Switch configuration

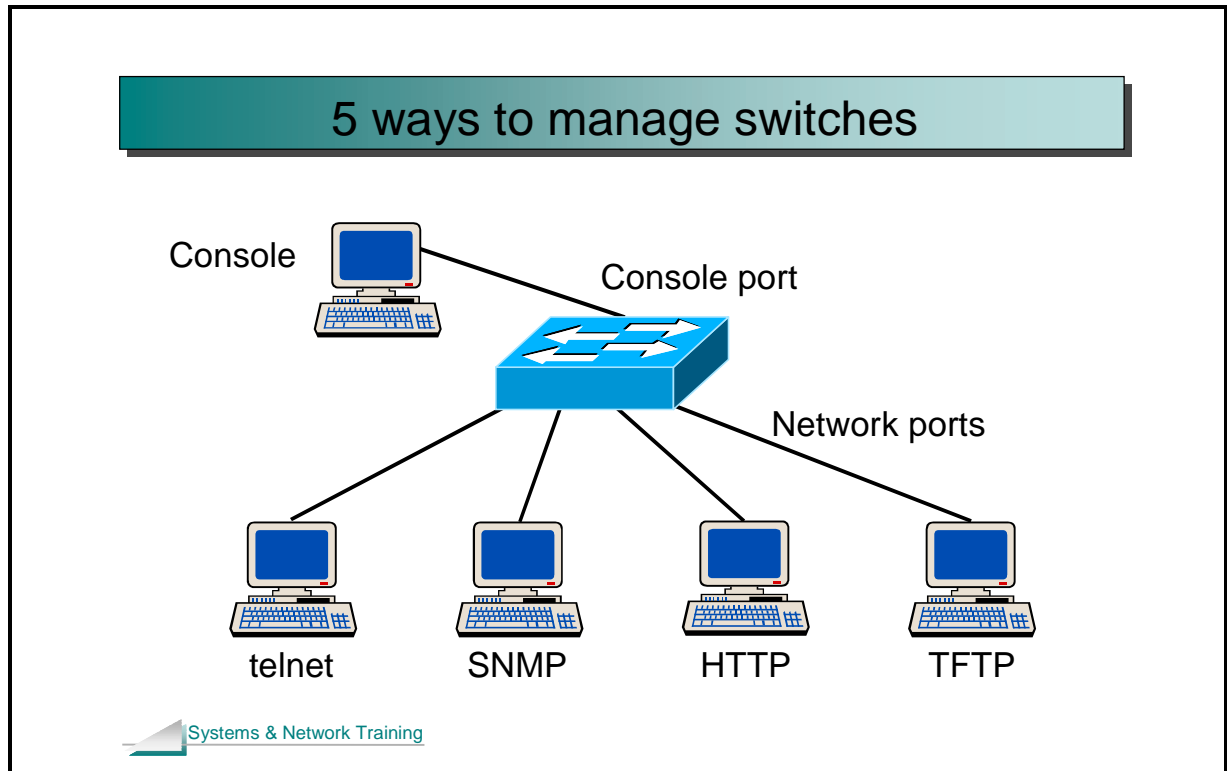By the end of this session, you will be able to:

- Describe basic switch configuration methods.

- Configure a switch.

4

Int

5 ways to manage switches

Console — Console port

Network ports

telnet   SNMP   HTTP   TFTP

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Management options

- After the hardware has been installed and cabled it is likely that at least a minimal additional configuration would be required.

- Until an IP address has been assigned configuration is performed using the console port (usually at the rear of the switch).

- Most switch management options require network access and a valid IP address for the switch.

- If and when the switch has a network connection and a valid IP address, then a number of options for switch management are possible:

> telnet
>> Accesses the command line – similar to console port access but over the network.
>
> SNMP (Simple Network Management Protocol)
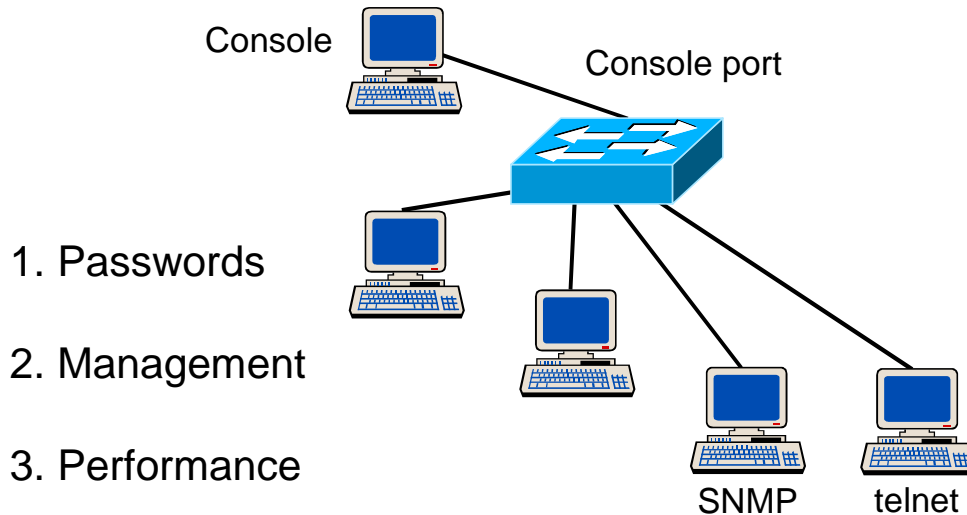>> For management using network management systems such as HP OpenView.
>
> HTTP (Hyper Text Transfer Protocol)
>> Web based management. The switch acts as a web server, the administrator just points the browser at the switch.
>
> TFTP (Trivial File Transfer Protocol)
>> Used to download configurations.

Why configure switches?

- Switches are layer 2 devices and are therefore relatively easy to configure in comparison to routers.

- In most cases, the default configuration of switches will enable the switch to connect PCs and servers together with ease - plug and play.

- Further configuration of switches is advisable for the following reasons:

  Security
  > Adding passwords to the switch to prevent unauthorised access.

  Management
 > An IP address is advisable to enable management of the switch and should be configured.

  Performance
  > With an "out of the box" configuration, convergence times of 50+ seconds would not be uncommon. With a little bit of effort these times can be reduced to 0-8 seconds. Extra configuration can also make the network more stable and less prone to issues, such as broadcast storms.
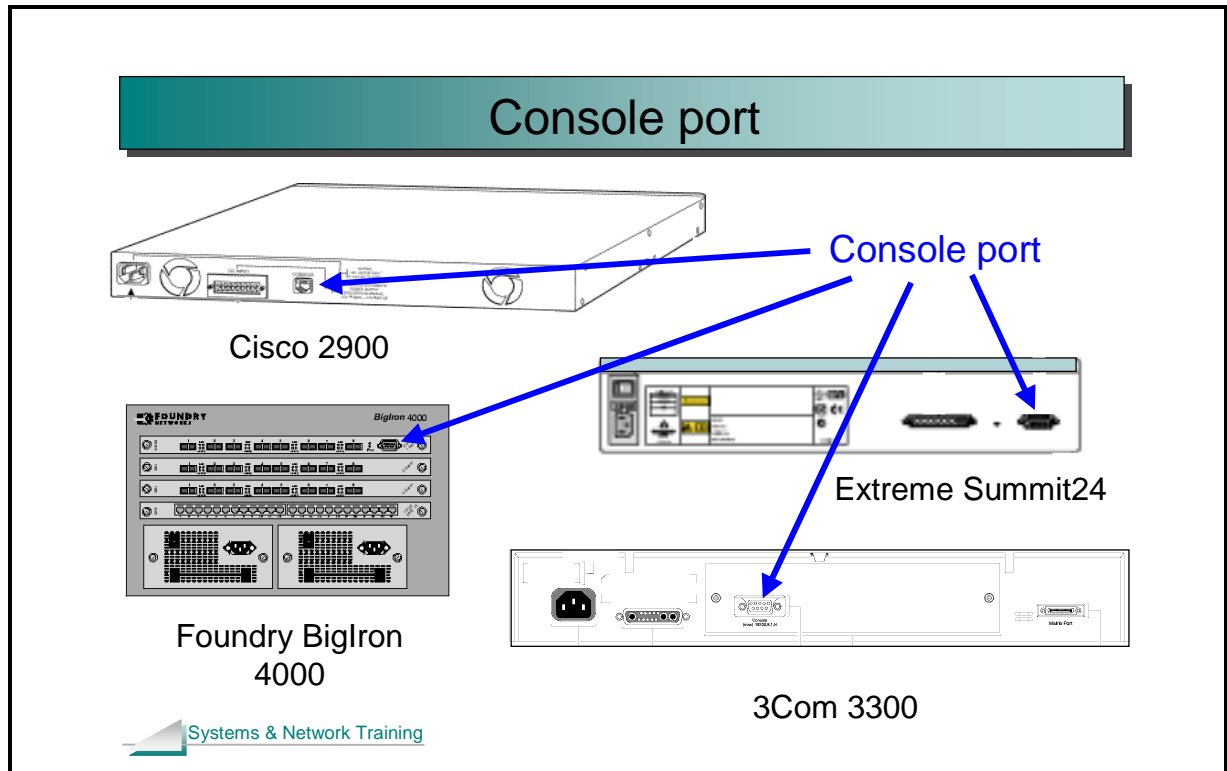
Console port

- The normal place to start configuring is via a console port.

- This is the only option if the switch does not have an IP address configured.

- The console cable is connected directly to the switch.

- The console connector is normally in the back of the switch, as shown above.

- The console connector is normally a 9-pin D type serial connector.

- However, Cisco uses an RJ connector, furthermore with a special "roll over cable".

- The other end of the console cable will be connected to a dumb ASCII terminal or the COM port of a PC.

- Note that some switches do not provide a console port.

- In this case a default IP address is usually provided.
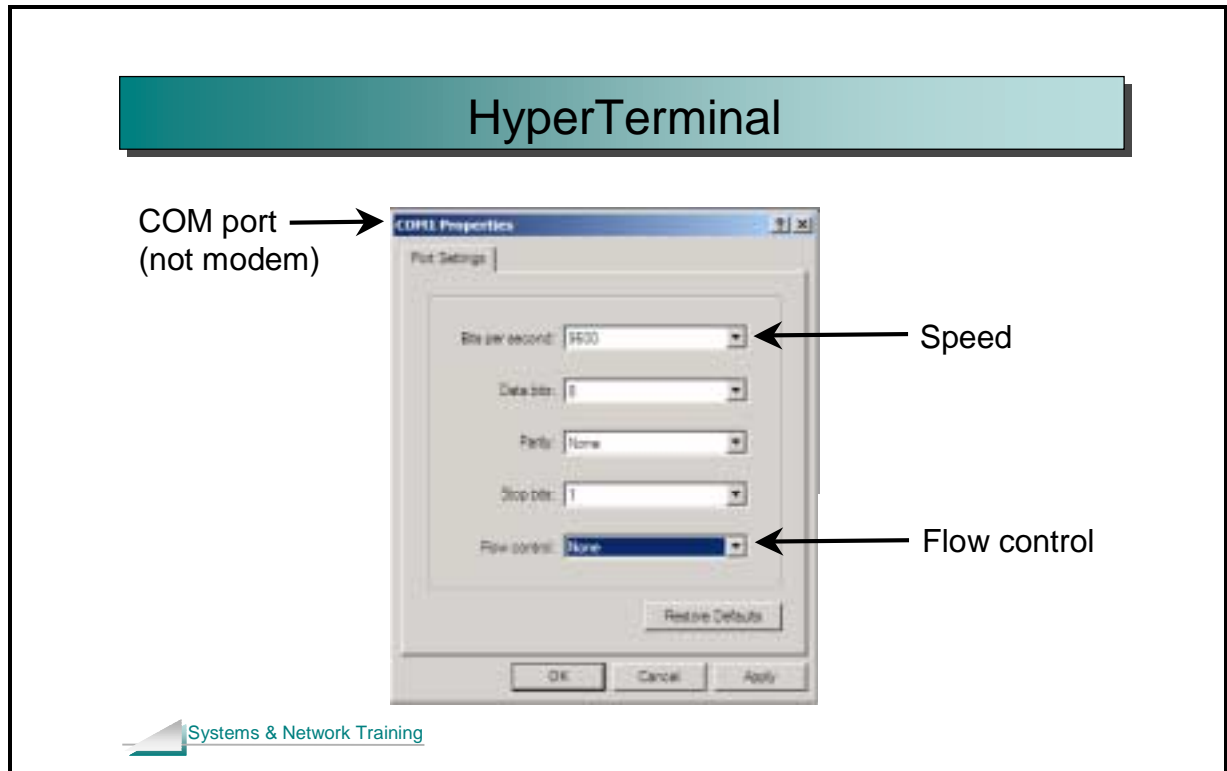
HyperTerminal

- HyperTerminal is the usual software to use when connecting your PC to the console port on a switch.

- The main reason for using HyperTerminal is that it is free and comes with Microsoft Windows.

- The settings for HyperTerminal need to match the console port settings on the switch.

- A typical configuration is:

Speed:	9600
Data bits:	8
Parity:	None
Stop bits:	1
Flow control:	None

- When using HyperTerminal, your PC is effectively acting as a screen and keyboard for the switch.

Basic troubleshooting

LEDs
Do not underestimate
their usefulness in troubleshooting

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Troubleshooting

- For troubleshooting the following is also available:

LEDs	IP not required. On connection of a cable the port LED should change colour (as long as the connected device is active). If the LED remains off after connection this is an indication that either the connected device is off or that the wrong cable type is being used.
Analyser ports	IP not required. By their nature switches do not allow analysers to work as the switches filter traffic. Most switches allow a port to be configured as an "analyser" port which stops filtering on that port. This then allows an analyser attached to that port to see all packets. Beware of legal issues of snooping if carrying other peoples' traffic.
Log files	IP not required. Most network devices provide log files, which provide a record of the messages that have been displayed on the screen. Syslog can often be used to allow these log files to be stored on a remote machine (syslog requires IP).

Quiz

1.   Name and describe five ways of configuring a switch.

        _____

        _____

        _____

        _____

        _____

2.   Name three reasons for configuring a switch.

        _____

        _____

        _____

3.   What is HyperTerminal used for?

        _____

4.   Why isn't `telnet` used for initial configuration?

        _____

5.   If the LED on a port is not lit what is probably wrong?

        _____

6.   When connecting a PC to a switch which type of cable should be used?
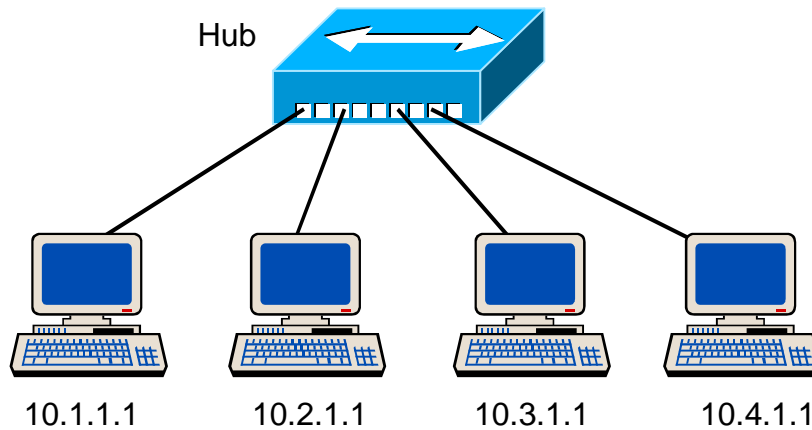   Straight through or cross over?

        _____

7.   When connecting a switch to a switch which type of cable should be used?
        Straight through or cross over?

        _____

Exercise: Hub based network

Hub

10.1.1.1   10.2.1.1   10.3.1.1   10.4.1.1

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Exercise

Building a hub based network

The main purpose of this stage of the exercise is to provide a contrast to when we use a switch (instead of the hub). Key points to discover in the exercise are:

> Hubs need no configuration to work.
> Traffic sent to one PC is actually sent everywhere.

1.   Connect your PC to a hub as shown above. What cable type is used?

_____

2.   Although this is a layer 2 Ethernet switching course, networks always use higher layers as well. We will use `ping` as a test tool. To use `ping` we first need to set IP addresses on the PCs. Record your IP address here.

_____

We will use subnet masks of 255.0.0.0

To set your IP address under XP:

> Right click on *My network places*.
> Left click *properties*.
> Right click *local area connection*.
> Left click *properties*.
> Highlight *TCP/IP*.
> Click the *properties* button.
> Select *use the following IP address*.
> Fill in the IP address and subnet mask.
> Click *OK* and then *close*.

3. Open a command prompt on your PC. (For example using Start --> Run, `cmd`)
    Now type:

    >   `ipconfig /all`

    What is the MAC address of your PC?

    _____

4. Set up Ethereal (a LAN analyser) and start capturing packets. From your command
    prompt, `ping` the IP address of another PC. Now stop the packet capture and answer
    the following questions:

    What is the source MAC address of your echo requests?

    _____

    Are pings between other PCs also seen? (If not try capturing packets again whilst two
    other PCs are pinging.)
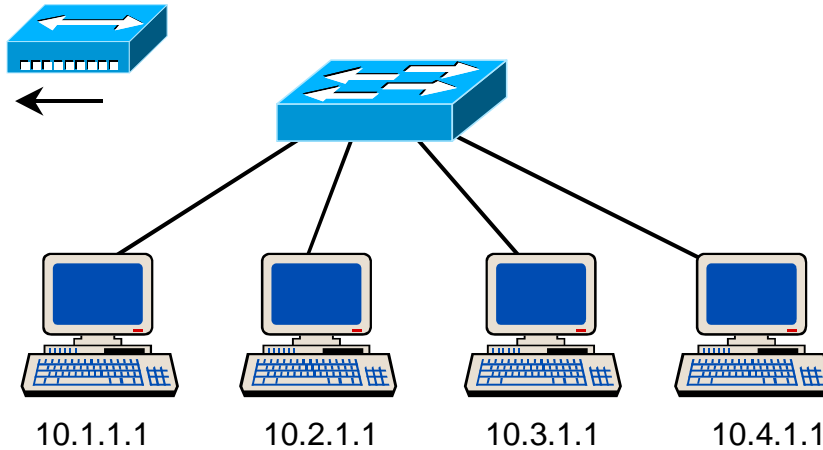
    _____

    What is the average time for a `ping`? Use either the `ping` output or the packet
    captures to answer this question.

    _____

5. Can you `ping` the hub? Why not?

    _____

    _____

Exercise: Switch based network

Hub

10.1.1.1   10.2.1.1   10.3.1.1   10.4.1.1

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Building a switch based network

In this part of the exercise the hub is replaced with a switch. Key points to discover in the exercise are:

> Switches need no configuration to work.
> Switches do not need an IP address to do their job of switching.
> Traffic is only sent to the ports that need the traffic.

6.   The switches are 10/100 auto sensing. What does this mean?

_____

7.   Move your PC from the hub and connect it to the switch.

8.   How would you know if you have connectivity?

_____

9.   If you do not have connectivity check the following:

Switch/PC powered on?

_____

Correct cables used?

_____

10. Use Ethereal and start capturing packets. From your command prompt, `ping` the IP address of another PC. Now stop the packet capture and answer the following questions:

Are pings between other PCs also seen? (If not try capturing packets again whilst two other PCs are pinging). If still not, why not?

_____

_____

What is the average time for a `ping`? Use either the `ping` output or the packet captures to answer this question. Is the switch faster than the hub?
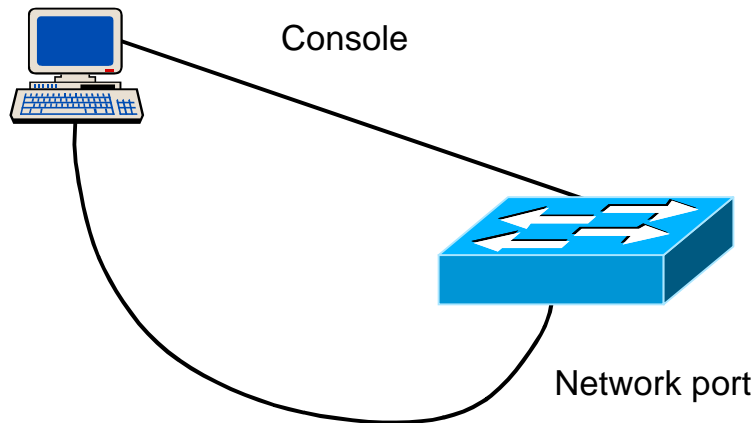
_____

_____

11. Can you `ping` the switch? Why not?

_____

_____

Configuring switches

In this part of the exercise each student will now use, and configure, his or her own switch. Key points to discover in this part of the exercise are:

> How to use HyperTerminal and console port access.

> Theoretical knowledge such as bridge tables, covered earlier in the course, is not just theory – bridge tables are real and can be seen.

> Reading the output of commands is an essential part of the job.

Note: The switches that we are using happen to be Cisco switches (they have a large market share). However, this is not a Cisco course. If you have any problems whatsoever with the command line please ask the instructor straight away – the main emphasis of the exercise is on switches in general, not a specific manufacturer's switch.

Please use the quick reference at the back if you wish.

The main points for Cisco switches are:

- To configure the Cisco from scratch connect to the router using a rollover cable and connect into the console port of the router from the PCs COM port.

- Use HyperTerminal with 9600 and no flow control to "drive" the Cisco.

- To do anything useful you must be in privileged mode.

- To enter privileged mode type:

  ```
  enable
  ```

- In privileged mode the main commands are:

  ```
  ?                 On line help
  show              To look at something
  configure t       Enter configuration mode.
  ```

- Configuration mode allows changing the configuration.

- To save the configuration

  ```
  copy run start
  ```

- **Once again, any problems with the user interface please ask the Instructor**.

12.   Connect your PC to the console port of the switch. What software needs to be used for this?

         _____

13.   Reboot the switch and text similar to the following should appear. The switch is asking whether you want to set up the switch. At this stage we will say **no**.

```
00:00:27: %SYS-5-RESTART: System restarted --
Cisco Internetwork Operating System Software
IOS (tm) C2900XL Software (C2900XL-C3H2S-M), Version
12.0(5)XU, RELEASE SOFTWARE
 (fc1)
Copyright (c) 1986-2000 by cisco Systems, Inc.
Compiled Mon 03-Apr-00 16:37 by swati


        --- System Configuration Dialog ---


At any point you may enter a question mark '?' for help.
Use ctrl-c to abort configuration dialog at any prompt.
Default settings are in square brackets '[]'.

Continue with configuration dialog? [yes/no]:
```

        If you do not get the above output, check the following items:

             Correct console cable and connector used?
                          Check by swapping with known good parts.

             Switch powered on?
                          Check power LED on switch.

             HyperTerminal settings correct?
                          9600, no flow control, rest defaults.

             Correct COM port used?
                          COM1 or COM2?

        You should be faced with the user mode prompt after you typed **no**.

14.   At this stage type

             enable

        to enter privileged mode. No password should be asked for, as we have not yet setup the switch. Your prompt should now look something like:

             Switch#

Now type

```
sh mac
```

which will display the "bridge" table. The output should look something like this:

```
Switch# sh mac
Dynamic Address Count:                1
Secure Address Count:                 0
Static Address (User-defined) Count:  0
System Self Address Count:            47
Total MAC addresses:                  48
Maximum MAC addresses:                2048
Non-static Address Table:
Destination Address  Address Type  VLAN  Destination Port
-------------------  ------------  ----  ----------------
00e0.9806.d9b2       Dynamic          1  FastEthernet0/9
```

15.   Looking at the output above AND on your screen answer each of the following
       questions twice. Once for the real screen output and once for the output above.

       How many machines are connected to the switch?

       _____   _____

       How many MAC addresses does this switch have itself?

       _____   _____

       On what port is (are) the PC(s) attached?

       _____   _____

       How has the switch learnt that address?

       _____   _____

       What is the maximum size of the bridge table? How will this affect the performance
       of the switch?

       _____   _____

       _____

16.   Now look at one of the interfaces with a PC attached. To do this:

```
switch# show interface fa 0/9
```

       where *0/9* is the port number with the PC attached.

       The output should look something like that shown over.

```
Switch# sh int fa 0/9
FastEthernet0/9 is up, line protocol is up
  Hardware is Fast Ethernet, address is 0002.4b88.4689 (bia
0002.4b88.4689)
  MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
      reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not set
  Auto-duplex (Half), Auto Speed (10), 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output 00:00:01, output hang never
  Last clearing of "show interface" counters never
  Queueing strategy: fifo
  Output queue 0/40, 0 drops; input queue 0/75, 0 drops
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     8 packets input, 512 bytes
     Received 7 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog, 0 multicast
     0 input packets with dribble condition detected
     579 packets output, 22456 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
```

17.   Looking at the output above AND on your screen answer each of the following
       questions twice. Once for the real switch and once for the output above.

       Which duplex is in use?

       _____   _____

       What does bia stand for?

       _____   _____

       Is the port being used?

       _____   _____

       What speed is the port being used at?

       _____   _____

       How many broadcasts have there been?

       _____   _____

       How many collisions?

       _____   _____

18.   Type the following

            show ip int brief

        At this stage we are not worried about the IP addressing but how many ports are in
        use?

        _____

19.   So far we have used the switch and looked at items discussed in the theory sessions.
        We will now configure the switch in a simple fashion by shutting down (disabling) a
        port. Type the following:

            conf t
                        This enters configuration mode. Note the prompt has changed.

            int fa0/9
                        where *0/9* is the name of the port you wish to disable.

            shut
                        This command disables the port.

            exit
            exit
                        We are now back in privileged mode where we can look at
                        things.

20.   What has happened to the LED for the port shut down?

        _____

21.   Now repeat the show ip interface brief command. Before the output would
        have shown the interface as being "up up". What state is the port now in?

        _____

22.   Re-enable the port which was shut down:

            conf t
            int fa0/9
            no shut
            exit
            exit

23.   What does this do to the show ip interface brief output and the LEDs?

        _____

        _____

If time permits

24. Working in pairs, connect two PCs to one switch. Check everything is O.K. by using `ping`. Now issue the following commands and note the changes from earlier in the exercise when there was only one PC connected to the switch.

    sh mac

    _____

    sh int

    _____

    sh ip int brief

    _____

25. Now move a PC from one port to another. Does `ping` still work? (It should but note that we haven't used VLANS yet.) Which of the above commands best shows the change in port usage?

    _____

    _____

26. Still working with a partner, connect a hub to one of the switch ports. Then connect two PCs on the hub. Now look at the MAC address table. How many MAC addresses do you see on the switch port with the hub attached?

    _____

27. On the switch run the following command. If the command doesn't work ensure that you are in privileged mode.

    sh run

    What does this show?

    _____

28. Does the source MAC address of a `ping` change as the `ping` passes through the switch?

    _____

29.   Using Ethereal, capture packets for a while. What packets does the switch transmit periodically? What source MAC address is used by these packets? If you move your PC to another port does the source MAC address change?

_____

_____

_____

30.   Investigate the menus on HyperTerminal, in particular look at the transfer menu. What are the first four items on this menu?

_____

_____

_____

_____

31.   The two most useful items are "Capture text" and "Send text file". With these you can copy and paste configurations to/from your PC. For example:

To copy a configuration
>   *Capture text*
>   sh run
>   *Stop the capture text*

An editor can then be used to change the configuration.

To download a configuration
>   enable
>   conf t
>   *send text file* can then be used.

Note: This can be used in the following way:
A central technical team produce configurations in a text editor. These configurations are then copied to floppy disks that are then given to field engineers who use them on site to configure the switches (using *send text file*).

Try this out by copying the configuration, editing the resulting text file to shut down a port and downloading the new configuration. Check it worked.

32.   Try the above again but make sure enable and conf t are in the text file. What would normally be needed in the text file after the enable?

_____