

High CPU Utilization on Catalyst 2900XL/3500XL Switches

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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 Process** and **Led Control Process**. It is normal behavior for these processes to be a high percentage of the total CPU utilization.

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 at IDLE	CPU Utilization at 50 Percent Write Speed Using Unicast 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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