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Tech Notes

High CPU Utilization on Catalyst 2900XL/3500XL Switches

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Contents

[Introduction](#)

[Before You Begin](#)

[Conventions](#)

[Prerequisites](#)

[Components Used](#)

[Background](#)

[Baseline CPU Utilization](#)

[Troubleshoot High CPU Utilization](#)

[Check Utilization of 2900XL and 3500XL Switches](#)

[Sample show processes cpu Command Output](#)

[Known Issues](#)

[High CPU Utilization Due to Autoconf Process](#)

[High CPU Utilization Due to Excess STP Instances](#)

[Related Information](#)

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Introduction

After issuing a **show processes cpu** command, the Catalyst fixed configuration switches 2900XL and 3500XL report a high value for CPU utilization at idle.

With other Cisco devices, high CPU utilization at idle is cause for concern; however, it is normal for the 2900XL and 3500XL.

This document explains the reason for the high CPU utilization value and gives some suggestions for monitoring and troubleshooting excessively high CPU utilization.

Before You Begin

Conventions

For more information on document conventions, see the [Cisco Technical Tips Conventions](#).

Prerequisites

There are no specific prerequisites for this document.

Components Used

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

Background

The 2900XL/3500XL switches have two separate hardware subsystems, the switching subsystem and the internal CPU engine. Each is described below:

- The switching subsystem controls the receiving and forwarding of data traffic.
- The internal CPU engine implements higher-level protocols to control and monitor switch behavior.

As a result, 2900XL/3500XL CPU utilization does **not** reflect:

- The number of packets being switched.
- The total load on the switch.

CPU utilization does reflect the switch CPU processing, which includes the following:

- spanning-tree processing
- port status
- LED indicators

In comparison, Cisco routers such as the Cisco 3600 process and route packets using software; therefore, the output of the **show processes cpu** command provides insight into the overall load on the router. The CPU utilization is linear for the amount of packet processing and routing being performed on the Cisco 3600 router.

The common observation is that the CPU utilization output for the **show processes cpu** command on the 2900XL/3500XL switch shows a fairly high value when the switch is idle and has no active ports. When viewing the output of the **show processes cpu** command, the highest percentage processes are **Port Status Proc** (Port Status Process) and **LED Control Proc** (LED Control Process). It is normal behavior for these processes to be a high percentage of the total CPU utilization. These processes run constantly to maintain and monitor the status of the ports and the different LEDs available on the panel of the switch.

Baseline CPU Utilization

The table below summarizes typical CPU utilization seen by 3500XL switches at idle and under load. It is noteworthy that CPU utilization does not increase linearly with increased load.

Switch	CPU Utilization	CPU Utilization at 50 Percent Write Speed Using Unicast
--------	-----------------	---

	at IDLE	Traffic
3512 XL	5 seconds (32 percent/2 percent)	5 seconds (32 percent/2 percent)
	1 minute (32 percent)	1 minute (33 percent)
	5 minutes (32 percent)	5 minutes (32 percent)
3548 XL	5 seconds (44 percent/6 percent)	5 seconds (46 percent/7 percent)
	1 minute (44 percent)	1 minute (33 percent)
	5 minutes (32 percent)	5 minutes (33 percent)

Therefore, it is normal for a 2900XL or 3500XL switch to indicate a CPU utilization value of 30 percent to 50 percent, even under minimal load.

Troubleshoot High CPU Utilization

The CPU is responsible for the following:

- processing broadcasts
- spanning-tree Bridge Protocol Data Units (BPDUs)
- address learning
- port status
- LED operations

The processes listed above may contribute to excessive CPU utilization. If the CPU utilization is extremely high (around 80 percent to 99 percent), or if the CPU utilization is higher than normal, follow these recommendations.

1. Create a baseline CPU utilization at no load.
2. Note which processes are generating the most load.
3. Check for consistent MAC address clearing or spanning-tree instability. Use the **show spanning-tree vlan *vlan-id*** command to gather this information.
4. Check for network broadcast storm.

5. Create a [Service Request](#) with Cisco Technical Support, if necessary.

Check Utilization of 2900XL and 3500XL Switches

The **show controller switch** command provides indicative information regarding the total switch utilization. This is an example:

```
Switch#show controller switch
Switch registers:

Device Type : 0x00040273
Congestion Threshold : 0x00000E95
Peak Total Allocation : 0x0000001A
Total Allocation : 0x00000000
Peak Total Bandwidth : 0x00000020
Total Bandwidth : 0x00000000
Total Bandwidth Limit : 0x000003DE
Lower Bandwidth Limit : 0x000003DE
Switch Mode : 0x00040000

Switch#
```

The **Total Bandwidth Limit** varies between different 2900XL and 3500XL models. When the **Total Bandwidth** reaches the **Total Bandwidth Limit** value, the switch has reached its full bandwidth capacity and begins to drop packets. The **Peak Total Bandwidth** is the highest value attained by the **Total Bandwidth** since the last time the **show controller switch** command was executed. Note, the values for the above parameters are in hexadecimal.

The **Congestion Threshold** value is used as conservative value for the maximum global buffer utilization. When the buffer utilization noted by **Total Allocation** reaches this value, the switch may drop frames. The **Peak Total Allocation** value shows the highest value attained by the **Total Allocation** since the last time the **show controller switch** command was executed. It is possible for the **Peak Total Allocation** and/or the **Total Allocation** to be greater than **Congestion Threshold**. If the **Total Allocation** reaches or is over the **Congestion Threshold** amount, the switch is experiencing considerable network activity near its full capacity.

The global buffer utilization may be adversely affected by several configuration issues, described here:

1. Speed mismatch between an ingress and egress port; for example, several 100 Mb clients transferring files to a server connected to the switch at 10 Mb, half-duplex.
2. Multiple input ports feeding a single output port.
3. Duplex mismatch on multiple ports.
4. Numerous ports that are experiencing collisions and/or output errors due to half-duplex configuration or oversubscription of a slow link.

Sample show processes cpu Command Output

Below is sample output from the **show processes cpu** command.

```
Switch#show processes cpu
CPU utilization for five seconds 35%/4%; one minute 35%; five minutes 35%
  PID  Runtime(ms)   Invoked  uSecs   5Sec   1Min   5Min  TTY Process
    1      15      44349      0    0.00%  0.00%  0.00%  0 Load Meter
    2      18       31      580    0.24%  0.02%  0.00%  0 Exec
    3   90945     22514     4039    0.00%  0.01%  0.00%  0 Check heaps
    4      3       1     3000    0.00%  0.00%  0.00%  0 Chunk Manager
    5      2       3      666    0.00%  0.00%  0.00%  0 Pool Manager
    6      0       2       0    0.00%  0.00%  0.00%  0 Timers
    7      0       1       0    0.00%  0.00%  0.00%  0 Entity MIB API
    8     451     3742     120    0.00%  0.00%  0.00%  0 ARP Input
    9      0       1       0    0.00%  0.00%  0.00%  0 RAM Access (dm 0
   10      0       1       0    0.00%  0.00%  0.00%  0 Critical Bkgnd
   11    1202     89758      13    0.00%  0.00%  0.00%  0 Net Background
   12      0       53       0    0.00%  0.00%  0.00%  0 Logger
   13    2410     221081     10    0.00%  0.00%  0.00%  0 TTY Background
   14   352967     767348     459    0.04%  0.09%  0.08%  0 Per-Second Jobs
   15     708     9223      76    0.00%  0.00%  0.00%  0 Net Input
   16      70     44350      1    0.00%  0.00%  0.00%  0 Compute load avg
   17   37697     3697    10196    0.00%  0.01%  0.00%  0 Per-minute Jobs
   18   877166    17911145      48    0.32%  0.21%  0.20%  0 LED Control Proc
   19   11915     221085      53    0.00%  0.00%  0.00%  0 Frank Aging
   20  23499061    26508015     886    5.73%  5.54%  5.55%  0 Port Status Proc
   21      0       1       0    0.00%  0.00%  0.00%  0 VM Prune Events
   23   1554627     741189     2097    0.32%  0.41%  0.43%  0 GDS Frame Ager
   24      0       1       0    0.00%  0.00%  0.00%  0 RAM Access (gi0/
   25      0       1       0    0.00%  0.00%  0.00%  0 IP NAT Ager
   28      0       1       0    0.00%  0.00%  0.00%  0 RAM Access (gi0/
   30   2568178    5890745     435    0.65%  0.73%  0.74%  0 Broadcast Storm
   31      0       1       0    0.00%  0.00%  0.00%  0 Port Group Chang
   32    2265     5952     380    0.00%  0.00%  0.00%  0 IP Input
   33     627     392    1599    0.00%  0.00%  0.00%  0 Address Learning
   34      0       1       0    0.00%  0.00%  0.00%  0 RAM Access (dm 1
   35      0       1       0    0.00%  0.00%  0.00%  0 RAM Access (dm 2
   36   369323     663847     556    0.00%  0.00%  0.00%  0 Enet Aging
   37    3073     26588     115    0.00%  0.00%  0.00%  0 CDP Protocol
   38     805       70    11500    0.00%  0.00%  0.00%  0 Address Deletion
   39     71      35     2028    0.00%  0.00%  0.00%  0 Switch CGMP Prot
   40      0       1       0    0.00%  0.00%  0.00%  0 TCP Timer
   41      0       1       0    0.00%  0.00%  0.00%  0 TCP Protocols
   42      0       1       0    0.00%  0.00%  0.00%  0 Socket Timers
   43      0       1       0    0.00%  0.00%  0.00%  0 HTTP Timer
   44      0       1       0    0.00%  0.00%  0.00%  0 CGMP Forwarding
   45     121     22176      5    0.00%  0.00%  0.00%  0 Cluster RARP
   46     184     27803      6    0.00%  0.00%  0.00%  0 Cluster Base
   47     105     113     929    0.00%  0.00%  0.00%  0 Spanning Tree
   48    6438     36032     178    0.00%  0.00%  0.00%  0 STP Hello
   49   283088    128597     2201    0.00%  0.00%  0.00%  0 STP Queue Handle
   50     172      93    1849    0.00%  0.00%  0.00%  0 Malibu STP Adjus
   51      0       1       0    0.00%  0.00%  0.00%  0 Time Range Proce
   52      0       1       0    0.00%  0.00%  0.00%  0 SNMP ConfCopyPro
   53      0       2       0    0.00%  0.00%  0.00%  0 Bridge MIB traps
```

Known Issues

High CPU Utilization Due to Autoconf Process

If you are experiencing high CPU utilization (up to 99 percent) and the **show processes cpu** command output indicates a large portion of this as the Autoconf process, you are probably hitting a known bug. This problem is filed against Cisco IOS Software Release 12.0(5.4)WC1 and earlier.

The problem occurs when you boot a switch which is configured with VLAN 1 interface in the administratively down state without an IP address, and another VLAN interface exists with an IP address that is administratively up. With this configuration, when the switch boots up, it finds that there is no IP address for VLAN 1 and starts the DHCP-based auto-configuration. This calls a function in the software which checks for interface VLAN 1 to be up before starting the DHCP, and hence comes up in an infinite loop. This results in the high CPU utilization.

The workaround is to configure the following commands, save the configuration, and reload the switch:

- **interface vlan 1**
- **no ip address**

Note: If you have any other interface VLANs without IP addresses, you will have to follow the same procedure for all those VLANs.

The following command shows the sample output if the switch is hitting this bug:

```
Switch#show processes cpu
CPU utilization for five seconds: 99%/7%; one minute: 99%; five minutes: 99%
PID  Runtime(ms)   Invoked  uSecs   5Sec   1Min   5Min  TTY  Process
   1         4034     538437    7      0.00%  0.00%  0.00%  0  Load Meter
   2          0         1         0      0.00%  0.00%  0.00%  0  IP NAT Ager
!--- Output suppressed.

   62  1888112123 117660129 16047   24.77% 49.89% 51.43%  0  Router Autoconf
   63     12583     1254   10034   0.00%  0.00%  0.00%  0  SNMP ConfCopyPro
   64         20         9     2222   0.00%  0.00%  0.00%  0  Bridge MIB traps
   66    592259    538607   1099   0.00%  0.00%  0.00%  0  Runtime diags
   67          0         1         0      0.00%  0.00%  0.00%  0  SNMP Timers
!--- Output suppressed.

Switch#
```

The fix for this Autoconf process high CPU issue has been integrated in code Cisco IOS Software Release 12.0(5)WC2 and later. Refer to Cisco bug ID [CSCdv21552](#) [☞](#) ([registered](#) customers only) in the [Bug Toolkit](#) [☞](#) ([registered](#) customers only).

High CPU Utilization Due to Excess STP Instances

You create a Spanning Tree Protocol (STP) instance when you assign an interface to a VLAN. The STP instance is removed when the last interface is moved to another VLAN. Each VLAN is a separate STP instance. If you have already used up all available STP instances on a switch, adding another VLAN anywhere in the VLAN Trunking Protocol (VTP) domain creates a VLAN that does not run STP on that switch. For example, if 250 VLANs are defined in the VTP domain, you can enable STP on 64 of those

VLANs. The rest of the VLANs must operate with STP disabled. There is a limitation on the number of instances of STP that a switch can handle.

The Catalyst 2912 XL, Catalyst 2924 XL, and Catalyst 2924C XL support only 64 STP instances and 64 VLANs. All other Catalyst 2900 XL switches and all Catalyst 3500 XL switches support 64 STP instances and 250 VLANs. Ensure that the total number of logical ports across all instances of STP for different VLANs does not exceed the maximum number supported. If you exceed these STP instance recommendations, the switch exhibits high CPU utilization. The Spanning Tree Algorithm (STA) is generally not processor intensive and has priority over other processes. You can see the CPU usage for the Spanning Tree process from the **show processes cpu** command output.

```
Switch#show processes cpu
CPU utilization for five seconds: 98%/10%; one minute: 96%; five minutes: 96%
PID  Runtime(ms)   Invoked  uSecs   5Sec   1Min   5Min  TTY Process
  1      111      411944    0    0.00%  0.00%  0.00%  0 Load Meter
  2     8251      2638    3127    0.90%  0.07%  0.01%  0 Exec
  3    753782    209157    3603    0.00%  0.01%  0.00%  0 Check heaps
  4         0         1         0    0.00%  0.00%  0.00%  0 Chunk Manager
```

!--- Output suppressed

```
 54      9862    282046    34    0.00%  0.00%  0.00%  0 Cluster Base
 55     2050    959972   3791   32.63% 30.03% 17.35% 0 Spanning Tree
 56   144660   6673996    21    0.00%  0.00%  0.00%  0 STP Hello
 57         0         14         0    0.00%  0.00%  0.00%  0 STP Queue Handle
 58      167      193     865    0.00%  0.00%  0.00%  0 Malibu STP Adjus
```

!--- Output suppressed

Issue the **show spanning-tree summary** command to verify the number of logical ports or interfaces per VLAN in the *STP Active* column.

```
Switch#show spanning-tree summary
```

UplinkFast is disabled

Name	Blocking	Listening	Learning	Forwarding	STP Active
VLAN1	19	0	0	7	26
VLAN3	19	0	0	5	24
VLAN4	19	0	0	5	24
VLAN5	19	0	0	5	24
VLAN6	19	0	0	5	24
VLAN7	19	0	0	5	24
VLAN9	19	0	0	5	24
VLAN10	19	0	0	5	24
VLAN11	19	0	0	5	24
VLAN12	19	0	0	5	24
VLAN20	19	0	0	7	26
VLAN21	19	0	0	5	24

!--- Output suppressed

Name	Blocking	Listening	Learning	Forwarding	STP Active
VLAN111	19	0	0	5	24

VLAN200	19	0	0	5	24
VLAN222	19	0	0	5	24
VLAN900	19	0	0	5	24

64 VLANs	1217	0	0	329	1546

Related Information

- [Catalyst 2900 Series XL and Catalyst 3500 Series XL Switches Documentation](#)
- [Troubleshooting High CPU Utilization on Cisco Routers](#)
- [Technical Support - Cisco Systems](#)

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