TECHNOLOGY

Overview

Tsunami™ Delivers A Tidal Wave of Bandwidth: Tsunami FDD vs 802.11 TDD Technology

As network professionals consider different wireless Ethernet bridge options, the question of which technology to deploy can be perplexing. This Technology Overview focuses on the two major radio technologies typically under consideration: Frequency Division Duplex (FDD), which is the technology underlying Tsunami Wireless Ethernet Bridges, and Time Division Duplex (TDD), which is typically used in 802.11 environments and other point-to-multipoint platforms. FDD technology and its focus on high-speed point-to-point connectivity enables Tsunami to consistently provide superior throughput and distance when compared to TDD technology.

Design Focus: Point-to-Point vs Point-to-Multipoint

Tsunami Wireless Ethernet Bridges were designed from their inception to provide the fastest possible throughput and the longest possible distances when transmitting data between two points. This focus on high-performance point-to-point communication enables Tsunami to consistently provide full network speeds from under 10 Mbps to over 420 Mbps full duplex. Tsunami innovation continues to focus on providing more bandwidth over longer distances to facilitate higher volumes of IP traffic.

In contrast, the IEEE 802.11 technology was designed with a focus on enabling point-to-multipoint communications for Wireless Local Area Networking (WLAN) applications. As a secondary application, 802.11 has been used to provide point-to-point communications. This strategy has enabled 802.11 technologies to offer innovative WLAN solutions to the mobile PC environment, but has resulted in relatively slow point-to-point throughput compared to Tsunami Wireless Ethernet Bridges.

Performance: Full or Half Duplex

Tsunami Wireless Ethernet Bridges use FDD technology to provide maximum throughput. FDD uses two separate frequencies that are "always on" in both directions. This approach eliminates the protocol communications overhead required by TDD devices and allows for "actual" throughput in both directions at the same time. As a May 2000 *Network Computing* magazine article reviewing wireless bridges including the Tsunami 10 stated, "Proxim also had the only true full-duplex radio among our tested products, with the ability to transmit a total of 24 Mbps over the air."[1]

All 802.11-based devices use Time Division Duplexing (TDD) to transmit data. A TDD product changes directions with a single frequency to accomplish the bi-directional "duplexing," incurring a considerable amount of protocol overhead to manage the communications. Typically, 802.11 devices operate at "half duplex." While any 802.11 bridge is called an "11Mb" bridge, the true throughput at the data network layer (layer 2) is only about half on a point-to-point system. For example, the *Network Computing* magazine article found that the Cisco Aironet 340 Series offers maximum radio bandwidth of 11 Mbps, but averages 5.5 Mbps for large amounts of data and 4.8 Mbps for smaller burst segments at the data network layer.

This fundamental technical difference permits Tsunami to provide superior speed for point-to-point connectivity. Tsunami Wireless Ethernet Bridges can provide full 10 Mbps throughput at the base data network layer (IEEE 802.3), while 802.11 bridges provide significantly less than their 11 Mbps peak radio throughput when one measures at the network layer.

Wayside T1/E1s: Tsunami Has You Covered

Tsunami Wireless Ethernet Bridges not only provide superior data throughput, but also add "industrial strength" features such as an available "wayside" T1/E1 line. A Tsunami 10MB bridge transports a true 10MB throughput at the data network layer while also providing one or two telephony-grade T1 or E1 lines that ride independently on the side of the Ethernet circuit.

These T1 or E1 lines can be used to connect PBXs, provide dedicated video conferencing or support other applications that utilize a typical telephony circuit. Voice circuits that would normally be toll calls can be

completely eliminated with the Tsunami wayside T1/E1 in a campus environment.

Wayside T1/E1 lines are not available on 802.11 products.

FDD & Tsunami Go The Distance

FDD also differs from TDD technology in the distance it can cover. Any TDD device suffers from a phenomenon known as "degradation of bandwidth over distance." This refers to the usable throughput figure decreasing based on an increase in distance.

For example, an 802.11 system at five miles may get the maximum possible throughput of about 6 Mbps. However, as distance increases, the throughput decreases so that at 10 miles the throughput may be only 3Mbps. At 15 miles the throughput might be 2 Mbps. At 20 miles you might obtain 1 Mbps (if you get anything at all).

Tsunami Wireless Ethernet Bridges maintain a consistent and "non degraded" throughput at distances of less than one mile to more than 40 miles (8 Mbps for our Tsunami 8 Wireless Ethernet Bridge, 10Mbps for our Tsunami 10 Wireless Ethernet bridge, 45Mbps for our Tsunami 45 Wireless Ethernet Bridge, etc.). This bandwidth is available at whatever distance the Tsunami link covers, making Tsunami Wireless Ethernet Bridges the leaders in terms of distance.

This combination of high throughput at significant distances makes Tsunami the ideal solution for building-to-building interconnection for enterprises, as well as "last mile" connection and "middle mile" backhaul applications for service providers.

[1] "Wireless Bridges Span the Divide," Network Computing Magazine May 1, 2000. (www.networkcomputing.com)

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