

occur in a secure setting (i.e. The users who are transferring files know each other's names and passwords and are permitted to transfer the file, whereas mail can be sent to anybody as long as their name is known).

While mail and transfer accomplish the transfer of raw information from one computer to another, Telnet allows a distant user to process that information, either by logging in to a remote computer or by linking to another terminal. Telnet is most often used to remotely log in to a distant computer, but it is actually a general-purpose communications protocol. I have found it incredibly useful over the last year. In some ways, it could be used for a great deal of access because you can directly connect to another computer anywhere that has TCP/IP capabilities, however please note that Telnet is "NOT" Telenet. There are other functions that some networks provide, including the following:

- Name to address translation for networks, computers and people
- The current time
- Quote of the day or fortune
- Printing on a remote printer, or use of any other remote peripheral
- Submission of batch jobs for non-interactive execution
- Dialogues and conferencing between multiple users
- Remote procedure call (i.e. Distributing program execution over several remote computers)
- Transmission of voice or video information

Some of these functions are still in the experimental stages and require faster computer networks than currently exist. In the future, new functions will undoubtedly be invented and existing ones improved.

The DOD Protocol Suite is a layered network architecture, which means that network functions are performed by different programs that work independently and in harmony with each other. Not only are there different programs but there are different protocols. The protocols SMTP, FTP and Telnet are described above. Protocols have been defined for getting the current time, the quote of the day, and for translating names. These protocols are called applications protocols because users directly interact with the programs that implement these protocols.

The Transmission Control Protocol, TCP, is used by many of the application protocols. Users almost never interact with TCP directly. TCP establishes a reliable end-to-end connection between two processes on remote computers. Data is sent through a network in small chunks called packets to improve reliability and performance. TCP ensures that packets arrive in order and without errors. If a packet does have errors, TCP requests that the packet be retransmitted.

In turn, TCP calls upon IP, Internet Protocol, to move the data from one network to another. IP is still not the lowest layer of the architecture, since there is usually a "data link layer protocol" below it. This can be any of a number of different protocols, two very common ones being X.25 and Ethernet.

FTP, Telnet and SMTP are called "application protocols", since they are directly used by applications programs that enable users to make use of the network. Network applications are the actual programs that implement these protocols and provide an interface between the user and the computer. An implementation of a network protocol is a program or package of programs that provides the desired network function such as file transfer. Since computers differ from vendor to vendor (e.g. IBM, DEC, CDC), each computer must have its own implementation of these protocols. However, the protocols are standardized so that computers can interpolate over the network (i.e. Can understand and process each other's data). For example, a TCP packet generated by an IBM computer can be read and processed by a DEC computer.

In many instances, network applications programs use the name of the protocol. For example, the program that transfers files may be called "FTP" and the program that allows remote logins may be called "Telnet." Sometimes these protocols are incorporated into larger packages, as is common with SMTP. Many computers have mail programs that allow users on the same computer to send mail to each other. SMTP functions are often added to these mail programs so that users can also send and receive mail through a network. In such cases, there is no separate program called SMTP that the user can access, since the mail program provides the user interface to this network function.

Specific implementation of network protocols, such as FTP, are tailored to the computer hardware and operating system on which they are used. Therefore, the exact user interface varies from one implementation to another. For example, the FTP protocol specifies a set of FTP commands which each FTP implementation must understand and process. However, these are usually placed at a low level, often invisible to the user, who is given a higher set of commands to use.

These higher-level commands are not standardized so they may vary from one implementation of FTP to another. For some operating systems, not all of these commands make equal sense, such as "Change Directory," or may have different meanings. Therefore the specific user interface that the user sees will probably differ.

This file describes a generic implementation of the standard TCP/IP application protocols. Users must consult local documentation for specifics at their sites.

#### *Names and Addresses In A Network*

In DOD Protocol Suite, each network is given a unique identifying number. This number is assigned by a central authority, namely the Network Information Center run by SRI, abbreviated as SRI-NIC, in order to prevent more than one network from having the same network number. For example, the ARPAnet has network number 10 while MIDnet has a longer number, namely 128.242. Each host in a network has a unique identification so other hosts can specify them unambiguously. Host numbers are usually assigned by the organization that manages the