Lab X2: PPP Connections (Extra Credit)

The purpose of this lab is to connect a standalone computer to a LAN using a serial connection with PPP. Whereas the serial connection is usually established with analog modems, in this lab, you will establish the serial connection with a virtual null-modem cable connecting the serial ports of two computers. You will first create the PPP link by hand, and then automate the connection with PPP scripts. In the following discussion, Sauron will be to the isolated client, Arwen will refer to the computer acting as the PPP server, and Celebrian will refer to another system on the 192.168.2.0 LAN.
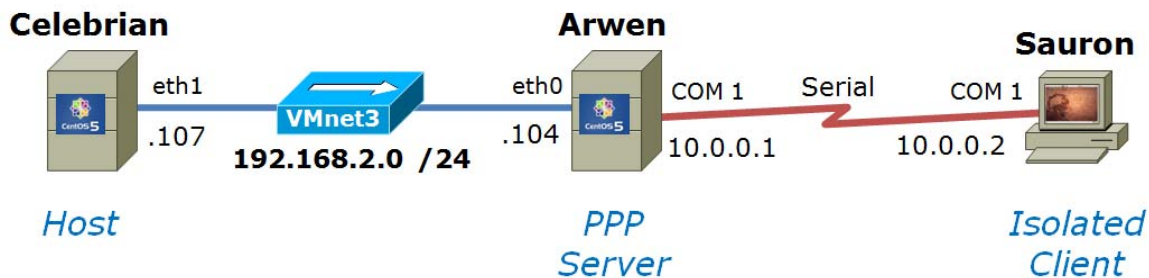
Supplies

- VMWare Server 1.08 or higher
- 192 VMs: Celebrian, Arwen and Sauron
- Virtual networks: VMnet3

Preconfiguration

- Original versions of all VMs.
- If you plan to do this lab at home see: http://simms-teach.com/howtos/129-working-at-home.pdf

Forum

Use the forum to ask for help, post tips and any lessons learned when you have finished. Forum is at: http://simms-teach.com/forum/viewforum.php?f=18

Background

PPP has replaced SLIP as the preferred method for establishing serial connections between computers that emulate a network connection. Operating at the network interface layer of the TCP/IP stack, PPP relies on an external component for establishing the serial link and then manages that connection to act as an IP connection so that network applications will work transparently across the link. At first you will use minicom, a small communications utility, to establish a serial connection. Second, you will use the chat utility with PPP scripts to both establish the connection and start the interface. PPP is a peer-to-peer protocol that requires the pppd daemon to be running on both sides of the connection. The client is simply the computer that initiates the connection; the server responds to it. Once a connection is establish and a PPP interface built, you must perform any necessary routing changes to make use of the new interface.

The commands we will be using for this lab are:

- pppd
- minicom
- chat
- commands used in prior labs.

Configuring the pppd daemon requires root access since PPP modifies network settings. Note that although you will be using three machines, you don't need the 172.30.4.0 network.

Procedure

Part 1

Connect Sauron with Arwen using a **virtual** null-modem cable plugged into the serial (COM 1) port of each computer, and enable the server Arwen to accept login connections from that port.

1. **Revert to snapshot** both Sauron and Arwen.
2. Virtually cable the **eth1** port on Celebrian and the **eth0** port of Arwen to **VMnet3**.
3. Sauron and Arwen will need some serial ports (COM 1). To implement this in VMware they will use something called a "named pipe".
4. Use the **VMware Hardware Wizard** to add a serial port to both Arwen and Sauron. For the Serial port access use **Output to named pipe**. Take the defaults from there.
5. After adding the serial ports to both VMs configure the ends of the cable using VM settings. On Arwen select **This end is the server** (where the pppd is running). On Sauron select **This end is the client**.
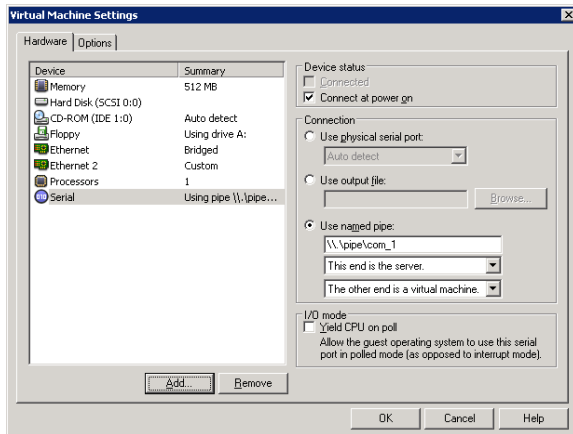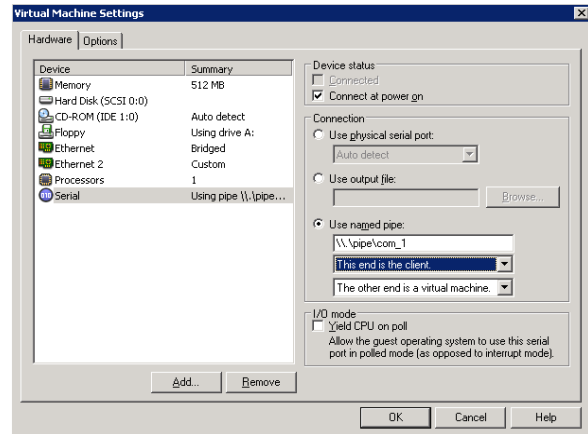
Arwen (server end)　　　　　　　　Sauron (client end)

6. When you have virtually "connected the two computers with the null-modem cable", power up Arwen and logon as root.
7. Verify that the serial port exists and is active:
   ls -l /dev/ttyS?
   setserial /dev/ttyS0
   Note that the COM1 serial port is accessed through the device file /dev/ttyS0.
   Verify that the serial chip is a UART 16550A which can support baud rates in excess of 14400.
8. Enable this port for logins by editing /etc/inittab. Add the following line near the bottom of the file:
   s1:35:respawn:/sbin/agetty 38400 ttyS0
9. Tell init to re-read the inittab file:
   telinit q
10. Allow the pppd daemon to be executed by normal users by setting the user id bit:
   chmod u+s /usr/sbin/pppd
   Verify the "s" bit is set (rwsr_xr_x) with:
   ls -l /usr/sbin/pppd

Part 2

Bring up the client Sauron and manually connect to the server Arwen using minicom.

1. Log in to Sauron as root, we will need to install the minicom utility.
2. Use the VM settings for Sauron to connect eth0 to the lab network. This is done by configuring the Ethernet device to **Bridged.**
3. Bring up the eth0 interface and get a 172.30.N.1xx IP address using dhcp
   ifconfig eth0 up
   dhclient
4. Install the minicom utility
   apt-get install minicom
5. Isolate Sauron from the network by bringing down the network interface:
   dhclient -r
   ifconfig eth0 down
6. Unplug Sauron from the lab network. Use VMware settings to change the connection back to VMnet4. You can disconnect the interface as well.
7. Verify that eth0 is down using the **ifconfig** command.

8. You are now going to configure the minicom utility which runs in character mode using the curses library. Configure the minicom utility to use the COM1 serial port:

   minicom -s
   Select (down arrow) **Serial port setup**
   Change **A** to be **/dev/ttyS0**

```
+------------------------------------------------------------------------------+
|   A -     Serial Device      : /dev/ttyS0                                     |
|   B - Lockfile Location      : /var/lock                                      |
|   C -    Callin Program      :                                               |
|   D -   Callout Program      :                                               |
|   E -      Bps/Par/Bits      : 115200 8N1                                     |
|   F - Hardware Flow Control  : Yes                                            |
|   G - Software Flow Control  : No                                            |
|                                                                              |
|     Change which setting?                                                    |
+------------------------------------------------------------------------------+
            | Screen and keyboard      |
            | Save setup as dfl        |
            | Save setup as..          |
            | Exit                     |
            | Exit from Minicom        |
            +--------------------------+
```

   Use Esc key to exit the submenu.
   Select **Save setup as dfl** (for default). Note this saves the config file in /etc/minicom/minirc.dfl.
   Select **Exit from Minicom**
9. Connect to the server and log in as user cis192:
   minicom -o
   Note: after minicom comes up, press the enter key once or twice until you get the login prompt.
   (The -o option forgoes the modem initialization sequence)
10. Verify that you are on the server using the **hostname** command.
11. Logout from the cis192 account on the server.
12. Exit the minicom utility with the following key sequence:
    Ctrl-A z q
    and confirm your decision to **Leave without reset** as Yes.

Part 3

You will now create and configure a guest account on the server Arwen to start the pppd daemon automatically when it is logged into. The client Sauron will then initiate the login session and start PPP on the client side thereby establishing a network session.

1. Create a guest account on **Arwen** using:
   useradd -c "Guest account for serial access" guest
   passwd guest
2. Edit .bash_profile in guest's home directory by appending the following command line to the bottom of the file:
   /usr/sbin/pppd -detach crtscts proxyarp 10.0.0.1:10.0.0.2 /dev/ttyS0 38400

2. On the client Sauron, use the minicom utility (with the -o option) to **login as guest** to **Arwen**. When you log in, you should see some "garbage" characters spewed out to the screen. This is pppd talking to you.
3. Quit the minicom session with the following keystrokes:
    Ctrl-A z q
   and **quickly** type the following command at the prompt:
    pppd -detach crtscts /dev/ttyS0 38400 &
4. You should get a connection, assuming you didn't take too long to type the above command.
5. Use **ifconfig** to verify that you have a connection. You should see the ppp0 interface. Note the server IP address and the client IP address. **Ping** the server Arwen from the client Sauron.
6. Power up **Celebrian**.
7. Configure the Ethernet interfaces on **Celebrian** and **Arwen** as shown in the map above.
8. Set up the server Arwen as a router by turning on IP forwarding.
    echo 1 > /proc/sys/net/ipv4/ip_forward
9. Set up the routing tables so that client Sauron can ping the host Celebrian on the 192.168.2.0 network. Save the output of a successful ping as part of your lab submission. Who's routing tables did you have to configure?
10. Terminate the PPP connection from the client Sauron by killing the pppd process:
    killall pppd

Part 4

Now that you have successfully set up a PPP connection manually in Part III, you will configure ppp scripts to automate the whole process, including the configuration of the routing table.

1. On the server Arwen create a special account for ppp connections:
    useradd -u 100 -g 100 -c "PPP Account" -d /etc/ppp -s /usr/sbin/pppd ppp
   Note: we are making the pppd daemon the shell for this account!
2. Set the password on this account to be "**secret**"
    passwd ppp
3. Options for the pppd daemon can be specified in the /etc/ppp/options file. Make sure the following options are specified in that file, one option per line:
    -detach
    crtscts
    lock
    proxyarp
    10.0.0.1:10.0.0.2
    /dev/ttyS0
    38400
4. On the client Sauron, in root's directory, write a script called ppp-on that contains the following line:
    **pppd updetach crtscts defaultroute /dev/ttyS0 38400 connect **
    "exec chat -v TIMEOUT 3 ogin:--ogin: ppp assword: secret"
   Note: to type one command on two lines you have to escape the <cr>
5. Make this script executable:
    chmod 755 ppp-on
6. Now run the script and verify the ppp connection is up:
    ./ppp-on
    ifconfig

7. Make sure your network is good by pinging from Sauron to the host Celebrian
8. Note that the default route was set up for you. Why?
9. When you are all done collecting your data, bring down the pppd interface with the following command from the client: **killall pppd**

To turn in

Your *lab0x2* **text** file should contain the following sections.

- Standard boilerplate information:
    - CIS 192 Lab *XX*
    - *Name*
    - *Date*
    - TBA hours*: X.X*
    - Station number: CIS-Lab-*XX*

- Sauron ifconfig output showing the ppp0 interface
- Sauron route –n output showing the default gateway
- The ping output from Sauron to Celebrian over the serial connection and LAN
- The ppp-on script you wrote for the client Sauron
- The /etc/ppp/options file on the server Arwen
- The ppp entry from the /etc/passwd file on the server Arwen.
- Command summary

The command summary should be a concise set of documented examples that can be used as a resource for repeated operations in future labs.

Check your work for completeness then submit as many times as you wish up until the due date deadline.

> **scp labx2 cis192@opus.cabrillo.edu:labx2.lastname**

Grading rubric (30 points)

4 points for correct submittal, professional appearance and quality
4 points for correct ifconfig and route –n output on Sauron
5 points for correct ping from Sauron to Celebrian
5 points for correct ppp-on script
4 points for correct /etc/ppp/options file
4 points for the correct ppp entry in /etc/passwd on Arwen.
4 points for complete and concise command summary