# King Fahd University of Petroleum & Minerals

Electrical Engineering Department

## EE 400, Experiment # 6

# 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-to-point 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 twisted-pair 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 Summary Table**

| 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 Mbps downstream; 1.5 to 2.3 Mbps upstream; 1.6 Mbps to 2.3 Mbps downstream | 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 |

## 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.

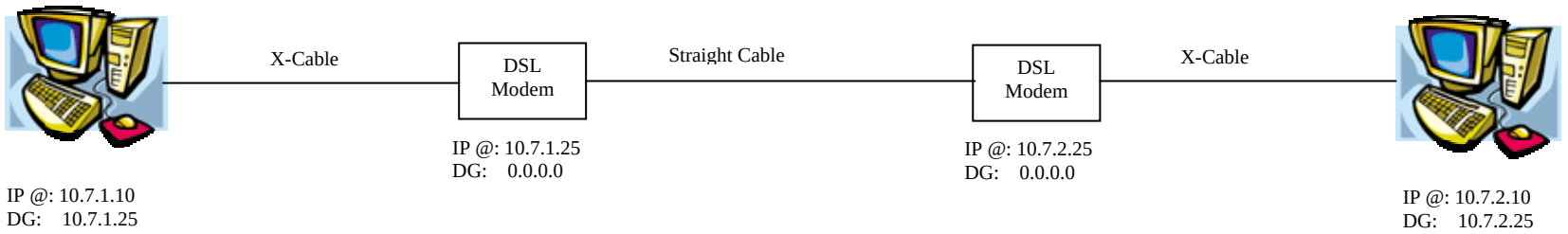
**Note:** Follow the figure 6.1

## 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.

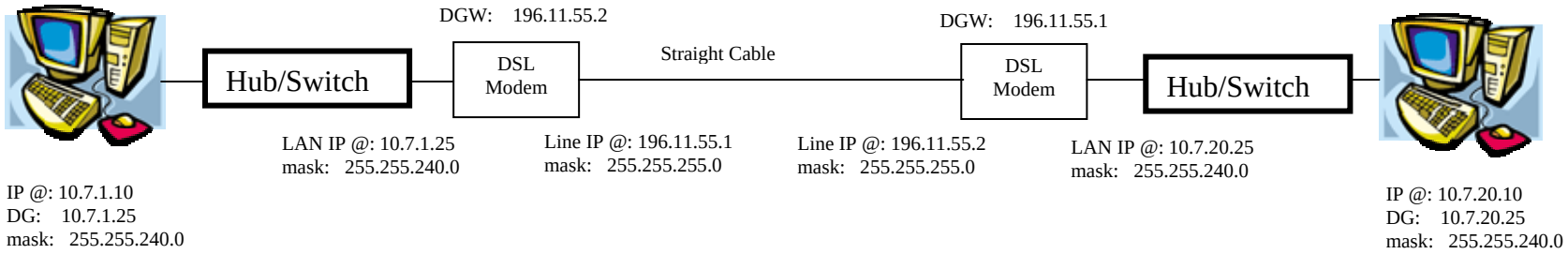
**Note:** Follow the figure 6.2

# Figure 6.1: Bridge Mode




Note: All Subnet Masks = 255.255.240.0

# Figure 6.2: 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.