LAYERED VS WIDE AREA (FLAT) PACKET NETWORKS

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Flat wide area networks (WANs) utilize packet nodes all on the same frequency, and placed on tall towers to extend the radio horizons so to minimize the number of nodes and thus the cost to cover a wide area. The tradeoff is that many of the stations can "see" each other resulting in undesirable channel sharing over large portions of the network. A layered network uses different frequencies for local operations than for point-to-point links between local area networks (LANs) to virtually eliminate channel sharing except at each LAN where sharing is manageable. Greater throughput on a 24/7 basis is more assured than on a WAN. The tradeoff is that a greater number of packet switches is required as the coverage by each is not as broad.

In a flat WAN a station in each of two neighboring LANs may communicate beyond their radio horizons much as when using a voice repeater. Connections are made between the nodes using digipeating (as in APRS), or node-to-node connections (as in SEDAN). The latter facilitates data transfers using temporary store-and-forward of the data eliminating the need for end-to-end digipeating acknowledgement. Where sufficient stations are strategically located, and conditions amenable, connections may be made over several hundred miles in tens of seconds. Since all nodes are on the same frequency, they must timeshare the channel. Two neighbor nodes may keep many others tied up as the protocol only permits one station within the broad radio horizon to use the channel at one time. The use of tall towers increases the occurrence of interference between alternate neighbor stations. In Florida skip due to ducting on vhf/uhf often aggravates this situation, reducing the throughput rate on sections of a flat WAN. The occurrence of "hidden transmitters" (stations which are not seen by all nodes) increases as the number of nodes increases and as the range of any single node increases with antenna height or unusual propagation. Therefore, where a LAN is on the same frequency as the flat WAN, (i.e., all user stations are on the WAN frequency, along with the network NODES), the network may become loaded with just a few stations passing information. (Six stations in the Sanford, FL area tested the conference mode on the local SEDAN node on 145.770 after dark. Within five minutes over half of the SEDAN network in Florida was tied up. Yet, all the stations on the conference were only connected to the local SEDAN node.)

Most WANs are not equipped to handle large data file (message) transfers. Neither the APRS nor the SEDAN networks accommodate large file transfers, and specifically discourage the use of BBS-to-BBS transfers across the network.

The layered network approach is designed to minimize, virtually eliminate, interference between adjacent LANs by (1) coordinating neighboring LANs on different frequencies, and (2) connecting between neighbor LANs on yet a third frequency. With proper coordination, channel timesharing is restricted to the LAN level, each LAN is independent, and transfers between LANs are transparent to all users. Antenna height and ERP are driven only by requirements to serve the LAN, and beams are used for point-to-point backbone transfers between LANs. This requires a greater number of packet nodes than a WAN to cover a wide area but, when taken to full fruition, provides excellent throughput on a 24/7 basis and is less susceptible to changing propagation conditions.

The main purpose for the layered network in Florida is to move large message files from one location to another, primarily in support of emergency communications preparedness. The most efficient way to manage this is to use BBS-to-BBS transfers that are automated once configured. BBS protocols are efficient at managing transfers through a network. Because BBS transfers are generally not made on the LANs, keyboard QSOs on a LAN, user keyboard QSOs between LANs over the backbones, and BBS transfers between LANs over the backbones may be ongoing at the same time. This is ideal to support emergency operations in adjacent LANs (e.g. two adjacent counties), as neither LAN will interfere with the other, yet traffic flows freely between LANs over the backbone channels.

The layered network in Florida employs switches using the ROSE or compatible FPAC network management. A typical network switch has three radio ports on three different frequencies. Each port requires a TNC, a radio, and an antenna. The 2M LAN is one port on a switch; the other two ports are backbones, each linking to a different neighboring switch. The switching functions between ports are managed by firmware or computer, totally transparent to users on the network.

Local keyboard users on the LAN connect to users on another LAN through the switch which automatically routes to the destination over the backbone ports at higher speed. Network routing tables are established at each NODE and may be updated remotely. This facilitates routing between any two packet stations that have network access anywhere in the State. A connection is made by sending only three elements in a single command: target mycall, local switch call, and target node identifier. The network manages the connection across all network nodes totally transparent to the user. This automatic routing scheme is not compatible with that used by X1J-, TheNet, or KA nodes commonly employed on wide area flat networks in Florida.

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