King Fahd University of Petroleum & Minerals

Electrical Engineering Department

EE 400, Experiment # 5

LAN Extension by Bridges and WAN Connectivity by Routers using HDSL Links

Objectives:

In this experiment students will learn the connectivity and configuration issues for a Point-topoint LAN extension by bridges and LANs connectivity over a WAN by routers using HDSL link. Students will have hands-on practice for the configuration of the involved network components i.e. HDSL equipment, bridges and routers.

Introduction:

The campus HDSL system provides connection between geographically distributed Ethernet Local Area Networks (LANs) in a campus environment. To provide the connection, the campus-REX performs MAC bridging or static IP routing over a HDSL line. Telephone-grade copper wiring can be used as the HDSL transmission medium. When LANs are distributed over a large physical area (such as within a metropolitan area) or cabling is not available between sites, unloaded pair of coppers may be leased from a local carrier for LAN connectivity.

XDSL:

DSL stands for Digital Subscriber Line:

- *Digital* means a line able to carry data traffic in its original form, as opposed to analog (see below)
- *Subscriber Line* the line connecting the individual subscriber (e.g. a household) to the local exchange

Digital Subscriber Line (DSL) technology is a modem technology that uses existing twistedpair telephone lines to transport high-bandwidth data, such as multimedia and video, to service subscribers. The term *xDSL* covers a number of similar yet competing forms of DSL technologies, including ADSL, SDSL, HDSL, HDSL-2, G.SHDL, IDSL, and VDSL. xDSL services are dedicated, point-to-point, public network access over twisted-pair copper wire on the local loop between a network service provider's (NSP) central office and the customer site, or on local loops created either intrabuilding or intracampus

DSL Type	Description	Data Rate Down/Upstream	Distance Limit	Application
ADSL	Asymmetric Digital Subscriber Line	Up to 8 Mbps downstream; Up to 1 Mbps upstream	1.544 Mbps at 18,000 feet; 2.048 Mbps at 16,000 feet; 6.312 Mpbs at 12,000 feet; 8.448 Mbps at 9,000 feet	Used for Internet and Web access, motion video, video on demand, remote LAN access
G.Lite	Splitterless DSL	Up to 1.5 Mbps downstream; Up to 0.5 Mbps upstream	18,000 feet on 24 gauge wire	The standard ADSL; sacrifices speed for not having to install a splitter at the user's home or business
HDSL	High bit-rate Digital Subscriber Line	1.544/2.048 Mbps duplex on two twisted-pair lines	12,000 feet on 24 gauge wire	T1/E1 service between server and phone company or within a company; WAN, LAN extension, server access
SDSL	Symmetric DSL	1.544 / 2.048 Mbps on a single duplex line downstream and upstream	12,000 feet on 24 gauge wire	Same as for HDSL but requiring only one line of twisted-pair
VDSL	Very high bit- rate Digital Subscriber Line	12.9 to 52.8 Mbpsdownstream;1.5 to 2.3 Mbps upstream;1.6 Mbps to 2.3 Mbpsdownstream	4,500 feet at 12.96 Mbps; 3,000 feet at 25.82 Mbps; 1,000 feet at 51.84 Mbps	ATM networks; Fiber to the Neighborhood

DSL Summary Table

Exercise:

A. Point-to-point LAN extension by bridges using HDSL link

- 1. Connect the campus-REX unit1 to the console using COM1.
- 2. Log on the HyperTerminal utility. Press Spacebar and you will be asked to enter password. Hit Enter to skip the password.
- 3. You are now in the Main Menu. Go to System Settings Menu.
- 4. Go to HDSL Parameters Menu. Set the HDSL operating mode to be Standard. Set transceiver mode to Auto and HDSL Rate to E1.
- 5. Return to main menu.
- 6. Go to Data Port Settings Menu.
- 7. Go to Bridge/Router configuration.
- 8. Set Bridge/Router mode to Bridge, Encapsulation to HDLC, and Timing source to Internal.
- 9. Assign the device (here half bridge) an IP address that may be used to connect to the device in case of any remote reconfiguration or troubleshooting.
- 10. Return to Data Port Settings Menu. Perform Write NVRAM operation and Reset the interface.
- 11. Configure the other unit also with the same settings.
- 12. Connect the units to each other on Line Port using straight cat-3 or cat-5 UTP cable.
- 13. Connect unit1 to the Switch1 and unit2 to the Switch2 on 10BaseT/LAN ports using straight cat-3 or cat-5 UTP cable.
- 14. Connect the two terminals/(groups of PCs) on Switch1 and Switch2, respectively.
- 15. Check the connectivity of the two network groups/sections by Pinging each other in a step by step manner.
- 16. The IP addresses of all of the nodes must be from the same subnet.

Note: Follow the figure 5.1

B. LAN connectivity over a WAN by routers using HDSL link

- 1. Repeat steps 1 to 7 from part A.
- 2. Set Bridge/Router mode to Router and Encapsulation to HDLC.
- 3. Assign LAN and Line IP addresses and subnet masks. Enter the default gateway address.
- 4. Return to Data Port Settings Menu. Perform Write NVRAM operation and Reset the interface.
- 5. Configure the other unit also with the same settings
- 6. Repeat steps 12 to 15 from part A.

Note: Follow the figure 5.2

Figure 5.1: Bridge Mode



Note: All Subnet Masks = 255.255.240.0

Figure 5.2: Router Mode



Note: X-cable has to be replaced by straight cable if the DSL modem is connected to a Hub/Switch instead of a PC.