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Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays

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Introduction

This document addresses initial connectivity delays that occur when workstations (that are connected to switches) are unable to log in to a network domain (Windows NT or Novell), or are unable to obtain a Dynamic Host Configuration Protocol (DHCP) address. The steps in this document are easy to implement and address the most common causes of workstation connectivity delays encountered during a workstation's initialization/startup phase.

Before You Begin

Conventions

For more information on document conventions, see the Cisco Technical Tips Conventions.

The terms workstation, end−station, and server are all used interchangeably in this document. These terms refer to any device directly connected to a switch by a single Network Interface Card (NIC). They may also refer to devices with multiple NICs, where the NIC is used only for redundancy; in other words, the workstation or server is not configured to act as a bridge, however, it has multiple NICs for redundancy.

Note: There are some server NICs that support trunking and/or EtherChannel. There are situations where the server needs to live on several VLANs at the same time (trunking), or the server needs more bandwidth on the link connecting it to the switch (EtherChannel). In these cases, you would not turn Port Aggregation Protocol (PAgP) `off,` and you would not turn trunking `off.` Also, these devices are rarely turned off or reset. The instructions in this document do not apply to these type of devices.

Prerequisites

With more and more customers deploying switching to the desktop and replacing shared hubs with switches, there is often an initial connectivity delay introduced in client/server environments. Most commonly, Windows 95/98/NT, Novell, VINES, IBM NetworkStation/IBM Thin Clients, and AppleTalk clients are unable to connect to their servers. If the software on these clients is not persistent during the startup procedure, the clients give up trying to connect to a server before the switch has even allowed traffic to pass through the switch to the client.

Note: This initial connectivity delay often manifests itself as errors that appear when you first boot up a workstation. The following are several examples of error messages and errors you might see:

- A Microsoft networking client displays `No Domain Controllers Available.`
- DHCP reports `No DHCP Servers Available.`
- A Novell IPX networking workstation does not have the **Novell Login Screen** upon bootup.
- An AppleTalk networking client displays `Access to your AppleTalk network has been interrupted. To re-establish your connection, open and close the AppleTalk control panel.` It is also possible that the AppleTalk client's **Chooser** application will either not display a zone list, or display an incomplete zone list.
- IBM Network Stations may have one of the following messages:

      NSB83619--Address resolution failed
      NSB83589--Failed to boot after 1 attempt
      NSB70519--Failed to connect to a server

  IBM has created fixes to help deal with this problem, and they are included in the PTF 7 for V2R1 code. Customers should be at Network Station Firmware level B3052500 (May 25, 2000) before attempting to connect to the switches listed in this document.

The initial connectivity delay is also frequently seen in a switched environment in which a network administrator updates software or drivers. In this case, a vendor may optimize the drivers so that network initialization procedures happen earlier in the client's startup process (before the switch is ready to process the packets).

With the various features that are now included in some switches, it can take close to a minute for a switch to begin servicing a newly connected workstation. This delay would affect the workstation every time it is turned on or rebooted. The four main features that cause this delay are as follows:

- Spanning Tree Protocol (STP)
- EtherChannel negotiation
- Trunking negotiation
- Link speed/duplex negotiation between the switch and the workstation

The four features above are listed in order of causing the most delay (STP) to causing the least delay (speed/duplex negotiation). A workstation connected to a switch usually does not cause Spanning Tree loops, usually does not need EtherChannel, and usually does not need to negotiate a trunking method. Disabling link speed/detection negotiation can also reduce port delay if you need to optimize your startup time as much as possible.

This document shows how to implement startup speed−optimization commands on three Catalyst switch platforms. The timing sections show how the switch port delay is reduced, and by how much.

To create the examples in this document, the following equipment was used:

- A console cable suitable for the Supervisor Engine in the switch.
- One Catalyst 5505 switch in a lab environment with cleared configurations.

  Note: This document was written in an isolated lab environment. Make certain that you understand the potential impact of any command on your network before using it.

  Note: The **clear config all** command was issued on the switch to ensure that it has a default configuration.
- A FastEthernet module capable of PAgP and trunking.
- One RJ−45 Ethernet cross−over cable to connect to the switch.
- A PC to connect to the switch.

Components Used

This document is not restricted to specific software and hardware versions.

Background

This section describes four features that some switches have which cause initial delays when a device is connected to a switch. A workstation will typically either not cause the Spanning Tree problem (loops), or not need the feature, commonly PAgP and/or Dynamic Trunking Protocol (DTP), so the delay is unnecessary.

Spanning Tree

If you have recently migrated from a hub environment to a switch environment, startup connectivity delays may appear because a switch works much differently than a hub. A switch provides connectivity at the Data Link layer, not at the Physical layer. The switch uses a bridging algorithm to decide if packets received on a port need to be transmitted out other ports. The bridging algorithm is susceptible to physical loops in the network topology. Because of this susceptibility to loops, switches run the protocol STP that causes loops to be eliminated in the topology. The running of the STP causes all ports that are included in the Spanning Tree process to become active much slower than they otherwise would, as it detects and blocks loops. A bridged

network having physical loops, without STP, will break. Despite the time involved, STP is beneficial. STP running on Catalyst switches is an industry standard specification (IEEE 802.1d).

After a port on the switch has linked and joined the bridge group, it will run STP on that port. A port running STP can have 1 of 5 states: `blocking`, `listening`, `learning`, `forwarding`, and `disabled`. STP dictates that the port starts out `blocking`, then immediately moves through the `listening` and `learning` phases. By default, it will spend approximately 15 seconds `listening` and 15 seconds `learning`. During the `listening` state, the switch is trying to determine where the port fits in the Spanning Tree topology. The switch especially wants to know whether this port is part of a physical loop. If it is part of a loop, this port may be chosen to go into `blocking` mode. `Blocking` means the port will not send or receive user data for the sake of eliminating loops. If the port is not part of a loop, it will proceed to the `learning` state, which involves learning which MAC addresses live off of this port. This entire STP initialization process takes about 30 seconds.

If you are connecting a workstation or a server with a single NIC card to a switch port, this connection cannot create a physical loop. These connections are considered leaf nodes. There is no reason to make the workstation wait 30 seconds while the switch checks for loops when the workstation cannot cause a loop. Cisco added the PortFast or fast–start feature, which means the STP for this port will assume that the port is not part of a loop and will immediately move to the `forwarding` state, without going through the `blocking`, `listening`, or `learning` states. This command does not turn STP off. This command makes STP skip a few (unnecessary in this circumstance) steps in the beginning on the selected port.

Note: The PortFast feature should **never** be used on switch ports that connect to other **switches, hubs, or routers**. These connections may cause physical loops and it is very important that Spanning Tree go through the full initialization procedure in these situations. A Spanning Tree loop can bring your network down. If PortFast is turned on for a port that is part of a physical loop, it can cause a window of time where packets could possibly be continuously forwarded (and even multiply) in such a way that the network cannot recover.

EtherChannel

Other features that switches may have enable are EtherChannel, Fast EtherChannel (FEC), or Gigabit EtherChannel (GEC). These features allow multiple links between the same two devices to work as if they were one fast link, with traffic load balanced among the links. A switch can form these bundles automatically with a neighbor using PAgP. Switch ports that can run PAgP usually default to a passive mode called `auto` mode, which means that they are willing to form a bundle if the neighbor device across the link asks them to. Running the protocol in `auto` mode can cause a port to delay for up to 15 seconds before passing control to the Spanning Tree Algorithm (STA) (PAgP runs on a port before STP does). There is no reason to have PAgP running on a port connected to a workstation. Setting the switch port PAgP mode to `off` will eliminate this delay.

Trunking

Another switch feature is the ability for a port to form a trunk. A trunk is configured between two devices when they need to carry traffic from multiple VLANs. A VLAN is what switches create to make a group of workstations appear to be on their own segment or broadcast domain. Trunk ports make these VLANs extend across multiple switches, so that a single VLAN can cover an entire campus. The trunk ports do this by adding tags to the packets, indicating which VLAN the packet belongs to.

There are different types of trunking protocols. If a port can become a trunk, it may also have the ability to trunk automatically, and in some cases even negotiate what type of trunking to use on the port. DTP provides this ability to negotiate the trunking method with the other device. The precursor to DTP is a protocol named Dynamic ISL (DISL). If these protocols are running, they can delay a port on the switch from becoming

active.

Usually, a port connected to a workstation belongs to only one VLAN, and therefore does not need to trunk. If a port has the ability to negotiate the formation of a trunk, it will usually default to the `auto` mode. If the port is changed to a trunking mode of `off`, it will further reduce the delay of a switch port becoming active.

Speed and Duplex Negotiation

Turning on PortFast and turning off PAgP (if present) is usually enough to solve an initial connectivity delay. If you need to eliminate every possible second, you could also set the port speed and duplex manually on the switch, if it is a multi–speed port (10/100). Auto–negotiation is a nice feature, however, turning it off could save you twoseconds on a Catalyst 5000. Auto–negotiation does not help much on the Catalyst 2800 or Catalyst 2900XL.

Note: If you turn off auto–negotiation on the switch, but leave it active on the workstation, the switch will not negotiate with the client. Potentially, the client might not choose the same duplex setting that the switch is using. Refer to Configuring and Troubleshooting Ethernet 10/100Mb Half/Full Duplex Auto–Negotiation for additional information on the caveats of auto–negotiation.

Catalyst 4500/4000, 5500/5000, 6500/6000 Switch Running CatOS

The following commands show how to turn on PortFast, turn off PAgP negotiation, and turn off trunking negotiation (DISL, DTP). The **set spantree portfast** command can be done on a range of ports at once (for example, **set spantree portfast 2/1−12 enable**). Usually, the **set port channel** command must be turned off using a valid group of channel–capable ports. In the example below, module 2 has the ability to channel with ports 2/1−2 or with ports 2/1−4. Either of these groups of ports would have been valid to use.

Note: Switch software version 5.2 for the Catalyst 4500/4000 and 5500/5000 has a new command. The **set port host** is a macro that combines the commands listed below into one easy–to–use command.

Configuration

```
Switch −A> (enable) set spantree portfast 2/1 enable

Warning: Spantree port fast start should only be enabled on ports connected to
a single host. Connecting hubs, concentrators, switches, bridges, etc. to a
fast start port can cause temporary spanning tree loops. Use with caution.

Spantree port 2/1 fast start enabled.
Switch-A> (enable) set port channel 2/1-2 off
Port(s) 2/1-2 channel mode set to off.

Switch-A> (enable) set trunk 2/1 off
Port(s) 2/1 trunk mode set to off.
```

The changes to the configuration will automatically be saved to NVRAM.

Verification

The version of the switch software used in this document is 4.5(1). For the full output of the **show version** and **show module** commands, refer to the timing test section of this document.

```
Switch-A> (enable) show version
WS-C5505 Software, Version McpSW: 4.5(1) NmpSW: 4.5(1)
```

The following command shows how to view the current state of a port with regards to STP. Currently, the port is in the STP `forwarding` state (sending and receiving packets), and the Fast–Start column shows that PortFast is currently disabled. The port will take at least 30 seconds to move to the `forwarding` state whenever it initializes.

```
Switch-A> (enable) show port spantree 2/1

Port      Vlan Port-State    Cost   Priority Fast-Start Group-Method
--------  ---- ------------- -----  -------- ---------- ------------
 2/1      1    forwarding       19        32 disabled
```

Enable PortFast on this switch port. The switch warns you that this command should be used only on ports that are connected to a single host (a workstation, server, and so on), and never used on ports connected to other hubs or switches. With a single host, PortFast is enabled, and the port will start forwarding immediately; a workstation or server will not cause a network loop.

```
Switch-A> (enable) set spantree PortFast 2/1 enable

Warning: Spantree port fast start should only be enabled on ports connected
to a single host.  Connecting hubs, concentrators, switches, bridges, etc. to
a fast start port can cause temporary spanning tree loops.  Use with caution.

Spantree port 2/1 fast start enabled.
```

To verify that PortFast is enabled for this port, issue the following command:

```
Switch-A> (enable) show port spantree 2/1

Port      Vlan Port-State    Cost   Priority Fast-Start Group-Method
--------  ---- ------------- -----  -------- ---------- ------------
 2/1      1    forwarding       19        32 enabled
```

Another way to view the PortFast settings for one or more ports is to view the STP information for a specific VLAN. The timing section of this document shows how to have the switch report each stage of STP that it moves through in real time. The output below also shows the forward delay time (15 seconds), which is how long STP will be in the `listening` state, and how long it will be in the `learning` state for each port in the VLAN.

```
Switch-A> (enable) show spantree 1
VLAN 1
Spanning tree enabled
Spanning tree type         ieee

Designated Root            00-e0-4f-94-b5-00
Designated Root Priority   8189
Designated Root Cost       19
Designated Root Port       2/24
Root Max Age   20 sec    Hello Time 2  sec    Forward Delay 15 sec

Bridge ID MAC ADDR         00-90-92-b0-84-00
Bridge ID Priority         32768
Bridge Max Age 20 sec    Hello Time 2  sec    Forward Delay 15 sec

Port       Vlan Port-State    Cost   Priority Fast-Start Group-Method
---------  ---- ------------- -----  -------- ---------- ------------
```

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```
      2/1     1   forwarding       19       32    enabled
      ...
```

To verify that PAgP is `off`, use the **show port channel** command (shown below). Be sure and specify the module number (2 in this case) so that the command will show you the channel mode even if there is no channel formed. If you issue the **show port channel** with no channels formed, it reports that there are no ports channeling. You need to go further and see the current channel mode.

```
Switch-A> (enable) show port channel
No ports channeling
Switch-A> (enable) show port channel 2
Port  Status      Channel   Channel     Neighbor                  Neighbor
                  mode      status      device                    port
----- ---------- --------- ----------- ------------------------- ----------
 2/1  notconnect auto       not channel
 2/2  notconnect auto       not channel
...
Switch-A> (enable) set port channel 2/1-2 off
Port(s) 2/1-2 channel mode set to off.

Switch-A> (enable) show port channel 2
Port  Status      Channel   Channel     Neighbor                  Neighbor
                  mode      status      device                    port
----- ---------- --------- ----------- ------------------------- ----------
 2/1  connected  off        not channel
 2/2  connected  off        not channel
...
```

To verify that trunking negotiation is `off`, issue the **set trunk off** command. The example below shows the default state, shows that trunking is `off`, and the the resulting state. Specify module number 2 so that you can see the current channel mode for the ports in this module.

```
Switch-A> (enable) show trunk 2
Port      Mode         Encapsulation  Status       Native vlan
--------  -----------  -------------  -----------  -----------
 2/1      auto         negotiate      not-trunking 1
 2/2      auto         negotiate      not-trunking 1
...

Switch-A> (enable) set trunk 2/1-2 off
Port(s) 2/1-2 trunk mode set to off.

Switch-A> (enable) show trunk 2
Port      Mode         Encapsulation  Status       Native vlan
--------  -----------  -------------  -----------  -----------
 2/1      off          negotiate      not-trunking 1
 2/2      off          negotiate      not-trunking 1
...
```

An example of turning off speed/duplex auto–negotiation by manually setting the speed and duplex on the switch is not shown; it should not be necessary except in the rarest of cases.

Timing Tests With and Without DTP, PAgP, and PortFast on a Catalyst 5500

The following test shows what happens with switch port initialization timing as the various commands are applied. The default settings of the port are used first to give a benchmark. They have PortFast disabled, PAgP (EtherChannel) mode set to `auto` (it will channel if asked to channel), and the trunking mode (DTP) set to `auto` (it will trunk if asked to trunk).

The test then proceeds to turn PortFast on and measure the time, turn PAgP off and measure the time, and turn trunking *off* and measure the time. Auto–negotiation is turned off, and the time is measured. All of these tests will be done on a Catalyst 5500 with a 10/100 Fast Ethernet card that supports DTP and PAgP.

Note: Turning PortFast on is not the same thing as turning STP off (as noted earlier in the document). With PortFast on, STP is still running on the port; blocking, listening, and learning are skipped, and the port immediately goes to the forwarding state. Turning STP off is not recommended because it affects the entire VLAN, and can leave the network vulnerable to physical topology loops. This can cause serious network problems.

1. Show the switch software version and configuration by issuing the **show version** and **show module** commands.

```
Switch-A> (enable) show version
WS-C5505 Software, Version McpSW: 4.5(1) NmpSW: 4.5(1)
Copyright (c) 1995-1999 by Cisco Systems
NMP S/W compiled on Mar 29 1999, 16:09:01
MCP S/W compiled on Mar 29 1999, 16:06:50

System Bootstrap Version: 3.1.2

Hardware Version: 1.0  Model: WS-C5505  Serial #: 066507453

Mod Port Model       Serial #  Versions
--- ---- ---------- --------- --------------------------------------
1   0    WS-X5530   006841805 Hw : 1.3
                              Fw : 3.1.2

                              Fw1: 3.1(2)
                              Sw : 4.5(1)
2   24   WS-X5225R  012785227 Hw : 3.2
                              Fw : 4.3(1)
                              Sw : 4.5(1)

        DRAM                    FLASH                  NVRAM
Module Total   Used    Free    Total   Used    Free    Total Used  Free
------ ------- ------- ------- ------- ------- ------- ----- ----- -----
1       32640K 13648K  18992K   8192K   4118K   4074K   512K  119K  393K

Uptime is 28 days, 18 hours, 54 minutes

Switch-A> (enable) show module
Mod Module-Name        Ports Module-Type          Model      Serial-Num Status
--- ------------------ ----- -------------------- ---------- --------- -------
1                      0     Supervisor III       WS-X5530   006841805 ok
2                      24    10/100BaseTX Ethernet WS-X5225R 012785227 ok

Mod MAC-Address(es)                         Hw     Fw         Sw
--- --------------------------------------- ------ ---------- ------------------
1   00-90-92-b0-84-00 to 00-90-92-b0-87-ff 1.3    3.1.2      4.5(1)
2   00-50-0f-b2-e2-60 to 00-50-0f-b2-e2-77 3.2    4.3(1)     4.5(1)

Mod Sub-Type Sub-Model Sub-Serial Sub-Hw
--- -------- --------- ---------- ------
1   NFFC     WS-F5521  0008728786 1.0
```
2. Set logging for STP to the most verbose by issuing the **set logging level spantree 7** command. Below is the default logging level (2) for STP, which means only critical situations will be reported.

```
Switch-A> (enable) show logging

Logging buffer size:        500
```

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```
            timestamp option:      enabled
       Logging history size:       1
       Logging console:            enabled
       Logging server:             disabled
            server facility:       LOCAL7
            server severity:       warnings(4)


       Facility          Default Severity        Current Session Severity
       ------------       ----------------------  -----------------------
       ...
       spantree          2                       2
       ...
       0(emergencies)     1(alerts)               2(critical)
       3(errors)          4(warnings)             5(notifications)
       6(information)     7(debugging)
```

Change the level for STP to 7 (debug) to view STP's state change on the port. This configuration change lasts only for the current terminal session.

```
       Switch-A> (enable) set logging level spantree 7
       System logging facility <spantree> for this session set to severity 7(debugging)

       Switch-A> (enable) show logging
       ...

       Facility          Default Severity        Current Session Severity
       ------------       ----------------------  -----------------------
       ...
       spantree          2                       7
       ...
```

3. The command below shuts down the port.

```
       Switch-A> (enable) set port disable 2/1
       Port 2/1 disabled.
```

4. Check the time and enable the port. Determine how long the switch stays in each state. To get the most accurate timing information, it is important to enter the commands below as quickly as possible. One idea is to type each command (**show time** and **set port enable 2/1**, in this example) on a separate line in a text file; you can then copy the commands to the clipboard and paste them into the switch.

```
       Switch-A> (enable) show time
       Fri Feb 25 2000, 12:20:17
       Switch-A> (enable) set port enable 2/1
       Port 2/1 enabled.
       Switch-A> (enable)
       2000 Feb 25 12:20:39 %PAGP-5-PORTTOSTP:
          Port 2/1 joined bridge port 2/1
       2000 Feb 25 12:20:39 %SPANTREE-6-PORTBLK:
          port 2/1 state in vlan 1 changed to blocking.
       2000 Feb 25 12:20:39 %SPANTREE-6-PORTLISTEN:
          port 2/1 state in vlane 1 changed to Listening.
       2000 Feb 25 12:20:53 %SPANTREE-6-PORTLEARN:
          port 2/1 state in vlan 1 changed to Learning.
       2000 Feb 25 12:21:08 %SPANTREE-6-PORTFWD:
          port 2/1 state in vlan 1 changed to forwarding.
```

Notice from the output above that it took about 22 seconds (20:17 to 20:39) for the port to begin the STP blocking stage. This time was spent joining the bridge group and completing DTP and PAgP negotiation. After blocking is started, you are now in the STP realm. After blocking, STP went immediately to listening (20:39 to 20:39). Listening state took approximately 14 seconds (20:39 to 20:53). The learning state (until forwarding state began) took 15 seconds (20:53 to

21:08). The total time before the port actually became functional for traffic was about **51 seconds** (20:17 to 21:08).

Note: Technically, the `listening` and `learning` stage should both be 15 seconds, which is how the forward delay parameter is set for this VLAN. The `learning` stage is 15 seconds (closer than 14 seconds) if there were more accurate measurements. None of the measurements here are perfectly accurate.

5. As seen from the above output and from the **show spantree** command output, STP is `active` on this port. There are other factors that could slow the port from reaching the `forwarding` state. The **show port capabilities** command shows that this port has the ability to trunk and to create an EtherChannel. The **show trunk** command says that this port is in `auto` mode, and that it is set to negotiate the type of trunking to use (ISL or 802.1q, negotiated through DTP).

```
Switch-A> (enable) show port capabilities 2/1
Model                  WS-X5225R
Port                   2/1
Type                   10/100BaseTX

Speed                  auto,10,100
Duplex                 half,full
Trunk encap type       802.1Q,ISL
Trunk mode   on,off,desirable,auto,nonegotiate
Channel       2/1-2,2/1-4
Broadcast suppression  percentage(0-100)
Flow control           receive-(off,on),send-(off,on)
Security               yes
Membership             static,dynamic
Fast start             yes
Rewrite                yes
Switch-A> (enable) show trunk 2/1
Port     Mode         Encapsulation Status        Native vlan
-------- -----------  ------------- ------------   -----------
 2/1     auto         negotiate     not-trunking  1
...
```

6. Enable PortFast on the port. Trunking negotiation (DTP) and EtherChannel (PAgP) are still in the `auto` mode.

```
Switch-A> (enable) set port disable 2/1
Port 2/1 disabled.

Switch-A> (enable) set spantree PortFast 2/1 enable

Warning: Port fast start should only be enabled on ports connected to a
single host. Connecting hubs, concentrators, switches, bridges, etc. to a fast
start port can cause temporary spanning tree loops. Use with caution.

Spantree port 2/1 fast start enabled.

Switch-A> (enable) show time
Fri Feb 25 2000, 13:45:23
Switch-A> (enable) set port enable 2/1
Port 2/1 enabled.
Switch-A> (enable)
Switch-A> (enable)
2000 Feb 25 13:45:43 %PAGP-5-PORTTOSTP:
   Port 2/1 joined bridgeport 2/1
2000 Feb 25 13:45:44 %SPANTREE-6-PORTFWD:
   port 2/1 state in vlan 1 change to forwarding.
```

There is a total time of **21 seconds**. It takes 20 seconds before it joins the bridge group (45:23 to 45:43). Because PortFast is enabled, it takes only 1 second until STP starts `forwarding` (instead of 30 seconds). 29 seconds are saved by enabling PortFast. Now, try to reduce the delay further.

7. Turn PAgP mode to `off`. You can see from the **show port channel** command that the PAgP mode is set to `auto`, which means it will channel if asked to by a neighbor running PAgP. You must turn `off` channeling for at least a group of two ports. You cannot turn `off` channeling for an individual port.

```
Switch-A> (enable) show port channel 2/1
Port  Status      Channel   Channel      Neighbor                  Neighbor
                  mode      status       device                    port
----- ----------  --------- -----------  ------------------------  ----------
 2/1  connected   auto      not channel

Switch-A> (enable) set port channel 2/1-2 off
Port(s) 2/1-2 channel mode set to off.
```

8. Shut down the port and repeat the test.

```
Switch-A> (enable) set port disable 2/1
Port 2/1 disabled.

Switch-A> (enable) show time
Fri Feb 25 2000, 13:56:23
Switch-A> (enable) set port enable 2/1
Port 2/1 enabled.
Switch-A> (enable)
2000 Feb 25 13:56:32 %PAGP-5-PORTTOSTP:
   Port 2/1 joined bridgeport 2/1
2000 Feb 25 13:56:32 %SPANTREE-6-PORTFWD:
   port 2/1 state in vlan 1 changed to forwarding.
```

Notice above that now it takes only **9 seconds** to reach the `forwarding` state (56:23 to 56:32), instead of 21 seconds as in the previous test. Changing PAgP from `auto` to `off` in this test saved about **12 seconds**.

9. Turn trunking to `off` (instead of `auto`) to determine how that affects the time it takes for the port to reach `forwarding` state. Turn the port `off` and `on` and record the time.

```
Switch-A> (enable) set trunk 2/1 off
Port(s) 2/1 trunk mode set to off.
Switch-A> (enable) set port disable 2/1
Port 2/1 disabled.
```

Start the test with trunking set to `off` (instead of `auto`).

```
Switch-A> (enable) show time
Fri Feb 25 2000, 14:00:19
Switch-A> (enable) set port enable 2/1
Port 2/1 enabled.
Switch-A> (enable)
2000 Feb 25 14:00:22 %PAGP-5-PORTTOSTP:
   Port 2/1 joined bridge port 2/1
2000 Feb 25 14:00:23 %SPANTREE-6-PORTFWD:
   port 2/1 state in vlan 1 change for forwarding.
```

You saved a few seconds at the beginning since it took only **4 seconds** to reach the STP `forwarding` state (00:19 to 00:22). You saved about **5 seconds** by changing the trunking mode from `auto` to `off`.

10. **(Optional)** If the switch port initialization time was the problem, it should be solved now. If you have to reduce a few more seconds off the time, you could set the port speed and duplex manually instead

of using auto–negotiation.

Note that this step is not usually required for resolving startup delay issues.

Setting the speed and duplex manually on our side requires that you set the speed and duplex on the other side as well. This is because setting the port speed and duplex disables auto–negotiation on the port and the connecting device will not see auto–negotiation parameters. The connecting device will connect only at half–duplex and the resulting duplex mismatch results in poor performance and port errors. Remember, if you set speed and duplex on one side, you must set speed and duplex on the connecting device as well to avoid these problems.

To view the port status after setting the speed and duplex, issue the **show port** command.

```
Switch-A> (enable) set port speed 2/1 100
Port(s) 2/1 speed set to 100Mbps.
Switch-A> (enable) set port duplex 2/1 full
Port(s) 2/1 set to full-duplex.
Switch-A> (enable) show port
Port  Name               Status     Vlan       Level  Duplex Speed Type
----- ------------------ ---------- ---------- ------ ------ ----- ------------
 2/1                     connected  1          normal full   100 10/100BaseTX
...
```

The timing results are shown below.

```
Switch-A> (enable) show time
Fri Feb 25 2000, 140528 Eastern
Switch-A> (enable) set port enable 2/1
Port 2/1 enabled.
Switch-A> (enable)
2000 Feb 25 140529 Eastern -0500 %PAGP-5-PORTTOSTP:
   Port 2/1 joined bridgeport 2/1
2000 Feb 25 140530 Eastern -0500 %SPANTREE-6-PORTFWD:
   port 2/1 state in vlan 1 changed to forwarding.
```

The final result gives a time of **2 seconds** (0528 to 0530).

11. Another visually timed test (using your watch) is started by a continuous ping (**ping –t**) directed to the switch on a PC attached to the switch. Disconnect the cable from the switch and the pings started failing. Reconnect the cable to the switch, and check your watch to see how long it took for the switch to respond to the pings from the PC.

It took about 5–6 seconds with auto–negotiation for speed and duplex turned `on`, and about 4 seconds with auto–negotiation for speed and duplex turned `off`. There are a lot of variables in this test (PC initialization, PC software, switch console port responding to requests, and so on) , however, an idea for how long it would take to get a response from the PCs point of view was the most important part of the test. All the above tests were from the switches internal debug message point of view.

Catalyst 6500/6000 Switch Running Cisco IOS System Software

The following commands show how to turn `on` Spanning Tree PortFast and turn `off` trunking negotiation (DISL, DTP). With this operating system, PAgP is not active until you add a port to an EtherChannel. You do not need to turn it `off`. These commands can be applied to a group of ports at one time by issuing the **interface range** command. The following commands would allow you to apply commands to ports 3/2 through 3/4 at the same time (note that the space between the 2 and the – in the command **interface range**

fastEthernet 3/2 –4 is mandatory to avoid a syntax error).

```
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.

Native_IOS(config)# interface range fastEthernet 3/2 -4
Native_IOS(config-if-range)#
```

For these examples, only one port is used. A port in Cisco IOS Software defaults to being a routed port (Layer 3 (L3)), as you would encounter on a router. You only need to add these commands to ports that are configured to be switch ports (Layer 2 (L2)), because these are the ports running L2 protocols (Spanning Tree and DTP) on them and are therefore subject to startup delay. To make a routed port into a switched port you would use the **switchport** command (with no parameters after it) in interface mode.

Configuration

Start with a port in the default (L3) state, configure it as a switchport (using the **switchport** command on a line by itself), turn off DTP by configuring it as an access port (only), turn on the Spanning Tree PortFast feature, and save the configuration. The first command below **show run interface fastEthernet 3/13** shows the current configuration for this port.

```
Native_IOS# show run interface fastEthernet 3/13
Building configuration...

Current configuration : 61 bytes
!
interface FastEthernet3/13
 no ip address
 shutdown
end

Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)# interface fastEthernet 3/13
Native_IOS(config-if)# switchport
Native_IOS(config-if)# switchport mode access
Native_IOS(config-if)# spanning-tree portfast
%Warning: PortFast should only be enabled on ports connected to a single host.
 Connecting hubs, concentrators, switches,  bridges, etc.to this interface
 when PortFast is enabled, can cause temporary Spanning Tree loops.
 Use with CAUTION

%PortFast has been configured on FastEthernet3/13 but will only
 have effect when the interface is in a non-trunking mode.
Native_IOS(config-if)# no shutdown
Native_IOS(config-if)# ^Z
Native_IOS# copy run start
```

Verification

The version of the switch software used in this document is Cisco IOS Software Release 12.1(6)E. For the full output of the **show version** and **show module** commands, refer to the timing test section of this document.

```
Native_IOS# show version
Cisco Internetwork Operating System Software
IOS (tm) c6sup1_rp Software (c6sup1_rp-JSV-M), Version 12.1(6)E, EARLY DEPLOYME)
```

This is how the configuration looks after the above changes have taken effect.

Cisco – Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays

```
Native_IOS# show run interface fastEthernet 3/13
Building configuration...

Current configuration : 109 bytes
!
interface FastEthernet3/13
 no ip address
 switchport
 switchport mode access
 spanning-tree portfast
end

Native_IOS# show interfaces fastEthernet 3/13 switchport
Name: Fa3/13
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001

Native_IOS# show spanning-tree interface fastEthernet 3/13
 Port 141 (FastEthernet3/13) of VLAN1 is forwarding
    Port path cost 19, Port priority 128, Port Identifier 128.141.
    Designated root has priority 32768, address 00d0.024f.6001
    Designated bridge has priority 32768, address 00d0.024f.6001
    Designated port id is 128.141, designated path cost 0
    Timers: message age 0, forward delay 0, hold 0
    Number of transitions to forwarding state: 1
    BPDU: sent 8984, received 0
    The port is in the PortFast mode
Native_IOS#
```

Timing Tests on a Catalyst 6000 Running Cisco IOS System Software

The following test shows what happens with switch port initialization timing as the various commands are applied. The default settings of the port are used first to give a benchmark. They have PortFast disabled, and the trunking mode (DTP) set to `auto` (it will trunk if asked to trunk). PAgP is not active by default in this operating system. The test then proceeds to turn PortFast `on` and measure the time, and turn trunking `off` and measure the time. Finally, turn auto–negotiation `off` and measure the time.

Note: Turning PortFast `on` is not the same thing as turning STP `off` (as noted earlier in the document). With PortFast `on`, STP is still running on the port; `blocking`, `listening`, and `learning` are skipped, and the port immediately goes to the `forwarding` state. Turning STP `off` is not recommended because it affects the entire VLAN, and can leave the network vulnerable to physical topology loops. This can cause serious network problems.

1. Show the switch software version and configuration by issuing the **show version** and **show module** commands

```
Native_IOS# show version
Cisco Internetwork Operating System Software
IOS (tm) c6sup1_rp Software (c6sup1_rp-JSV-M), Version 12.1(6)E, EARLY DEPLOYME)
TAC Support: http://www.cisco.com/cgi-bin/ibld/view.pl?i=support
Copyright (c) 1986-2001 by cisco Systems, Inc.
Compiled Sat 17-Mar-01 00:14 by eaarmas
```

```
        Image text-base: 0x60020950, data-base: 0x6165E000

        ROM: System Bootstrap, Version 12.0(3)XE, RELEASE SOFTWARE
        BOOTFLASH: MSFC Software (C6MSFC-BOOT-M), Version 12.1(6)E, EARLY DEPLOYMENT RE)

        Native_IOS uptime is 12 hours, 36 minutes
        System returned to ROM by reload (SP by reload)
        System image file is "sup-bootflash:c6sup11-jsv-mz.121-6.E"

        cisco Catalyst 6000 (R5000) processor with 114688K/16384K bytes of memory.
        Processor board ID SAD04281AF6
        R5000 CPU at 200Mhz, Implementation 35, Rev 2.1, 512KB L2 Cache
        Last reset from power-on
        Bridging software.
        X.25 software, Version 3.0.0.
        SuperLAT software (copyright 1990 by Meridian Technology Corp).
        TN3270 Emulation software.
        24 Ethernet/IEEE 802.3 interface(s)
        1 Virtual Ethernet/IEEE 802.3  interface(s)
        48 FastEthernet/IEEE 802.3 interface(s)
        4 Gigabit Ethernet/IEEE 802.3 interface(s)
        381K bytes of non-volatile configuration memory.
        4096K bytes of packet SRAM memory.

        16384K bytes of Flash internal SIMM (Sector size 256K).
        Configuration register is 0x2102

        Native_IOS# show module
        Slot Ports Card Type                                   Model                 Serir
        ---- ----- ------------------------------------------ --------------------- -----
         1     2   Cat 6000 sup 1 Enhanced QoS (active)        WS-X6K-SUP1A-2GE      SAD0
         2     2   Cat 6000 sup 1 Enhanced QoS (other)         WSSUP1A-2GE           SAD0
         3    48   48 port 10/100 mb RJ45                      WS-X6348-RJ-45        SAD0
         6    24   24 port 10baseFL                            WS-X6024-10FL-MT      SAD0

        Slot MAC addresses                         Hw    Fw           Sw
        ---- ----------------------------------- ----- ------------ ----------
         1   00d0.c0d2.5540 to 00d0.c0d2.5541    3.2   unknown      6.1(0.105)OR
         2   00d0.bceb.8bb4 to 00d0.bceb.8bb5    5.0   unknown      unknown
         3   0002.7ef1.36e0 to 0002.7ef1.370f    1.1   5.3(1) 1999- 6.1(0.105)OR
         6   00d0.9738.5338 to 00d0.9738.534f    0.206 5.3(1) 1999- 6.1(0.105)OR
```

2. Turn on debugging to see the various Spanning Tree states to determine when the port is ready to send and receive data. Turn on timestamps to see timing information in the messages being displayed. In Cisco IOS Software, the Switch Processor (SP) and the Router Processor (RP) work together to present one Command Line Interface (CLI) to the user, with the RP in charge of the CLI. Each module is responsible for different functions behind the scenes. To see debugs for Spanning Tree running on a port configured as a switch port (L2), you need to turn on debugging on the SP. To do this, issue the **remote login** command to access the SP. Notice the prompt will change to let you know that you are on the SP. To return to the RP, issue the **exit** command (not "^C^C^C" as the message below says). Limit the debugging information to just the port of interest (**debug interface fastEthernet 3/13**), and turn on Spanning Tree debugging on the SP. After doing this, return to the RP to continue the test. The switch defaults to sending debug output to the console.

```
        Native_IOS# conf t
        Native_IOS(config)# service timestamps debug datetime msec
        Native_IOS(config)# service timestamps log datetime msec


        !--- Turning on timestamps prints the time whenever debug and/or
        !--- log messages are produced. This allows us to measure the time
        !--- between various messages.
```

```
Native_IOS(config)# exit
Native_IOS# remote login
Trying Switch ...
Entering CONSOLE for Switch
Type "^C^C^C" to end this session

Switch-sp# debug interface fastEthernet 3/13
Condition 1 set
Switch-sp# debug spanning-tree events
spanning tree event debugging is on
Switch-sp# exit

[Connection to Switch closed by foreign host]
Native_IOS#
```

3. The command below shuts down the port.

```
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)# Int f3/13
Native_IOS(config-if)# shutdown
Native_IOS(config-if)# ^Z
Native_IOS#
```

4. Check the time and enable the port to determine how long the switch stays in each state. To get the most accurate timing information, it is important to enter the commands below as quickly as possible. One idea is to type each command (**show clock**, **conf t**, and **Int f3/13 No shut** in this example) on a separate line in a text file; you can then copy the commands to the clipboard and paste them into the switch.

```
Native_IOS# show run int f3/13
Building configuration...

Current configuration : 71 bytes
!
interface FastEthernet3/13
 no ip address
 shutdown
 switchport
end

Native_IOS# show clock
*08:35:55.059 UTC Sun Jan 2 2000
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)#Int f3/13
Native_IOS(config-if)#No shut
*Jan  2 08:36:00.847: SP: STP: VLAN1 Fa3/13 -> listening
*Jan  2 08:36:15.847: SP: STP: VLAN1 Fa3/13 -> learning
*Jan  2 08:36:30.847: SP: STP: VLAN1 Fa3/13 -> forwarding
```

Notice from the output above that it took about 5.8 seconds (35:55 to 36:00) for the port to begin the STP `listening` stage. This time was spent joining the bridge group and completing DTP negotiation. The `listening` state took 15 seconds (36:00 to 36:15). The `learning` state (until `forwarding` state began) took 15 seconds (36:15 to 36:30). The total time before the port actually became functional for traffic was about **35 seconds** (35:55 to 36:30).

5. As seen in the above output, STP is active on this port. There are other factors that may slow the port from reaching the `forwarding` state. The **show int f3/13 switchport** command shows that this port will dynamically become a trunk if the other side of the link will (administrative mode will be `dynamic desirable`), however, the current operational mode is static access (no one is willing to trunk on the other side). Notice that negotiation of trunking is `on`, and should remain on for the duration of the test.

```
Native_IOS# show int f3/13 switchport
Name: Fa3/13
Switchport: Enabled
Administrative Mode: dynamic desirable
Operational Mode: static access
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001
```
6. Enable PortFast on the port. Trunking negotiation (DTP) is still in the `auto` mode.

```
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)# int f3/13
Native_IOS(config-if)# spanning-tree portfast
%Warning: PortFast should only be enabled on ports connected to a single host.
 Connecting hubs, concentrators, switches,  bridges, etc.to this interface
 when PortFast is enabled, can cause temporary spanning tree loops.
 Use with CAUTION

%PortFast has been configured on FastEthernet3/13 but will only
 have effect when the interface is in a non-trunking mode.
Native_IOS(config-if)# shutdown
Native_IOS(config-if)# ^Z
Native_IOS#
```

Perform the test.

```
Native_IOS# show clock
*08:41:09.531 UTC Sun Jan 2 2000
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)# Int f3/13
Native_IOS(config-if)# No shut
*Jan  2 08:41:15.175: SP: STP: VLAN1 Fa3/13 ->jump to forwarding from blocking
```

There is a total time of about **5.7 seconds** (41:09 to 41:15). You saved about 30 seconds by enabling PortFast. Try to reduce the delay further.
7. Turn trunking to `off` (instead of auto) to determine how that affects the time it takes for the port to reach `forwarding` state. Again, turn the port `off` and `on` and record the time. To turn trunking `off` in Cisco IOS Software, issue the command **switchport mode access**.

```
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)# Int f3/13
Native_IOS(config-if)# switchport mode access
Native_IOS(config-if)# shutdown
Native_IOS(config-if)# ^Z
Native_IOS#
```

Start the test with trunking set to `off` (instead of auto).

```
Native_IOS# show clock
*08:42:01.767 UTC Sun Jan 2 2000
Native_IOS# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Native_IOS(config)# Int f3/13
Native_IOS(config-if)# No shut
```

```
*Jan  2 08:42:04.363: SP: STP:
   VLAN1 Fa3/13 ->jump to forwarding from blocking
```

You saved a few seconds at the beginning since it took roughly **3 seconds** to reach the STP `forwarding` state (00:19 to 00:22). You saved about **2 seconds** by changing the trunking mode from `auto` to `off`.

8. **(Optional)** If the switch port initialization time was the problem, it should be solved now. If you have to reduce a few more seconds off the time, you could set the port speed and duplex manually instead of using auto–negotiation.

   Note that this step is not usually required for resolving startup delay issues, and can in fact lead to performance problems if the other side of the link is not taken out of auto–negotiation and manually set with the same settings.

   Setting the speed and duplex manually requires that you set the speed and duplex on the other side as well. This is because setting the port speed and duplex disables auto–negotiation on the port and the connecting device will not see auto–negotiation parameters. The connecting device will connect only at half–duplex and the resulting duplex mismatch results in poor performance and port errors. Remember, if you set speed and duplex on one side, you must set speed and duplex on the connecting device as well to avoid these problems.

   ```
   Native_IOS# conf t
   Enter configuration commands, one per line.  End with CNTL/Z.
   Native_IOS(config)# Int f3/13
   Native_IOS(config-if)# speed 100
   Native_IOS(config-if)# duplex full
   Native_IOS(config-if)# shutdown
   Native_IOS(config-if)# ^Z
   Native_IOS#
   ```

   The timing results are shown below.

   ```
   Native_IOS# show clock
   *08:43:47.367 UTC Sun Jan 2 2000
   Native_IOS# conf t
   Enter configuration commands, one per line.  End with CNTL/Z.
   Native_IOS(config)# Int f3/13
   Native_IOS(config-if)# No shut
   *Jan  2 08:43:49.079: SP: STP: VLAN1 Fa3/13 ->jump to forwarding from blocking
   ```

   The final result gives a time of roughly **2 seconds** (43:47 to 43:49).

9. To turn off the debugging on the SP, issue the following sequence of commands:

   ```
   Native_IOS# remote login
   Trying Switch ...
   Entering CONSOLE for Switch
   Type "^C^C^C" to end this session


   Switch-sp# undebug all
   All possible debugging has been turned off
   Switch-sp# exit

   [Connection to Switch closed by foreign host]
   Native_IOS#
   ```

Cisco – Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays

Catalyst 4500/4000 Switch Running Cisco IOS System Software

The following commands show how to turn on Spanning Tree PortFast and turn off trunking negotiation (DISL, DTP). With this operating system, PAgP is not active until you add a port to an EtherChannel, so it is not necessary to turn it off. These commands can be applied to a group of ports at one time by issuing the **interface range** command. The commands below allow you to apply commands to ports 3/2–3/4 at the same time.

Note: The space between the 2 and the – in the **interface range fastEthernet 3/2 –4** command is mandatory to avoid a syntax error.

```
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.

Switch(config)#interface range fastEthernet 3/2 –4
Switch(config-if-range)#
```

These examples will focus on one port. A port in a Catalyst 4000 switch running Cisco IOS System Software defaults to switch ports (L2). These are the ports running L2 protocols (Spanning Tree and DTP), and are subject to startup delay.

Configuration

Start with a port in the default L2 state, turn off DTP by configuring it as an access port (only), and turn on the Spanning Tree PortFast feature and save the configuration. The first command below shows the current configuration for this port:

```
SwitchB# show run interface fas 5/4
Building configuration...

Current configuration : 59 bytes
!
interface FastEthernet5/4
 no snmp trap link-status
end

SwitchB# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
SwitchB(config)# interface fastethernet 5/4
SwitchB(config-if)# switchport mode access
SwitchB(config-if)# spanning-tree portfast
%Warning: PortFast should only be enabled on ports connected to a single hos
t.
 Connecting hubs, concentrators, switches,  bridges, etc.to this interface
 when PortFast is enabled, can cause temporary spanning tree loops.
 Use with CAUTION

%PortFast has been configured on FastEthernet5/4 but will only
 have effect when the interface is in a non-trunking mode.
SwitchB(config-if)#^Z
SwitchB#
SwitchB# copy run start
```

Verification

The version of the switch software used in this document is Cisco IOS Software Release 12.1(11b)EW, as shown in the following example. For the full output of the **show version** and **show module** commands, refer to the timing test section of this document.

```
Switch#show version
Cisco Internetwork Operating System Software
IOS (tm) Catalyst 4000 L3 Switch Software (cat4000-IS-M), Version 12.1(11b)EW,
```

This is how the configuration looks after the above changes.

```
SwitchB# show run interface fas 5/4
Building configuration...

Current configuration : 107 bytes
!
interface FastEthernet5/4
 switchport mode access
 no snmp trap link-status
 spanning-tree portfast
end

SwitchB# show interfaces fastEthernet 5/4 switchport
Name: Fa5/4
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: negotiate
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Appliance trust: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Operational private-vlan: none
Trunking VLANs Enabled: ALL
Pruning VLANs Enabled: 2-1001

SwitchB# show spanning-tree interface fastEthernet 5/4
 Port 260 (FastEthernet5/4) of VLAN1 is forwarding
   Port path cost 19, Port priority 128, Port Identifier 129.4.
   Designated root has priority 1, address 0060.8355.7b00
   Designated bridge has priority 32768, address 0001.96d9.f300
   Designated port id is 129.4, designated path cost 38
   Timers: message age 0, forward delay 0, hold 0
   Number of transitions to forwarding state: 109
   BPDU: sent 148, received 0
   The port is in the PortFast mode
```

Timing Tests on a Catalyst 4500/4000 Running Cisco IOS System Software

The following test shows what happens with switch port initialization timing as the various commands are applied. The default settings of the port are used first to give a benchmark. They have PortFast disabled, and the trunking mode (DTP) set to `auto` (it will trunk if asked to trunk). PAgP is not active by default in this operating system. After that, the time will be measured with PortFast turned on, followed by turning trunking

off and measuring the time. Finally, auto–negotiation is turned off and the time is measured.

Note: Turning PortFast `on` is not the same thing as turning STP `off` (as noted earlier in the document). With PortFast `on`, STP is still running on the port; `blocking`, `listening`, and `learning` are skipped, and the port immediately goes to the `forwarding` state. Turning STP `off` is not recommended because it affects the entire VLAN, and can leave the network vulnerable to physical topology loops. This can cause serious network problems.

1. Show the switch software version and configuration by issuing the **show version** and **show module** commands, as shown in the following example:

```
SwitchB# show version
Cisco Internetwork Operating System Software
IOS (tm) Catalyst 4000 L3 Switch Software (cat4000-IS-M), Version 12.1(11b)EW,
   EARLY DEPLOYMENT RELEASE SOFTWARE (fc2)
TAC Support: http://www.cisco.com/tac
Copyright (c) 1986-2002 by cisco Systems, Inc.
Compiled Tue 14-May-02 13:31 by hqluong
Image text-base: 0x00000000, data-base: 0x00B1C1F8

ROM: 12.1(11br)EW
SwitchB uptime is 4 minutes
System returned to ROM by reload
System image file is "bootflash:cat4000-is-mz.121-11b.EW"

cisco WS-C4006 (MPC8245) processor (revision 5) with 262144K bytes of memory.
Processor board ID FOX04169082
Last reset from Reload
32 FastEthernet/IEEE 802.3 interface(s)
4 Gigabit Ethernet/IEEE 802.3 interface(s)
467K bytes of non-volatile configuration memory.

Configuration register is 0x2102

SwitchB# show module

Mod  Ports Card Type                                     Model            Serial No.
----+-----+-------------------------------------+----------------+-----------
 1      2  1000BaseX (GBIC) Supervisor Module    WS-X4014 JAB054109FE
 5     34  10/100BaseTX (RJ45), 1000BaseX (GBIC)  WS-X4232        JAB0253010D

 M MAC addresses                       Hw  Fw          Sw              Status
--+--------------------------------+---+-----------+---------------+---------
 1 0001.96d9.f300 to 0001.96d9.f6ff 0.5 12.1(11br)EW 12.1(11b)EW, EAR Ok
 5 0050.730a.da18 to 0050.730a.da39 1.0                             Ok
```

2. Turn on debugging so that you can see the various Spanning Tree states to determine when the port is ready to send and receive data, as shown in the example below. Turn on timestamps so that you can see timing information in the messages being displayed. Limit the debugging information to just the port you are interested in (by issuing the **debug interface fastEthernet 5/4** command). The switch defaults to sending debug output to the console.

```
SwitchB# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
SwitchB(config)# service timestamps debug datetime msec
SwitchB(config)# service timestamps log datetime msec
SwitchB(config)# end

!--- Turning on timestamps prints the time whenever debug and/or
!--- log messages are produced. This allows you to measure the time
!--- between various messages.
```

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```
SwitchB# debug interface fastEthernet 5/4
Condition 1 set
SwitchB# debug spanning-tree events
Spanning Tree event debugging is on
```

3. The command below shuts down the port.

```
SwitchB# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
SwitchB(config)# interface fastEthernet 5/4
SwitchB(config-if)# shutdown
SwitchB(config-if)# end
SwitchB#
```

4. Check the time and enable the port to determine how long the switch stays in each state, as shown in the example below. To get the most accurate timing information, it is important to enter the following commands as quickly as possible. One idea is to type each command (**show clock, conf t, int f5/4 no shut**, in this example) on a separate line in a text file; you can then copy the commands to the clipboard and paste them into the switch.

```
SwitchB# show running-config interface fastEthernet 5/4
Building configuration...

Current configuration : 69 bytes
!
interface FastEthernet5/4
 shutdown
 no snmp trap link-status
end

SwitchB# show clock
21:31:34.027 UTC Thu Jul 25 2002

SwitchB# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
SwitchB(config)# int f5/4
SwitchB(config-if)# no shut
Jul 25 21:31:38.187: set portid: VLAN1 Fa5/4: new port id 8104
Jul 25 21:31:38.187: STP: VLAN1 Fa5/4 -> listening
Jul 25 21:31:53.187: STP: VLAN1 Fa5/4 -> learning
Jul 25 21:32:08.187: STP: VLAN1 sent Topology Change Notice on Fa5/34
Jul 25 21:32:08.187: STP: VLAN1 Fa5/4 -> forwarding
```

Notice from the output above that it took about 4.2 seconds (34.02 to 38.18) for the port to begin the STP `listening` stage. This time was spent joining the bridge group and completing DTP negotiation. The `listening` state took 15 seconds (38.18 to 53.18). The `learning` state (until `forwarding` state began) took 15 seconds (53.18 to 08:18). The total time before the port actually became functional for traffic was about 34 seconds (34:02 to 08.18).

5. STP is active on this port. There are other factors that may slow the port from reaching the `forwarding` state. Issuing the **show int f5/4 switchport** command shows that this port is in passive negotiating state, and will become trunk if the other side of the link initiates negotiation (administrative mode is `dynamic auto`). Currently, the operational mode is static access (nothing is willing to trunk on the other side).

Notice that negotiation of trunking is `on`, and should remain `on` for the following test:

```
SwitchB# show interfaces fastEthernet 5/4 switchport
Name: Fa5/4
Switchport: Enabled
Administrative Mode: dynamic auto
```

```
                 Operational Mode: static access
                 Administrative Trunking Encapsulation: negotiate
                 Operational Trunking Encapsulation: native
                 Negotiation of Trunking: On
                 Access Mode VLAN: 1 (default)
                 Trunking Native Mode VLAN: 1 (default)
                 Voice VLAN: none
                 Appliance trust: none
                 Administrative private-vlan host-association: none
                 Administrative private-vlan mapping: none
                 Operational private-vlan: none
                 Trunking VLANs Enabled: ALL
                 Pruning VLANs Enabled: 2-1001
```

6. Enable PortFast on the port, as shown in the example below. Trunking negotiation (DTP) is still in the `auto` mode.

```
        SwitchB# conf t
        Enter configuration commands, one per line.  End with CNTL/Z.
        SwitchB(config)# interface fastethernet 5/4
        SwitchB(config-if)# spanning-tree portfast
        %Warning: PortFast should only be enabled on ports connected to a single host
         Connecting hubs, concentrators, switches,  bridges, etc.to this interface
         when PortFast is enabled, can cause temporary spanning tree loops.
         Use with CAUTION

        %PortFast has been configured on FastEthernet5/4 but will only
         have effect when the interface is in a non-trunking mode.
        SwitchB(config-if)# shutdown
        SwitchB(config-if)# ^Z
        SwitchB#
```

The total time was about 4.7 seconds (16.41 to 21:15). This saved about 30 seconds by enabling PortFast. Try to reduce the delay further.

7. Turn trunking to `off` (instead of auto) to determine how that affects the time it takes for the port to reach the `forwarding` state. Again, turn the port `off` and `on` and record the time. To turn trunking `off` in Cisco IOS System Software, issue the **switchport mode access** command, as shown in the following example:

```
        SwitchB# conf t
        Enter configuration commands, one per line.  End with CNTL/Z.
        SwitchB(config)# interface fastethernet 5/4
        SwitchB(config-if)# switchport mode access
        SwitchB(config-if)# shutdown
        SwitchB(config-if)# ^Z
        SwitchB#
```

Start the test with trunking set to `off` (instead of `auto`), as shown in the following example:

```
        SwitchB# show clock
        22:06:11.947 UTC Thu Jul 25 2002
        SwitchB#conf t
        Enter configuration commands, one per line.  End with CNTL/Z.
        SwitchB(config)# int f5/4
        SwitchB(config-if)# no shut
        Jul 25 22:06:16.143: set portid: VLAN1 Fa5/4: new port id 8104
        Jul 25 22:06:16.143: STP: VLAN1 Fa5/4 ->jump to forwarding from blocking
```

This saved a small amount of time at the beginning since it took roughly four seconds to reach the STP `forwarding` state (12.00 to 16.10). You saved about 0.5 second by changing the trunking mode from auto to off.

8. **(Optional)** If the switch port initialization time was the problem, it should be solved now. If you have to reduce a few more seconds off the time, you could set the port speed and duplex manually instead of using auto–negotiation.

   Note: This step is not usually required for resolving startup delay issues. This step can lead to performance problems if the other side of the link is not taken out of auto–negotiation and manually set with the same settings.

   Setting the speed and duplex manually on this side requires that you set the speed and duplex on the other side as well. This is because setting the port speed and duplex disables auto–negotiation on the port, and the connecting device will not see the auto–negotiation parameters. The connecting device will connect only at half–duplex and the duplex mismatch results in poor performance and port errors. Remember, if you set the speed and duplex on one side, you must set the speed and duplex on the connecting device as well to avoid these problems.

   ```
   SwitchB# conf t
   Enter configuration commands, one per line.  End with CNTL/Z.
   SwitchB(config)# interface fastethernet 5/4
   SwitchB(config-if)# speed 100
   SwitchB(config-if)# duplex full
   SwitchB(config-if)# shutdown
   SwitchB(config-if)# ^Z
   SwitchB#
   ```

   The timing results are shown below.

   ```
   SwitchB# show clock
   22:14:49.219 UTC Thu Jul 25 2002
   SwitchB# conf t
   Enter configuration commands, one per line.  End with CNTL/Z.
   SwitchB(config)# int f5/4
   SwitchB(config-if)# no shut
   Jul 25 22:14:53.135: set portid: VLAN1 Fa5/4: new port id 8104
   Jul 25 22:14:53.135: STP: VLAN1 Fa5/4 ->jump to forwarding
   from blocking
   ```

   The final result gives a time of roughly 3.9 seconds (49.21 to 53.13).
9. To turn off the debugging on the SP which you turned on earlier, issue the following sequence of commands:

   ```
   SwitchB# undebug all
   All possible debugging has been turned off
   SwitchB# exit
   ```

Catalyst 2948G–L3/4908G–L3/4840G Switches

The 2948G–L3/4908G–L3/4840G family of switches are another group of switches that run Cisco IOS Software. These switches do not have the ability to make ports into switchports like the Cisco IOS Software on the Catalyst 6000. The following are some things to understand about these switches:

- From a configuration standpoint, the Catalyst 2948G–L3 is a router . This switch uses a Cisco IOS configuration interface and by default, all interfaces are routed interfaces.
- The Catalyst 2948G–L3 does not extend your VLANs. This switch terminates them on a routed interface (using bridging commands you can simulate the functionality of VLANs to a certain degree).

- The Catalyst 2948G–L3 does not support several L2–oriented protocols, such as VTP, DTP, and PAgP, found on other Catalyst switches .

If you decide to configure ports for bridging on these devices the Spanning Tree will be active on these ports and you will have the normal 30 second startup delay as the port moves through the `blocking`, `listening`, and `learning` stages. If you know that only end–stations will be connected to these ports, you can reduce the startup delay by turning `off` Spanning Tree on these ports. This is different and more dangerous (as described in the next paragraph) than using PortFast. PortFast, however, is not available on these devices.

Note: Disabling Spanning Tree on a bridged router interface is not the same as enabling Spanning Tree PortFast on a switch port. The router will not block the port if BPDUs are received from a switch or if a bridge is mistakenly connected to the interface. Be careful to connect only workstations or other end–hosts to interfaces with Spanning Tree disabled. Do not disable Spanning Tree on the port if you are connecting a hub or switch to the port.

The following output shows how to configure the Catalyst 2948G–L3 for bridging. All of the Fast Ethernet interfaces are assigned to a single bridge–group and Spanning Tree is disabled to prevent various end–station startup issues.

```
2948G-L3# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
2948G-L3(config)# bridge irb
2948G-L3(config)# bridge 1 protocol ieee
2948G-L3(config)# bridge 1 route ip
2948G-L3(config)# interface bvi 1
2948G-L3(config-if)# ip add 10.1.1.1 255.255.255.0
2948G-L3(config-if)# exit
2948G-L3(config)# interface fast 1
2948G-L3(config-if)# no shutdown
2948G-L3(config-if)# bridge-group 1
2948G-L3(config-if)# bridge-group 1 spanning-disabled
2948G-L3(config-if)# exit
2948G-L3(config)# interface fast 2
2948G-L3(config-if)# no shutdown
2948G-L3(config-if)# bridge-group 1
2948G-L3(config-if)# bridge-group 1 spanning-disabled
. . .
```

For more information on configuring 2948G–L3 switches, refer to Catalyst 2948G–L3 Sample Configurations – Single VLAN, Multi–VLAN, and Multi–VLAN Distribution Layer Connecting to Network Core.

Catalyst 2900XL/3500XL/2950/3550 Switch

The Catalyst 2900XL/3500XL and Catalyst 2950/3550 models can be configured from a web browser, with Simple Network Management Protocol (SNMP), or with the Command Line Interface (CLI). It is recommended to use the CLI. Below is an example of viewing the STP state of a port, turning on PortFast, and then verifying that it is on. The 2900XL/3500XL **does** support EtherChannel and trunking, but it **does not** support dynamic EtherChannel creation (PAgP) or DTP. There is no need to turn them off in this test. Also, after turning on PortFast, the elapsed time for the port to come up is already less than 1 second, so there is not much point to trying to change speed/duplex negotiation settings to speed things up. By default, PortFast is off on the switch ports. The 2950/3550 does support both PAgP and DTP protocols. PAgP is not active by default in these switches, but DTP is active. The 2950 does not support DTP or PAgP if it is running Cisco IOS 12.0. The commands to turn PortFast on are listed below.

Configuration

```
2900XL# conf t
2900XL(config)# interface fastEthernet 0/1
2900XL(config-if)# spanning-tree portfast
2900XL(config-if)# exit
2900XL(config)# exit
2900XL# copy run start
```

Note: Catalyst 2950 and 3550 support DTP protocol. Issue the **switchport mode access** command (to turn off DTP) as well.

This platform is like a Cisco router's IOS. You must save the configuration (by issuing the **copy run start** command) if you want it to be permanently saved.

Verification

To verify that PortFast is enabled, issue the command below.

```
2900XL# show spanning-tree interface fastEthernet 0/1
Interface Fa0/1 (port 13) in Spanning tree 1 is FORWARDING
   Port path cost 19, Port priority 128
   Designated root has priority 8192, address 0010.0db1.7800
   Designated bridge has priority 32768, address 0050.8039.ec40
   Designated port is 13, path cost 19
   Timers: message age 0, forward delay 0, hold 0
   BPDU: sent 2105, received 1
   The port is in the PortFast mode
```

You can also view the switch's configuration with the command below.

```
2900XL# show running-config
Building configuration...

Current configuration:
!
version 11.2
...
!
interface VLAN1
 ip address 172.16.84.5 255.255.255.0
 no ip route-cache
!
interface FastEthernet0/1
 spanning-tree portfast
!
interface FastEthernet0/2
!
...
```

Timing Tests on the Catalyst 2900XL

Perform the following steps to execute timing tests on the Catalyst 2900XL.

1. Show the software version. The 11.2(8.2)SA6 version of software was used on the 2900XL for the following examples.

```
Switch# show version
```

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```
Cisco Internetwork Operating System Software
IOS (tm) C2900XL Software (C2900XL-C3H2S-M), Version 11.2(8.2)SA6,
MAINTENANCE INTERIM SOFTWARE
Copyright (c) 1986-1999 by cisco Systems, Inc.
Compiled Wed 23-Jun-99 16:25 by boba
Image text-base: 0x00003000, data-base: 0x00259AEC

ROM: Bootstrap program is C2900XL boot loader

Switch uptime is 1 week, 4 days, 22 hours, 5 minutes
System restarted by power-on
System image file is "flash:c2900XL-c3h2s-mz-112.8.2-SA6.bin",
booted via console

cisco WS-C2924-XL (PowerPC403GA) processor (revision 0x11) with
8192K/1024K bytes of memory.
Processor board ID 0x0E, with hardware revision 0x01
Last reset from power-on

Processor is running Enterprise Edition Software
Cluster command switch capable
Cluster member switch capable
24 Ethernet/IEEE 802.3 interface(s)

32K bytes of flash-simulated non-volatile configuration memory.
Base ethernet MAC Address: 00:50:80:39:EC:40
Motherboard assembly number: 73-3382-04
Power supply part number: 34-0834-01
Motherboard serial number: FAA02499G7X
Model number: WS-C2924-XL-EN
System serial number: FAA0250U03P
Configuration register is 0xF
```

2. Issue the following commands to determine what is happening on the switch:

```
2900XL(config)# service timestamps debug uptime
2900XL(config)# service timestamps log uptime
2900XL# debug spantree events
Spanning Tree event debugging is on
2900XL# show debug
General spanning tree:
  Spanning Tree event debugging is on
```

3. Shut down the port in question.

```
2900XL# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
2900XL(config)# interface fastEthernet 0/1
2900XL(config-if)# shut
2900XL(config-if)#
00:31:28: ST: sent Topology Change Notice on FastEthernet0/6
00:31:28: ST: FastEthernet0/1 -> blocking
00:31:28: %LINK-5-CHANGED: Interface FastEthernet0/1, changed state to
administratively down
00:31:28: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1,
changed state to down
2900XL(config-if)# exit
2900XL(config)# exit
2900XL#
```

4. Check the time, turn the port back on, and determine how long the switch stays in each state.

To get the most accurate timing information, it is important to enter the commands below as quickly as possible. One idea is to type each commands below on a separate line in a text file; you can then copy the commands to the clipboard and paste them into the switch.

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```
show clock
conf t
int f0/1
no shut
```

5. By default, PortFast is off. You can confirm it two ways. The first way is that the **show spanning–tree interface** command will not mention PortFast. The second way is to look at the running configuration; you will not see the **spanning–tree portfast** command under the interface.

```
2900XL# show spanning-tree interface fastEthernet 0/1
Interface Fa0/1 (port 13) in Spanning tree 1 is FORWARDING
   Port path cost 19, Port priority 128
   Designated root has priority 8192, address 0010.0db1.7800
   Designated bridge has priority 32768, address 0050.8039.ec40
   Designated port is 13, path cost 19
   Timers: message age 0, forward delay 0, hold 0
   BPDU: sent 887, received 1
```

Note: There is no message about being in PortFast mode is in this spot..

```
2900XL# show running-config
Building configuration...
...
!
interface FastEthernet0/1


!--- There is no Spanning Tree PortFast command under this interface.


!
...
```

6. This output shows the first timing test with PortFast off.

```
2900XL# show clock
*00:27:27.632 UTC Mon Mar 1 1993
2900XL# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
2900XL(config)# int f0/1
2900XL(config-if)# no shut
2900XL(config-if)#
00:27:27: ST: FastEthernet0/1 -> listening
00:27:27: %LINK-3-UPDOWN: Interface FastEthernet0/1,
changed state to up
00:27:28: %LINEPROTO-5-UPDOWN: Line protocol on Interface
FastEthernet0/1, changed state to up
00:27:42: ST: FastEthernet0/1 -> learning
00:27:57: ST: sent Topology Change Notice on FastEthernet0/6
00:27:57: ST: FastEthernet0/1 -> forwarding
```

Total time from shutdown until the port started forwarding was **30 seconds** (27:27 to 27:57).

7. To turn on PortFast, issue the following commands:

```
2900XL# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
2900XL(config)# interface fastEthernet 0/1
2900XL(config-if)# spanning-tree portfast
2900XL(config-if)# exit
2900XL(config)# exit
2900XL#
```

To verify that PortFast is enabled, issue the **show spanning tree interface** command. Notice at the end of the command output it says that PortFast is enabled.

```
2900XL# show spanning tree interface fastEthernet 0/1
Interface Fa0/1 (port 13) in Spanning tree 1 is FORWARDING
   Port path cost 19, Port priority 128
   Designated root has priority 8192, address 0010.0db1.7800
   Designated bridge has priority 32768, address 0050.8039.ec40
   Designated port is 13, path cost 19
   Timers: message age 0, forward delay 0, hold 0
   BPDU: sent 1001, received 1
   The port is in the PortFast mode.
```

You can also see that PortFast is enabled in the configuration output shown below.

```
2900XL# sh run
Building configuration...
...
interface FastEthernet0/1
 spanning-tree portfast
...
```

8. Perform the timing test with PortFast enabled.

```
2900XL# show clock
*00:23:45.139 UTC Mon Mar 1 1993
2900XL# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
2900XL(config)# int f0/1
2900XL(config-if)# no shut
2900XL(config-if)#
00:23:45: ST: FastEthernet0/1 ->jump to forwarding from blocking
00:23:45: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
00:23:45: %LINEPROTO-5-UPDOWN:
    Line protocol on Interface FastEthernet0/1, changed state to up
```

In this case, the total time was under **1 second**. If port initialization delay on the switch was the problem, then PortFast should solve it. Remember, the switch does not currently support trunk negotiation or PAgP so we do not need to turn them off. The switch does support auto–negotiation of speed and duplex, however, since the delay is so small this would not be a reason to turn it off.

9. Perform the ping test (Step 11 from the Timing Tests With and Without DTP, PAgP, and PortFast on a Catalyst 5000 section above) from a workstation to the switch. It should take about 5–6 seconds for the response to come from the switch whether auto–negotiation for speed and duplex was on or off.

Catalyst 1900/2800 Switch

The Catalyst 1900 and Catalyst 2820 call PortFast spantree start–forwarding. For the 8.01.05 version of software, the switches default to having PortFast enabled on the Ethernet (10Mbps) ports, and PortFast disabled on the FastEthernet (uplink) ports. When you issue the **show run** command to view the configuration and an Ethernet port says nothing about PortFast, PortFast is enabled. If a port reports no spantree start-forwarding in the configuration, PortFast is disabled. On a FastEthernet (100Mbps) port, it is the opposite; for a FastEthernet port, PortFast is on only if the port shows spantree start-forwarding in the configuration.

Below is an example of setting PortFast on a FastEthernet port. These examples use Enterprise edition software, version 8. The Catalyst 1900 automatically saves the configuration after changes have been made to NVRAM. Remember, you would not want PortFast enabled on any port that connects to another switch or hub; you only want PortFast enabled on a port that attaches to an end–station.

Cisco – Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays

Configuration

```
1900# show version
Cisco Catalyst 1900/2820 Enterprise Edition Software
Version V8.01.05
Copyright (c) Cisco Systems, Inc.  1993-1998
1900 uptime is 0day(s) 01hour(s) 10minute(s) 42second(s)
cisco Catalyst 1900 (486sxl) processor with 2048K/1024K bytes of memory
Hardware board revision is 5
Upgrade Status: No upgrade currently in progress.
Config File Status: No configuration upload/download is in progress
27 Fixed Ethernet/IEEE 802.3 interface(s)
Base Ethernet Address: 00-50-50-E1-A4-80
1900# conf t
Enter configuration commands, one per line.  End with CNTL/Z
1900(config)# interface FastEthernet 0/26
1900(config-if)# spantree start-forwarding
1900(config-if)# exit
1900(config)# exit
1900#
```

Verification

One way to verify that PortFast is on is to look at the configuration. Remember, a FastEthernet port must say it is on. An Ethernet port has it on unless the configuration shows that it is off. In the configuration below, interface Ethernet 0/1 has PortFast turned off (you can see the command to turn it off), interface Ethernet 0/2 has PortFast on (you see nothing, which means it is on), and interface FastEthernet 0/26 (port A in the menu system) has PortFast on (you can see the command to turn it on).

```
1900# show running-config
Building configuration...
...
!
interface Ethernet 0/1

  no spantree start-forwarding
!
interface Ethernet 0/2

!
...
!
interface FastEthernet 0/26
  spantree start-forwarding
!
```

The easiest way to view the PortFast status is through the menu system. If you select (P) for Port Configuration from the main menu, select a port, the output will say if PortFast mode is enabled. The following output is for port FastEthernet 0/26 (which is port A on this switch):

```
        Catalyst 1900 - Port A Configuration

        Built-in 100Base-FX
        802.1d STP State:  Blocking     Forward Transitions:  0

    ---------------------- Settings --------------------------------------
      [D] Description/name of port
      [S] Status of port                            Suspended-no-linkbeat
      [I] Port priority (spanning tree)             128 (80 hex)
      [C] Path cost (spanning tree)                 10
```

Cisco – Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays

```
      [H] Port fast mode (spanning tree)             Enabled
      [E] Enhanced congestion control                Disabled
      [F] Full duplex / Flow control                 Half duplex


      ---------------------- Related Menus ----------------------------------
      [A] Port addressing              [V] View port statistics
      [N] Next port                    [G] Goto port
      [P] Previous port                [X] Exit to Main Menu

   Enter Selection:
```

Timing Tests on the Catalyst 1900

The timing values are harder to verify on a Catalyst 1900/2820 because of the lack of debugging tools. Start a ping from a PC connected to the switch directed to the switch itself. Disconnect and reconnect the cable, and record how long it took for the switch to respond to the ping with PortFast on and with PortFast off. For an Ethernet port with PortFast on (the default state), the PC received a response within **5−6 seconds**. With PortFast off, the PC received a response in 34−35 seconds.

An Additional Benefit to Portfast

There is another STP−related benefit to using PortFast in your network. Every time a link becomes active and moves to the forwarding state in STP, the switch will send a special STP packet named a Topology Change Notification (TCN). The TCN notification is passed up to the root of the Spanning Tree where it is propagated to all the switches in the VLAN. This causes all the switches to age out their table of MAC addresses using the forward delay parameter, which is usually set to 15 seconds. So every time a workstation joins the bridge group, the MAC addresses on all the switches will be aged out after 15 seconds instead of the normal 300 seconds.

When a workstation becomes active, it does not change the topology to any significant degree. As far as all the switches in the VLAN are concerned, it is unnecessary for them to have to go through the fast−aging TCN period. If you turn on PortFast, the switch will not send TCN packets when a port becomes active.

Related Information

- **Troubleshooting Cisco Catalyst Switches to NIC Compatibility Issues**
- **Troubleshooting Switch Port Problems**
- **Configuring and Troubleshooting Ethernet 10/100Mb Half/Full Duplex Auto−Negotiation**
- **Technical Support − Cisco Systems**