumpet Winsock ‘tcpman.exe’.

2. Open the ‘File’ Menu and choose ‘Setup’.

3. Fill in the blanks as shown in the figure. And then choose ‘Dialler Settings’.

4. Fill in the table as shown in the figure and press OK for Dialler Settings, then press OK for Trumpet Winsock Setup.
Some Special Notes

Specify the COM Port, which your modem is connected to. This number may be COM1 or COM2 for external modems and COM3 or COM4 for internal modems. Set the baud rate as 19200 for beginning. Higher speeds can cause com overrun errors if you don’t have a 16550 UART and a good communication driver. Valid speeds are 2400, 9600, 19200, 38400, 57600 and 115200.

For MTU, RWIN and MSS settings you can try MTU=1500, RWIN=4096 and MSS=1460. Rule is, MSS=MTU-40 and RWIN approximately=4*MSS. Fields shown as marked (X) above are check boxes in real setup window. Click to that boxes these are shown as marked here. Your IP address will be dynamically given by Annex. You only have to give the DNS (Domain Name System) Server’s address (as shown in Trumpet Winsock Setup Menu). When you finished setup, press OK and exit from Trumpet Winsock and restart it.

Connecting to Internet

After starting Trumpet Winsock ‘tcpman.exe’, select Manual Login from Dialler Menu. Then dial the telephone number you want. Enter your username and password (which are on the systems rorqual or orca).

When you get Metu-CS2 prompt type ‘ppp’ and press enter. When you see some garbage characters press ESC key. Wait until the ‘My IP address is 144.122.xxx.xxx’ message comes. Then minimize Trumpet Winsock and use any of the Internet applications (Netscape, Internet Explorer, WsFtp, Qvtnet etc.) you want.
To be able to connect to METU systems via a modem you should have a user code on that system and a modem. Then you should configure your connection. The following document contains all steps that you need while configuring your connection on Windows 95 and 98.

- Access to “Control Panel” from start menu.
- Double click “Network”.
- Click “Add”.
- Highlight “Adapter” and then click “Add”.
- Select “Microsoft” on the left column of the window, and then “Dial-Up Adapter” on the right column.
- Click “OK”.
- Remove “Client for NetWare Networks” (Highlight it, and then click “Remove” button).
• Click “Add” and select “Protocol”.

• Click “Add”.
• Select “Microsoft” and then “TCP/IP”. Click “OK”.

• Select “Dial-Up Adapter” in the Network window and then click the “Properties” button. Then select “Bindings” tab.

• Unselect “IPX/SPX Compatible Protocol”.
• Unselect “NETBEUI”.
• Then from “Advanced” tab, select “Use IPX Header Compression” and value “No”. Click “OK”.

• Then select “TCP/IP”, click “Properties” button and select “DNS Configuration”. Fill in the blanks as in the following window.

• Then click “OK” on the Network window. Your computer will prompt you for disks of Windows95-98. After copying the necessary files, you should restart your computer.
• Then from the “Start/Programs/Accessories/Communications” path on the desktop click “Dial-Up Networking”.

If you do not have “Dial-Up Networking” on Accessories, you can install it from “Add/Remove Programs” icon clicking the “Windows Setup” tab (you can access “Add/Remove Programs” from the “Control Panel”).

• Double click on “Make New Connection”. Two windows will appear. In the active one, you should make your Windows detect your modem if it was not detected before.

• Click “Next” to make Windows detect your modem.

• After detection is completed you will see your modem name and type in a new window.

(If Windows can not detect your modem, then you should make it manually. To do this select “Don’t detect my modem; I will select it from a list”, and click “Next” button. Then click “Have disk” button on the new window.)

• Write anything (for example METU) in the field for the computer name.

• Click “Configure…” button and then click “Options” tab.
Select “Bring up terminal windows after dialing”.
Click “OK” and then “Next”.
Type the “Area-code”, “Telephone number” and the “Country code”.

0822 3141014 and 2101155 phone numbers are for academics, and 2101040 is for students in METU.

Click “Next”.

Click “Finish”.

Click the right mouse button on your connection.
Select “Properties”.

Unselect “Use country code and area code” and then click “Server Types” tab.
• Make your selections according to the following window for Windows 98. (For Windows 95, select “PPP: Windows 95, Windows NT 3.5, Internet” option.)

• Unselect “NETBEUI”.
• Unselect “IPX/SPX compatible” etc.
• Click “OK”.
• Again from “Server Types” click “TCP/IP Settings...”. Make your configurations according to the following window.

• Unselect “Use IP header compression”.
• Click “OK” until you return to Dial Up Networking window. (Make new connection and your connection window).
• Double click on your connection (METU in our case).

Click “Connect” button.
• You will see the following window.

• After you connect to the line, you will see the following window.

• Type your “user code” and “password” that you use on rorqual or orca systems in METU.
- After your user code and password are validated following window will appear.

- Type “ppp” as in the following window.

- After you see some garbage characters, click “Continue” or press “F7” on the keyboard.

- The following window declares that your connection has been established.

Anytime you want to connect to METU systems, just double click your connection on the Dial-Up Networking window and click Connect button. You can minimize the last window shown above and use Internet programs like browsers, telnet, or FTP programs.

- Press “Enter” on the keyboard.
APPENDIX C Setting Up Ethernet Card for Windows 9x

To be able to connect your computer to Local Area Network (LAN) you should have an ethernet card and configure it. The following document contains all steps that you need while installing and configuring your ethernet card on Windows 9x. You should obtain network information (like your IP number, gateway IP number, DNS IP number), and a UTP patch cable.

- Plug off your computer and open the chassis. Be sure that your computer will not lost its warranty since you open it. If that is the case, contact your firm to install the ethernet card to the computer.
- Place your ethernet card into an empty PCI or ISA slot. Short, white slots are PCI slots whereas long, brown ones are ISA slots (short, brown slots are AGP slots. Do not try to place your card there).
- Be sure that your card is inserted correctly to the slot, and then screw the card to the chassis.
- Now, you can power on your computer. When starting, Windows will find the ethernet card.

- Place the diskette or CD-ROM given with the Ethernet card to you into the corresponding driver.

- Click the “Search for the best driver for your device” choice.
- Continue with “Next”.

- Select the “Specify a location” choice, and click the “Browse” button. From the menu opened, select the operating system that your computer use (Windows 95 or 98).
- Continue with “Next”.

- Windows will inform you about your Ethernet card manufacturer name and model.
• Continue with “Next”.

![Insert Disk](image)

• Continue with “OK”

![Copying Files](image)

• Select again the directory that contains your operating system drivers, and click “OK” to continue.

![Network Neighborhood](image)

• Windows will now load the necessary files into your computer. It may want you to restart the computer.

• After restart, right click the “Network Neighborhood” icon.

• Select “Properties” field to set up your configurations.

![Network](image)

• This is your Network Configuration menu. Click the “Identification” field.

• Write your computer name that you want. Workgroup name is an identification of a computer group. You can see the computers under the same workgroup as you by double clicking the “Network Neighborhood” icon later.

• From the “Access Control” field, select the “Share-level access control” option.
- Return back to the “Configuration” field. We should add a new protocol and service.
- Click to “Add” button below.

- Double click the “Protocol” or after highlight it, click the “Add” button.

- Select “Microsoft” from left menu, and “NetBEUI” from right menu. Click “OK” to continue.

- To share your printers and directories, you should have to add another service.
- Click again “Add” button.

- Double click the service icon.
Select the “File and printer sharing for Microsoft Networks” icon, and click “OK” button to continue.

You successfully added the NetBEUI protocol and sharing service to your computer.

Now, click the “Client for Microsoft Networks” icon.

Check that “Log on to Windows NT domain” option is NOT checked if your network does not have Windows NT server. If there is, contact the server administrator to obtain username and password.

Lastly, you should add the Internet Protocol (IP) address to your computer.

Double click the “TCP/IP” icon or after highlight it, click the properties button.

Click the “Specify an IP address” option and write the IP address and subnet mask into fields.
Some networks have servers sending TCP/IP configurations to computers connected to network. If your network has that property, click the “Obtain an IP address automatically”, otherwise, write your IP Address shown below and “OK” to finish configuration.

Activate the DNS by clicking “Enable DNS” option. Write your DNS Server(s) in “DNS Server Search Order” field and click “Add”.

At last, click the “File and Printer Sharing” button at “Configuration” field.

Click both options to be able to share your files and printers. Click “OK” to continue.
- Click “OK” to finish the configuration. After restarting your computer, from “Start”, click “Run” and write
  `ping -t <your_ip_number>`

- If you get “Request timed out.” messages, there is something wrong with configurations. Check the above steps again to eliminate the wrong configuration. There is also possibility of wrong installation of ethernet card.

- If you get “Reply from xxx” messages, it means that you successfully installed and configured your ethernet card.
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