NET/ONE: A COMMERCIAL LOCAL AREA NETWORK

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INTRODUCTION

Net/One is a general purpose, local area communications network which interconnects data and word processing equipment within facilities such as office buildings, factories, laboratories, and computing centers. It is a system designed to maximize modularity, growth, and flexibility. From an initial installation of a few nodes, a network can be incrementally expanded to a communication system for thousands of digital devices.

Using a high-speed, bit serial bus architecture, Net/One supports point-to-point communications for computer systems, terminals, word processors, printers, and other digital devices. It also provides packet switched broadcast communications for intelligent devices and host computers. In addition, Net/One allows protocol translation between incompatible devices. No host software changes are required to utilize Net/One's virtual circuit capabilities. Devices can be connected to Net/One in several different ways allowing easy reconfiguration and a free choice of equipment vendors.

Net/One includes a number of modular components. A Network Administrative Station measures, monitors, and controls network activity. A user programmable Network Interface Unit allows unique management of specific interface functions. A Network Development System supports custom program development and testing.

NETWORK ARCHITECTURE

The Tap/Transceiver

Connection to the cable and data transmission are provided through a non-destructive tap with an integral, passive, baseband transceiver. The nondestructive tap permits connections to be added or removed from Net/One without interrupting network operation. Up to 200 taps may be placed on a single cable segment, with a minimum 10 feet separation between the taps. The passive nature of the transceiver allows the network to be unaffected by an inactive or malfunctioning node. The transceiver drives and receives data to and from the cable at 4 megabits per second using a modified Manchester encoding technique, and converts the cable's baseband signals to the logic levels required by the Network Interface Unit. The transceiver connects to the NIU with a 9 conductor cable which may be up to 80 feet in length.

NETWORK INTERFACE UNIT

The Network Interface Unit serves as the fundamental interface facility for a wide range of information processing equipment connected to a Net/One local area network. The NIU uses state-of-the-art packet-switching technology to move data in support of both point-to-point and broadcast communications. Its hardware provides for sharing of a high speed communications medium, using a Carrier Sense Multiple Access strategy with collision detection. Six (four serial and two parallel) standard electrical interfaces are available for connecting a variety of user equipment. Transport level protocols provide this equipment with both datagram and virtual circuit services.

Hardware

Functionally, the NIU hardware consists of a computer module and a

specialized transmit/receive (transceiver) interface module. The processing tasks handled by the computer module include support of the standard electrical interfaces as well as the network and transport protocols. The transceiver interface module provides complete management of the transmission medium.

Computer Module

The NIU computer module supports software that services user equipment interfaced to the NIU and provides active supervision and control over the transceiver interface. The computer's I/O section consists of four serial I/O ports and two 8-bit parallel I/O ports. Its memory section consists of both PROM and RAM components.

The four serial I/O ports are EIA RS-232 compatible interfaces which can be used to connect the NIU to data terminal equipment, host computers, or communication equipment. Each serial port can be configured to represent Data Communication Equipment (DCE) or Data Terminal Equipment (DTE).

The two parallel I/O ports provide flexible, TTL-level interface to a wide variety of peripheral devices. Each port includes eight input or output data lines with "strobe/ready" handshake lines. One port can be used in a bidirectional mode.

The PROM memory component contains power-on/reset diagnostics and bootload (IPL) logic. When the NIU is reset, the PROM firmware assumes control over processor activities, executes the power-on/reset diagnostics, and downloads a load module from either a locally attached or remotely accessible source. (When the NIU software has been loaded, the PROM is "mapped-out" of the address space to provide the NIU software with full addressability to RAM.)

The RAM component is partitioned into two separate memory arrays. The program array is used primarily for holding and executing the operational NIU software. The data array is used for buffering data packets on their way to and from the network. The data array is a dual-ported memory which can be accessed by both the computer and transceiver interface modules in order to facilitate rapid DMA transfers.

With the NIU Model 2, up to four computer modules can be configured in a single enclosure.

Transceiver Interface Module

The transceiver interface module gates packets to and from the local network. Link level (data encoding/decoding) and packet level (framing, CRC generation, and verification) protocols are handled by this specially designed hardware.

The transceiver interface module provides a 2K byte transmit First-In-First-Out (FIFO) buffer and a 4K byte receive FIFO buffer to stage packets on their way to and from the network. Packets in the transmit FIFO are gated to the net using a Carrier Sense Multiple Access protocol with the transmit hardware providing automatic, randomized retransmissions in the event of collisions. Packets arriving from the net are assembled in the receive FIFO buffer; only properly checksummed packets are passed in the NIU software. The receiver hardware will accept packets addressed either to itself (each receiver has a unique network address) or to a broadcast address which is common to all receivers.

Independent high-speed (2 Mbyte per second) DMA capability is provided for both transmit and receive data paths. Therefore, transfers in both directions may take place simultaneously, subject only to the available memory bandwidth.

Software

NIU software provides two specific transport protocol services: the Virtual Circuit service and the Datagram service.

The Virtual Circuit service provides a logical point-to-point circuit between any two devices, independent of their respective locations within the network. Most devices, such as interactive terminals or line printers, can be attached to the network by means of the Virtual Circuit service without changing their normal operation. Host computers can also use the Virtual Circuit service to gain access to these devices by means of any of their standard I/O ports. Virtual circuits may be established by a command string issued at either end of the desired circuit, by an operator at a privileged Net/One administrative station or by a power-on initialization procedure.

The Datagram service allows an intelligent device to exchange packets of information with other intelligent devices on the network. This NIU service provides the device with an interface that looks like a sophisticated broadcast medium. Both point-to-point and broadcast datagrams are supported.

The characteristics, or attributes of each device attached to an NIU port are held in a device-specific descriptor that may be modified from a Net/One administrative station, or by a user of the device.

Each NIU executes software that coordinates its activities with other

NIU's on the network. Thus, each NIU can participate in a variety of cooperative netwide operations, such as statistics acquisition, fault isolation, and network configuration and access control. In addition, each NIU can execute diagnostics that isolate faults to the circuit board level.

Power-on diagnostics are invoked at system reset, and verify the ability of the NIU to successfully transmit and receive data. Background mode diagnostics continue to monitor NIU operation and verify software integrity. More extensive diagnostic information may be gathered by setting the NIU to test mode. All NIU's in this mode establish communication with each other to implement a distributed diagnostic and network exercisor.