Terrestrial Wideband Network

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Description

The Terrestrial Wideband Network was built and deployed by BBN STC as a part of the initial phase of the Defense Research Internet (DRI). In May 1989, this network replaced the Satellite Wideband Network, which had been in operation for the previous 8 years. The Satellite Wideband was a domestic 3 Mbit/sec network that had been used for research into the use of packet satellite technology to efficiently support applications with varying delay, throughput, and reliability requirements, e.g., interconnection of distributed operating system clusters, development of end-to-end bulk transfer protocols, multimedia conferencing, interconnection real-time interactive simulation/training systems. The Terrestrial Wideband continues this tradition by using one of the cross-country T1 trunks from the DARPA National Networking Testbed (NNT) to support research in high speed networking, to provide connectivity among academic and government sites, and to support a testbed for Internet protocol development and experimentation with applications. Currently this network is carrying cross-country Internet datagram traffic associated with DARPA-funded projects. It also supports a research environment for multimedia conferencing and voice/video conferencing using gateways which use a real-time connection oriented protocol over a connectionless network.

Network Access

Access to the Terrestrial Wideband is typically via an IP or ST gateway. Connection of such a host is at the discretion of DARPA. The current network includes the following Wideband Packet Switches (WPS) and user sites -- BBN (BBN), NY (RADC), Washington (DARPA, NRL), Chicago (NCSA), LA (ISI), SRI (SRI, Stanford). This fall, Ft Monmouth will be connected to the NY WPS and CMU will be connected to a WPS to be installed in Pittsburgh.

Who Can Use the Network

The Terrestrial Wideband Network is to be used for DARPA-funded research and development activities of the Internet community. Users typically access the network via gateways which have Internet connectivity to the Terrestrial Wideband Network. Applications which might benefit most from the Terrestrial Wideband Network are those which require high bandwidth and/or low delay between geographically distant sites, such as bulk file transfer, remote procedure calls, conferencing, graphic simulations, and distributed operating systems.

Miscellaneous Information

a) System and Network Architecture

The Terrestrial Wideband is currently a trans-continental network built on T1 trunks belonging to the National Networking Testbed (NNT). The Wideband packet switch nodes (WPSs) are located at unattended NNT Points of Presence (POPs). They are based on Butterfly multiprocessor hardware and are connected via the T1 fiberoptic trunks into a backbone configuration. The WPSs pass network traffic using the Dual Bus Protocol reservation scheme. Local area networks at user sites, e.g., ethernets, are connected to the backbone packet switches via Internet IP and ST gateways and T1 tail circuits.

The current topology of the network, which resulted from external constraints, is a series of packet switches connected in a line by T1 trunks. This can result in partitioning of the network in the event of a packet switch failure. To minimize outages, the Terrestrial Wideband Network includes a number of features. The multiprocessor hardware configuration used for the packet switch provides redundancy in case a processor node fails. Also, a failsafe box isolates the WPS upon detection of an outage while continuing to maintain connectivity between the T1 trunks in and out of the failed WPS, thus maintaining network continuity. The network also allows remote dial-in access for a number of emergency functions that would otherwise have to be performed by on-site staff.

b) Operations

A remote monitoring center provides network control capabilities, and a dialup capability provides backup monitoring and control when necessary. The Terrestrial Wideband Network packet switch software can be updated via remote downloading. Network operations support is provided between 8AM and 8PM Eastern time.

c) Protocols

- TCP/IP traffic is supported by the Terrestrial Wideband Network. This is accomplished by using standard Internet gateways.

- Stream Protocol (ST) protocol (based on IEN 119) is used between gateways which support voice/video traffic. This is a connection-oriented protocol which operates over the connectionless Terrestrial Wideband Network, and allows the gateways to send packets to other destinations with minimal delay, as is required for voice/video conferencing.

- Gateways communicate with the Terrestrial Wideband Network packet switches (WPSs) via the Host Access Protocol (HAP), specified in RFC 907-A. This is a protocol by which a host can send datagrams across the network, and can request and manage network bandwidth.

- The WPS software provides an echo host which responds to ICMP ping packets.

- Dual Bus Protocol provides a link-level transport protocol which uses a reservation mechanism to provide access fairness for each WPS. This is a type of Distributed Queue Dual Bus (DQDB) protocol similar to the IEEE 802.6 Metropolitan Area Network (MAN) protocol, but with features that support wide area networking and multimedia conferencing. Whereas conventional packet store and forwarding would involve per packet forwarding processing and buffering at every intermediate node, a DQDB protocol performs processing and buffering only at the entry point and minimizes the processing and buffering at subsequent nodes along the trunk until the exit point.

- Wideband Monitoring Protocol (IP protocol number 78) is used between the WPSs and the monitoring center.