Switch Buffer Overflow

Problem Description

Switch Buffer Overflow is a network problem that occurs at Layer 2 level. Broadcast, multicast or large volume unicast data streams coming from many devices connected to a switch at the same time fill the switch's buffer. When the buffer is full, new incoming packets become packet drop and network communication delays or data loss occur.

OSI Layer Layer 2

Reasons for Formation

-Simultaneous data transmission of devices generating heavy traffic: A large number of clients (PC, IP camera, printer, etc.) connected to the same switch performing large data transfers simultaneously may exceed the buffer capacity.

-Uncontrolled broadcast/multicast traffic: Especially in networks without IP routing configured, ARP requests and multicast broadcasts cause buffer filling.

-Lack of QoS (Quality of Service): Without traffic prioritisation, critical services (VoIP, video streaming) are processed at the same priority as ordinary traffic, which can cause important packets to drop.

-Switches with low memory capacity: Old model or low segment switches cause conflicts and data loss in sudden traffic increases due to limited buffer capacity.

Signs of Detection

Sudden network-wide slowdown and increased latency: Users have difficulty connecting to the Internet, pages open late, applications become unresponsive.

-Inconsistency in ping results: "Request timed out" errors appear in the ping command or the delay times (ms) are irregular.

-Breaks in file transfers: During FTP, file sharing or data backup, connections are frequently broken and "transfer failed" warnings appear.

-Distortion in real-time devices: IP cameras may freeze; VoIP calls may be noisy or intermittent. This is especially noticeable in UDP-based services.

-Buffer errors on the switch console:

When examined with show interface or show buffers commands in CLI, log messages can be seen.

Admin Guide - Solutions and Precautions

Step 1: Separate Broadcast Domains with VLAN Configuration:

Thanks to VLANs that logically divide the network traffic, broadcast traffic is localised. In this way, the total broadcast load on the switch is reduced

Step 2: Apply QoS (Quality of Service) Settings:

Real-time services (VoIP, CCTV, etc.) are prioritised to ensure that this traffic is transmitted without delay.

Example:

Switch(config-if)# mls qos trust cos

Switch(config-if)# priority-queue out

Step 3: Monitor and Analyse Switch Performance:

Switch's buffer status and interface statistics should be monitored regularly.

Required commands:

Switch# show interface fa0/1

Switch# show buffers

Switch# show processes cpu sorted

Step 4: Increase Uplink Capacities:

1 Gbps connections can create bottlenecks under heavy traffic. Core switch or router connections should be upgraded to 10 Gbps connections if possible.

Step 5: Upgrade Hardware:

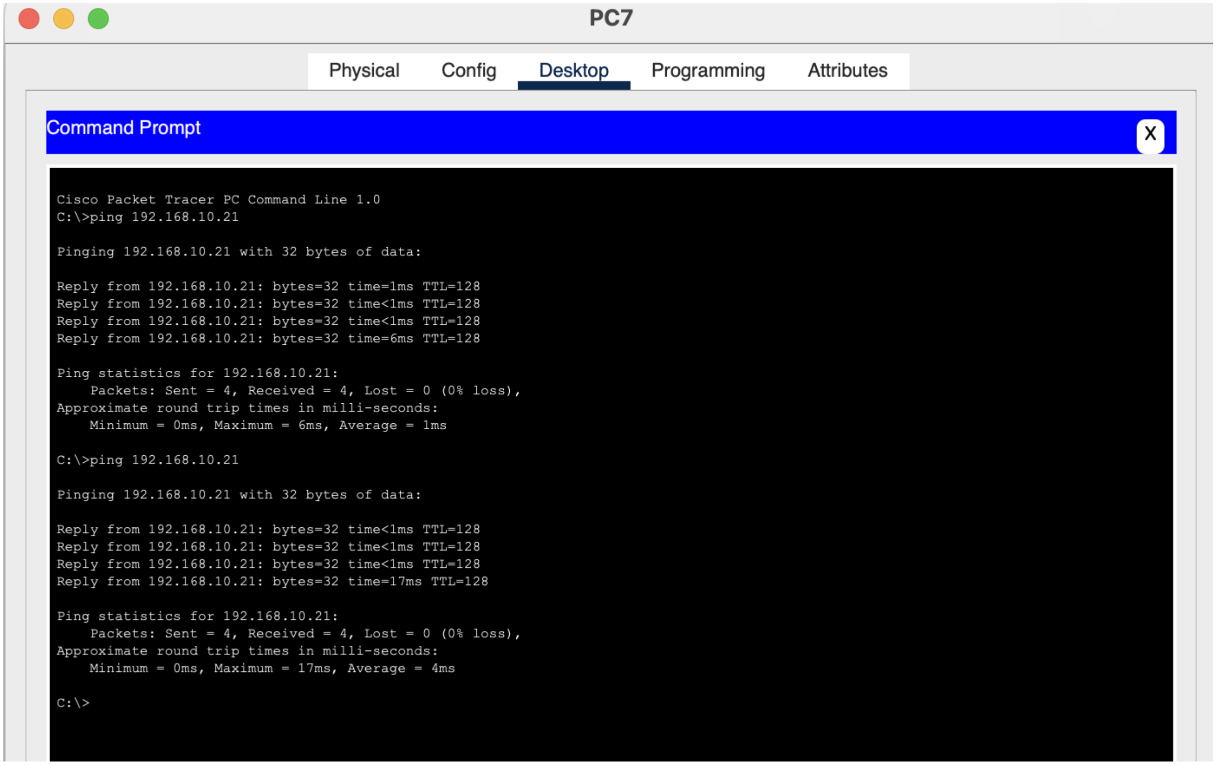
Old or entry-level switch models have insufficient buffer capacity. Especially in network segments exposed to heavy traffic, advanced manageable switches should be preferred.

Simulation Modelling

Technical Note:

Although the Cisco Packet Tracer environment does not fully reflect buffer overflow logs, delay and error observations can be made by creating high traffic scenarios. In real systems, buffer usage can be monitored in detail with SNMP-based monitoring systems (e.g. PRTG, SolarWinds).

Ping Test

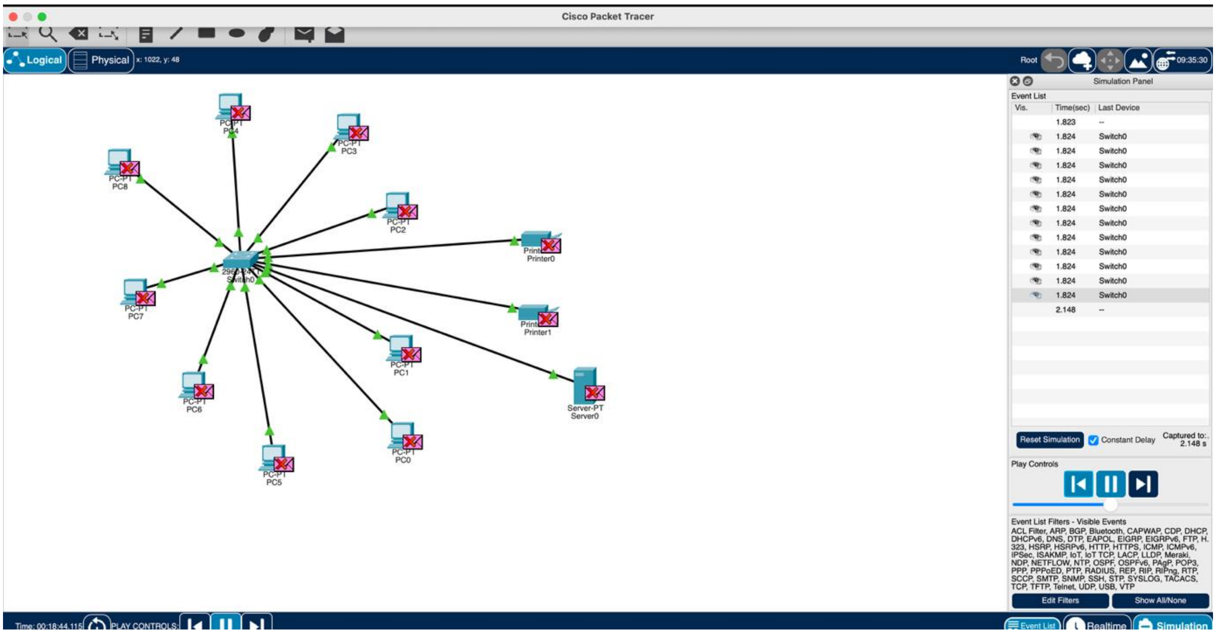


There was no packet loss in two separate ping tests sent from PC7 to Printer0 (IP: 192.168.10.21). All packets were successfully transmitted (0% loss). However, it is noteworthy that the latency increased in the second ping test:

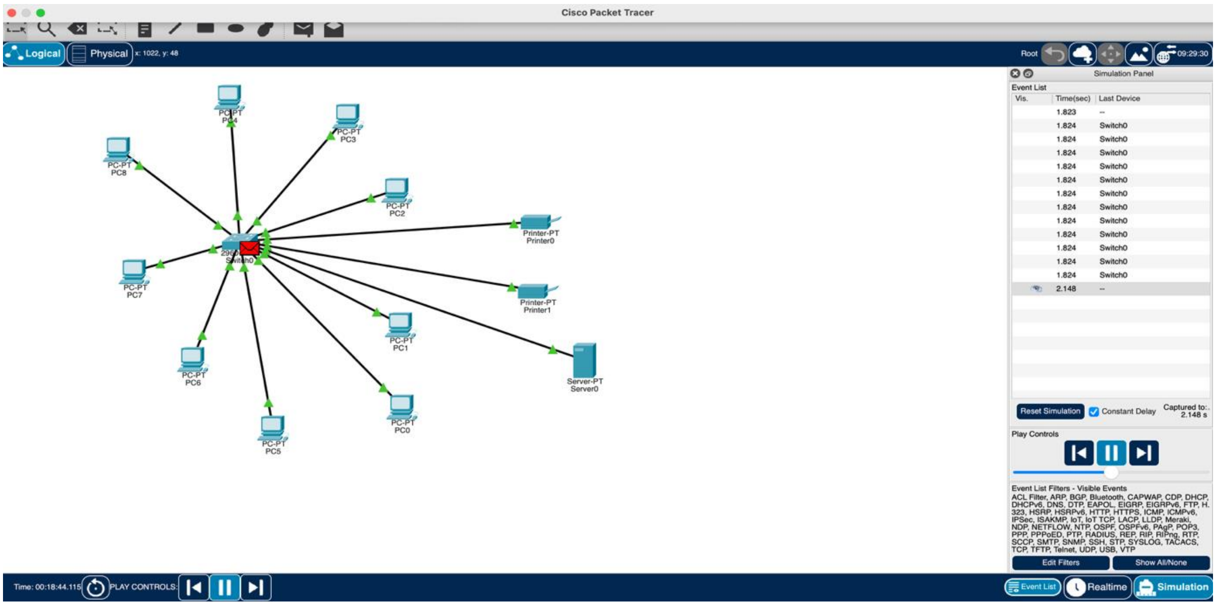
Test One: Average delay 1ms, maximum 6ms

Second Test: Average delay 4ms, maximum 17ms

These results indicate that the network has not yet experienced a critical **buffer overflow**, but **that delays have** started **to occur from** time to time. Such fluctuations may indicate that the switch's buffer memory is starting to accumulate load, especially when many requests are sent to the Server or printers from many devices at the same time.



All devices are successfully connected to the switch, connections are green (active). A traffic density has not yet been created.

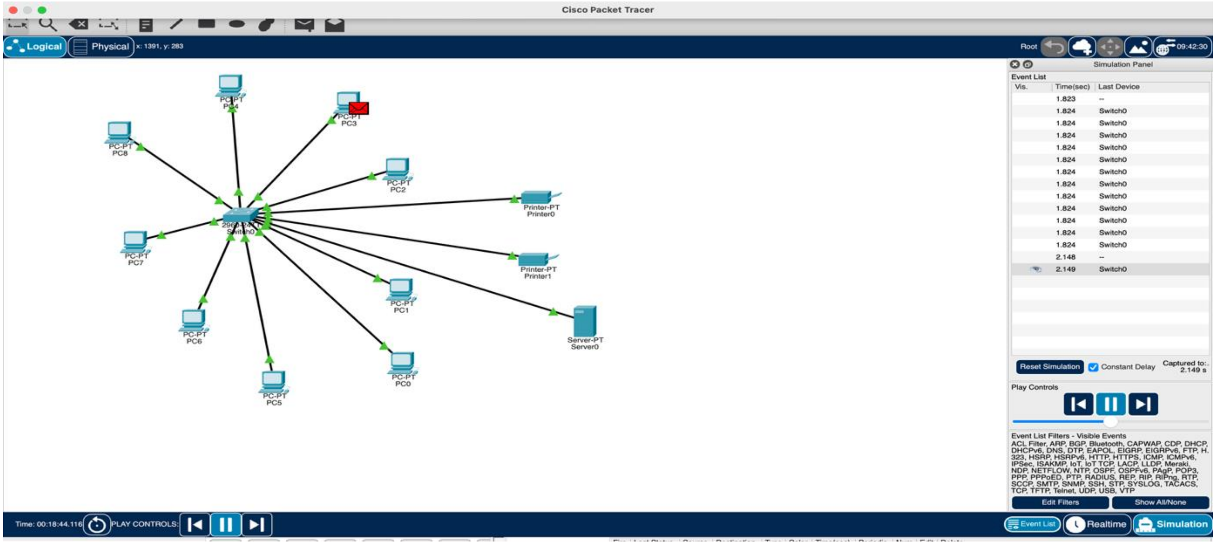


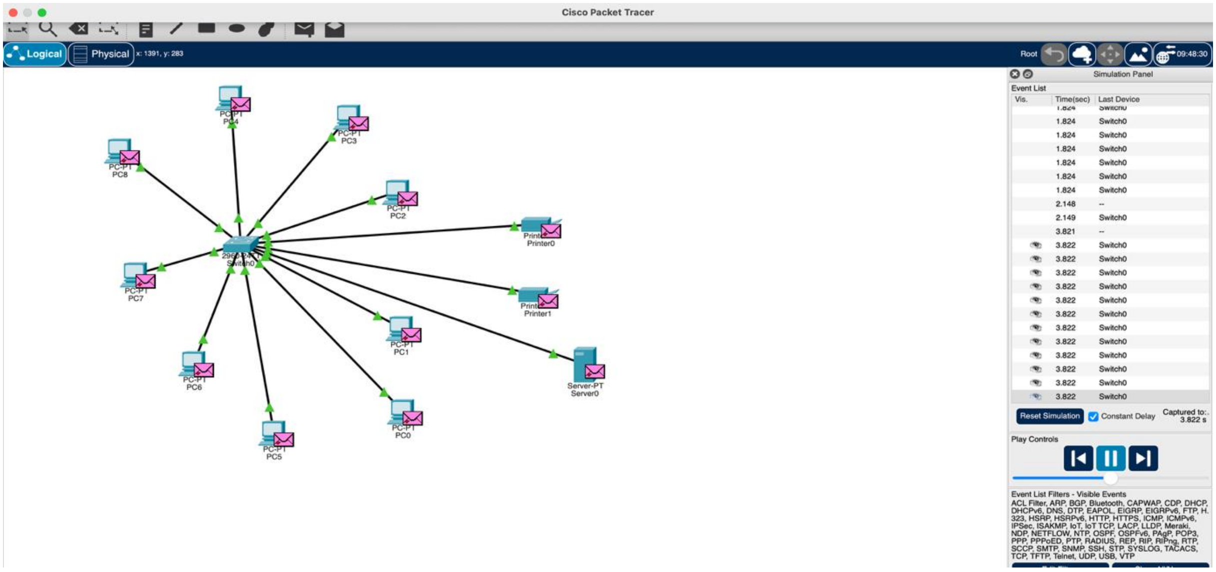
When data transmission is initiated from each device (e.g. by ping or file transfer), a large number of simultaneous packets arrive at the switch. At this stage:

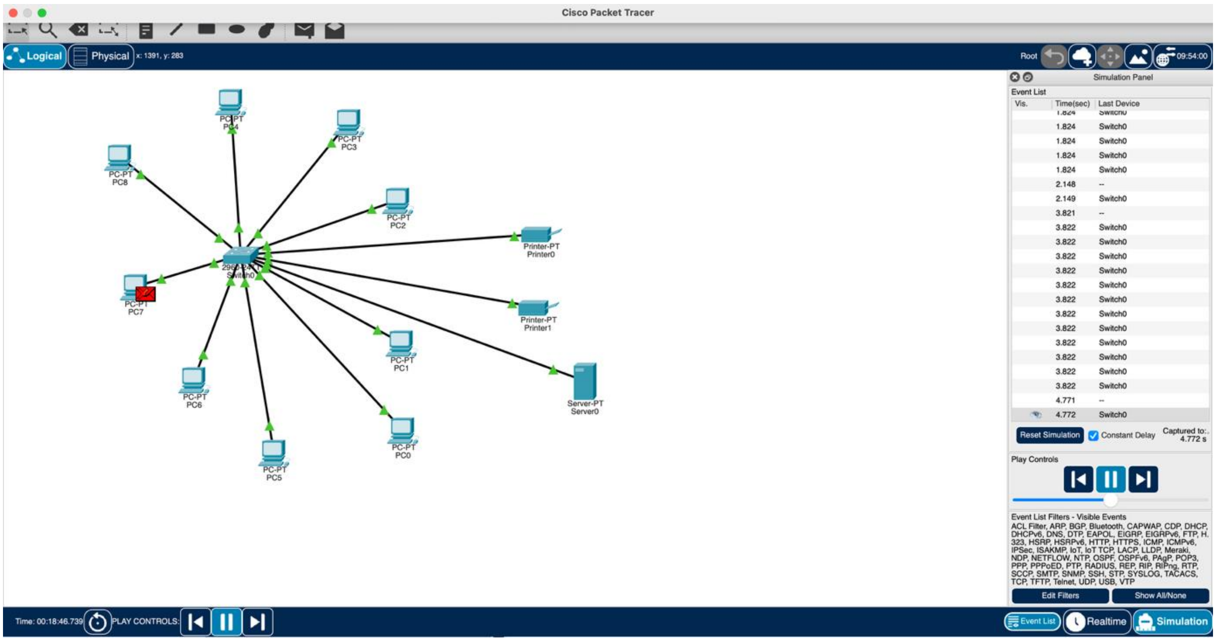
The buffer memory of the switch fills up quickly.

Cross marks on the devices indicate a transmission error.

Red icons appear, symbolising that the packet did not reach the destination.


Cisco Packet Tracer
Logical
Physical
PC8
PC4
PC3
PC2
Printer0
Printer1
PC7
PC1
PC6
Server0
PC0
PC5
Simulation Panel
Event List
Reset Simulation
Constant Delay
Play Controls
Event List Filters - Visible Events
Edit Filters
Show All/None
Realtime
Simulation


Cisco Packet Tracer
Logical
Physical
PC8
PC4
PC3
PC2
Printer0
Printer1
PC7
PC1
PC6
Server0
PC0
PC5
Simulation Panel
Event List
Reset Simulation
Constant Delay
Play Controls
Event List Filters - Visible Events


Cisco Packet Tracer
Logical
Physical
PC8
PC4
PC3
PC2
Printer0
Printer1
PC7
PC1
PC6
Server0
PC0
PC5
Simulation Panel
Event List
Reset Simulation
Constant Delay
Play Controls
Event List Filters - Visible Events
Edit Filters
Show All/None
Realtime
Simulation

Buffer Overflow

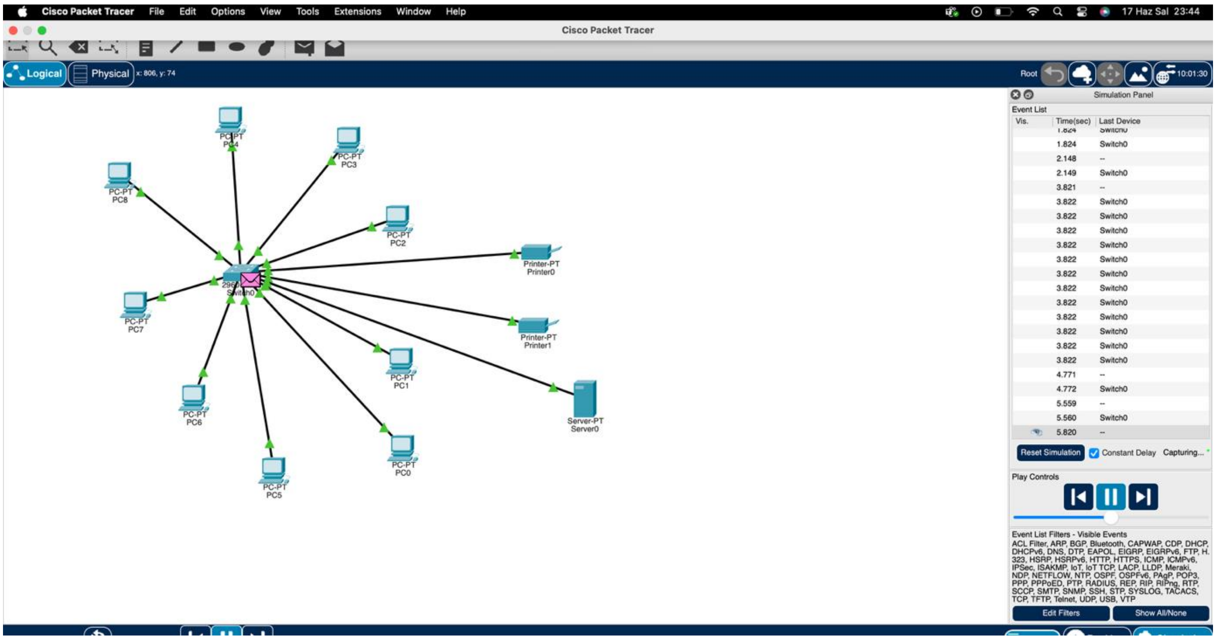
As traffic volume increases:

The switch becomes unable to process packets.

Disconnections or large delays occur between PCs and printers.

Some ping requests go unanswered or transmission times (latency) increase.

This is called "buffer overflow" and is a critical problem at Layer 2 (Data Link Layer).



Simulation at the end:

The switch is still trying to process a large number of packets. There are significant congestion and delays in data transmission across the network.

Simulation File Name: P5_210316084_BinnurSöztutar_Switch_Buffer_Overflow.pkt