Troubleshooting Input Drops on ATM Router Interfaces

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Introduction

All types of router interfaces, from serial to Ethernet to ATM, can report a large number of input drops in the output of the **show interface atm** command. The following sample output shows that a PA−A3 ATM port adapter has experienced 675 input drops since the counters were last cleared.

```
7200−17# show interface atm 4/0
ATM4/0 is up, line protocol is up
  Hardware is ENHANCED ATM PA
  Internet address is 10.10.203.2/24
  MTU 4470 bytes, sub MTU 4470, BW 149760 Kbit, DLY 80 usec,
  reliability 255/255, txload 1/255, rxload 1/255
  NSAP address: 47.009181000000009021449C01.777777777777.77
  Encapsulation ATM, loopback not set
  Keepalive not supported
  Encapsulation(s): AAL5
  4096 maximum active VCs, 7 current VCCs
  VC idle disconnect time: 300 seconds
  Signalling vc = 5, vpi = 0, vci = 5
  UNI Version = 4.0, Link Side = user
  0 carrier transitions
  Last input 00:00:05, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/675/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: Per VC Queueing
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
     44060 packets input, 618911 bytes, 0 no buffer
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
     65411 packets output, 1554954 bytes, 0 underruns
     0 output errors, 0 collisions, 0 interface resets
     0 output buffer failures, 0 output buffers swapped out
```

Users typically report input drops as slow performance. Since meeting user expectations of network response time is an important design goal, understanding the reasons for input drops is an important troubleshooting goal. This document provides the information you need to understand and troubleshoot input drops on ATM

interfaces.

Note: For information on troubleshooting input errors on PA−A3 ATM port adapters, click here.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

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

Conventions

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

Traditional Reasons for Input Drops

Cisco IOS® Software switching methods define how the router forwards a packet from an ingress (incoming) interface to an egress (exiting) interface.

The least−preferred method of Cisco IOS Software switching is process switching. In this, the central CPU performs a complete routing−table lookup based on the destination IP address. Process switching means that the router cannot use a preferable route−cache method, such as fast switching or Cisco Express Forwarding (CEF), to handle the forwarding decision. As a result, the router is forced to copy the packet from an input/output (I/O) buffer in static random−access memory (SRAM), also known as MEMD on 7xxx platforms, to a system buffer in dynamic random−access memory (DRAM). This is where Cisco IOS Software code, data structures, and dynamic tables are stored.

On ATM and non−ATM interfaces, the system may count input queue drops if the number of packet buffers allocated to the interface is exhausted or reaches its maximum threshold. When using a route−cache method, the system stores a packet in SRAM or packet memory. When using process switching, it stores a packet in DRAM.

For further information, refer to Troubleshooting Input Queue Drops and Output Queue Drops.

Understanding Throttles

The output of the **show interface atm** command might display a high number of throttles along with input queue drops. Input queue drops occur when a packet is being process switched. The throttles counter increments when a system buffer is available, but the interface already has the maximum number of packets waiting to be processed in the input hold queue The router temporarily disables the interface to give the interface time to catch up and process the already enqueued packets.

You can troubleshoot throttles by determining the root cause of why a high number of packets are being process switched.

Understanding Flushes

The flushes counter in the **show interface atm** command output increments as part of selective packet discard (SPD), which implements a selective packet drop policy on the router's IP process queue. Therefore, it applies to only process switched traffic.

The purpose of SPD is to ensure that important control packets, such as routing updates and keepalives, are not dropped when the IP input queue is full. When the size of the IP input queue is between the minimum and maximum thresholds, normal IP packets are dropped based a certain drop probability. These random drops are called SPD flushes.

In LAN Emulation (LANE) environments, the flush counter increments only for process switched traffic. LANE is supported by CEF. To troubleshoot incrementing flushes, determine how packets are being IOS switched by issuing the **show ip interface atm** command. In addition, confirm that LANE Data Direct VCs are forming. Capture the output of the **show lane client output** command.

InPktDrops on an ATM VC

The output of the **show atm vc {vcd#}** command displays an InPktDrops counter.

```
7200−1# show atm vc 200
atm6/0: VCD: 200, VPI: 5, VCI: 200
UBR, PeakRate: 44209
AAL5−LLC/SNAP, etype:0x0, Flags: 0xC20, VCmode: 0x0
OAM frequency: 0 second(s)
InARP DISABLED
Transmit priority 4
InPkts: 0, OutPkts: 0, InBytes: 0, OutBytes: 0
InPRoc: 0, OutPRoc: 0, Broadcasts: 0
InFast: 0, OutFast: 0, InAS: 0, OutAS: 0
InPktDrops: 157, OutPktDrops: 0
CrcErrors: 0, SarTimeOuts: 0, OverSizedSDUs: 0
OAM cells received: 0
OAM cells sent: 0
Status: UP
```

While input queue drops on an interface point to a high number of process switched packets, a non−zero value for the InPktDrops of a VC counter suggests that the ATM interface is running out of packet buffers for an individual virtual circuit (VC), or is exceeding the total number of VC buffers that can be shared by the VCs. For the PA−A3, such drops occur as a result of the PA−A3 driver implementing one of two throttling mechanisms:

1. The PA−A3 places a quota on the number of packet buffers that a VC can use from the receive segmentation and reassembly (SAR) common pool. This quota equates to a "receive credits" value which varies based on the configured traffic shaping rate. In addition, it prevents one aggressive or overloaded VC from exhausting all buffer resources. When the PA−A3 driver receives a packet and forwards it to either the processor or to an egress interface, it deducts one buffer credit. It restores a credit when either the processor or the egress interface returns the packet buffer to the VC's pool. If the VC experiences congestion and runs out of credits, the PA−A3 must drop subsequent packets and increments the InPktDrops counter.
2. The PA−A3 throttles an ATM VC when the adapter itself runs out of packet buffers. On an ATM interface with a large number of congested VCs, the adapter can run out of packet buffers quite easily since the per−VC quotas overlap and are not exclusive. In other words, the total number of buffers specified in the per−VC quotas exceeds the total number of buffers actually available on the PA−A3. When all of the PA−A3's buffers are in use, the framer's FIFO queue hold incoming cells. These can lead to overruns if congestion persists. Once such a backpressure condition occurs, the framer FIFO

may drop cells, causing cyclic redundancy check (CRC) errors.

InPktDrops counts the number of times a packet was dropped before it reached the host interface. Packets are not registered in the interface statistics until the host interface receives it from the SAR buffer. Thus, you may see drops with the **show atm vc** command, but see few, if any, drops with the **show interface atm** command.

The **show controllers atm** command displays three useful counters for determining whether the ATM interface is running out of onboard reassembly buffers. These are highlighted in bold below.

Note: The Rx_count should be well below the Rx_threshold.

```
C7200# show controller atm 1/0
Interface atm1/0 is up
Hardware is ENHANCED ATM PA - SONET OC3 (155Mbps)
 dfs is enabled, hwidb->ip_routecache = 0x15
 lane client mac address is 0060.3e73.e640 active HSRP group:
Framer is PMC PM5346 S/UNI-155-LITE, SAR is LSI ATMIZER II

!--- Output suppressed.

Control data:
 Rx_max_spins=2, max_tx_count=17, TX_count=4
 Rx_threshold=1366, Rx _count=15, TX_threshold=4608
 TX bfd write indx=0x11, Rx _pool_info=0x6066A3E0

!--- Output suppressed.
```

Counter	Explanation
Rx_threshold	Maximum number of receive particles that the PA−A3 driver or egress port adapter can hold without regulating receive particle usage among the configured VCs. To prevent any VC from allocating too many packet buffers and inhibiting other VCs from receiving packets, the PA−A3 uses a receive packet buffer regulating mechanism. When the total number of receive particles held by the PA−A3 driver or the egress interface exceeds this threshold, the next packet received by the PA−A3 is checked to see if one VC occupies too many packet buffers. If so, the PA−A3 discards incoming packets until the total number of receive particles held by this violating VC falls below the quota.
Rx_max_spins	Internally, the PA−A3 microcode notifies the PA−A3 driver of the arrival of incoming packets by asserting receive interrupts. The PA−A3 driver catches the receive interrupt and then drains as many particles from the receive ring as it can. This counter records the maximum number of receive particles ever drained by the PA−A3 driver in a single interrupt.

Rx_count	Total number of receive or reassembly particles currently held by the driver.

Other Reasons for Input Packet Drops

In addition to exceeding a VC's reassembly buffer credit, an ATM interface may drop packets because:

- No route to destination prefix
- Incomplete ARP entry
- Configured policy of an ACL

In certain versions of Cisco IOS Software, the PA−A3 driver is counting these drops as VC input packet drops and incrementing the per−VC InPktDrop counter. This problem is cosmetic only and has no performance impact. It is resolved via bug ID CSCdu23066 for the PA−A3−OC3/T3 and via bug ID CSCdw78297 for the PA−A3−OC12.

Known Issue: Negative Input Counters

Cisco DDTS CSCdm54053 resolves a problem in which the output of show interface displays negative packet input and output counters on a subinterface. A fix is implemented in various versions of Cisco IOS Software Version 12.0(6) as well as 12.0(7)XE2.

Related Information

- **How to Verify Cisco Express Forwarding Switching**
- **Troubleshooting Input Queue Drops and Output Queue Drops**
- **Troubleshooting Output Drops on ATM Router Interfaces**
- **ATM Technology Support**
- **Cisco ATM Port Adapter**
- **Technical Support − Cisco Systems**

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