

**IT Technology**  
**Networking Assignment 5**



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# 1 Introduction

In this report, students will show their capability in explaining the fundamentals of a switch, and the Spanning Tree Protocol (STP). They will also describe how these two are interconnected, and how to use Wireshark to monitor this connection.

# 2 Audience

This document is meant for teachers and fellow students alike, with the intention of receiving peer review from these parties.

# 3 Inventory

Software:

- VMWare Workstation Pro
  - Xubuntu (As both switches and as VM machines)
    - Ifupdown
    - Brctl
    - Ifconfig
    - wireshark
- Visio

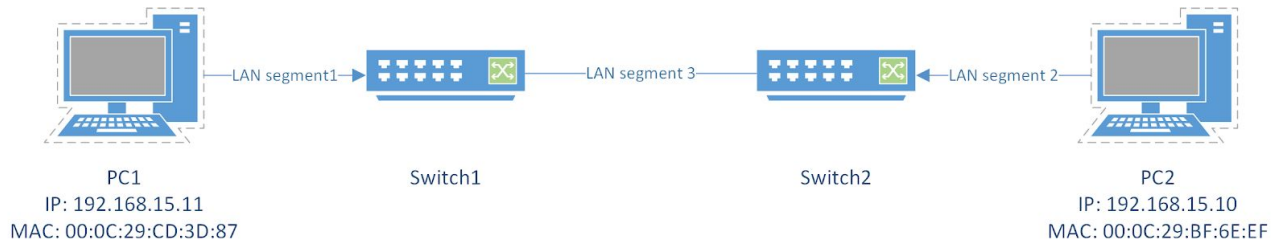
Hardware:

- Host machine

## 4 Network diagram

Task: Show a network diagram both with and without a switch loop

A



B

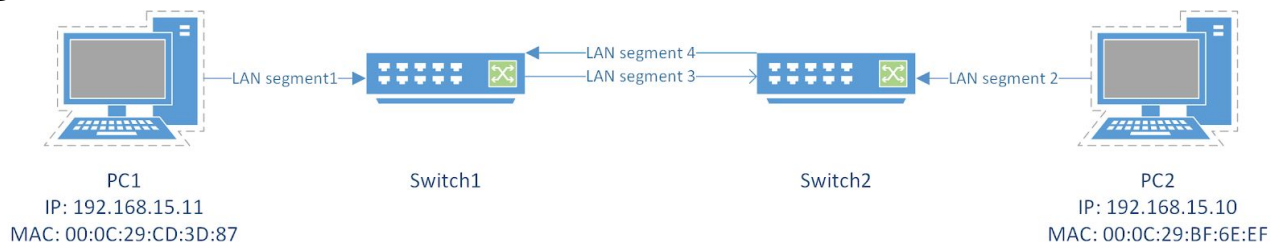


Diagram A shows only one connection between switch and switch2. When PC1 wants to communicate to PC2 it will send the frame to switch1. Since switch1 doesn't know the mac address of PC2, it will send a broadcast message to switch1. Switch1 will broadcast the message to all other ports except the receiving port. Once PC2 receives the frame it acknowledges, switch2 and will learn PC2's mac address. This will occur without causing switching loops. As shown in diagram A above there is only one connection between the two switches.

Diagram B shows 2 different connections between switch1 and switch2. Since there are multiple connections between two network switches (ie switch1 and switch2). This will cause a loop, and as a result, all broadcast and multicast packets will be forwarded by switches out every port, repeatedly, until the rebroadcasting of the packets will flood the network and result in a broadcast storm.

## 5 Show that the learning process is running

Task: Prove that the switch MAC table learning process is running. I.E. show that the MAC table in each SW has learned where the PC1 and PC2 devices MAC addresses are located. Do this with STP switched off. Omit the switch ports own MAC addresses.

```
dasters@ubuntu:~/Desktop$ sudo brctl showmacs br0
port no mac addr          is local?    ageing timer
 2    00:0c:29:00:f7:c1     no           9.10
 2    00:0c:29:00:f7:cb     no          217.58
 1    00:0c:29:43:5d:23     no           9.37
 2    00:0c:29:8f:f4:e0     no          20.62
```

switch 1

```
dasters@ubuntu:~/Desktop$ sudo brctl showmacs br0
port no mac addr          is local?    ageing timer
 2    00:0c:29:43:5d:23     no          187.72
 1    00:0c:29:8f:f4:e0     no          198.98
 2    00:0c:29:bf:a1:d4     no           8.74
```

switch 2

Task: Now interconnect the two switches with one more connection e.g. VMnet6. I.e. now two connections between the two switches.

```
nikolaj@ubuntu:~$ sudo brctl showmacs br0
[sudo] password for nikolaj:
port no mac addr          is local?    ageing timer
 3    00:0c:29:56:7f:09     no           0.00
 3    00:0c:29:bf:6e:ef     no           0.00
```

Switch 1

```
nikolaj@ubuntu:~/Desktop$ sudo brctl showmacs br0
[sudo] password for nikolaj:
port no mac addr          is local?    ageing timer
 2    00:0c:29:02:c2:6b     no           0.00
 2    00:0c:29:bf:6e:ef     no           0.00
```

Switch2

## 6 Loop creation

Task: Explain what will happen when this loop has now been created.

Broadcast storm - When switch B sends a message to an unknown source mac address, both switch A and B will receive the frame, and they will also broadcast the frames which will cause a loop and eventually lead to a broadcast storm.

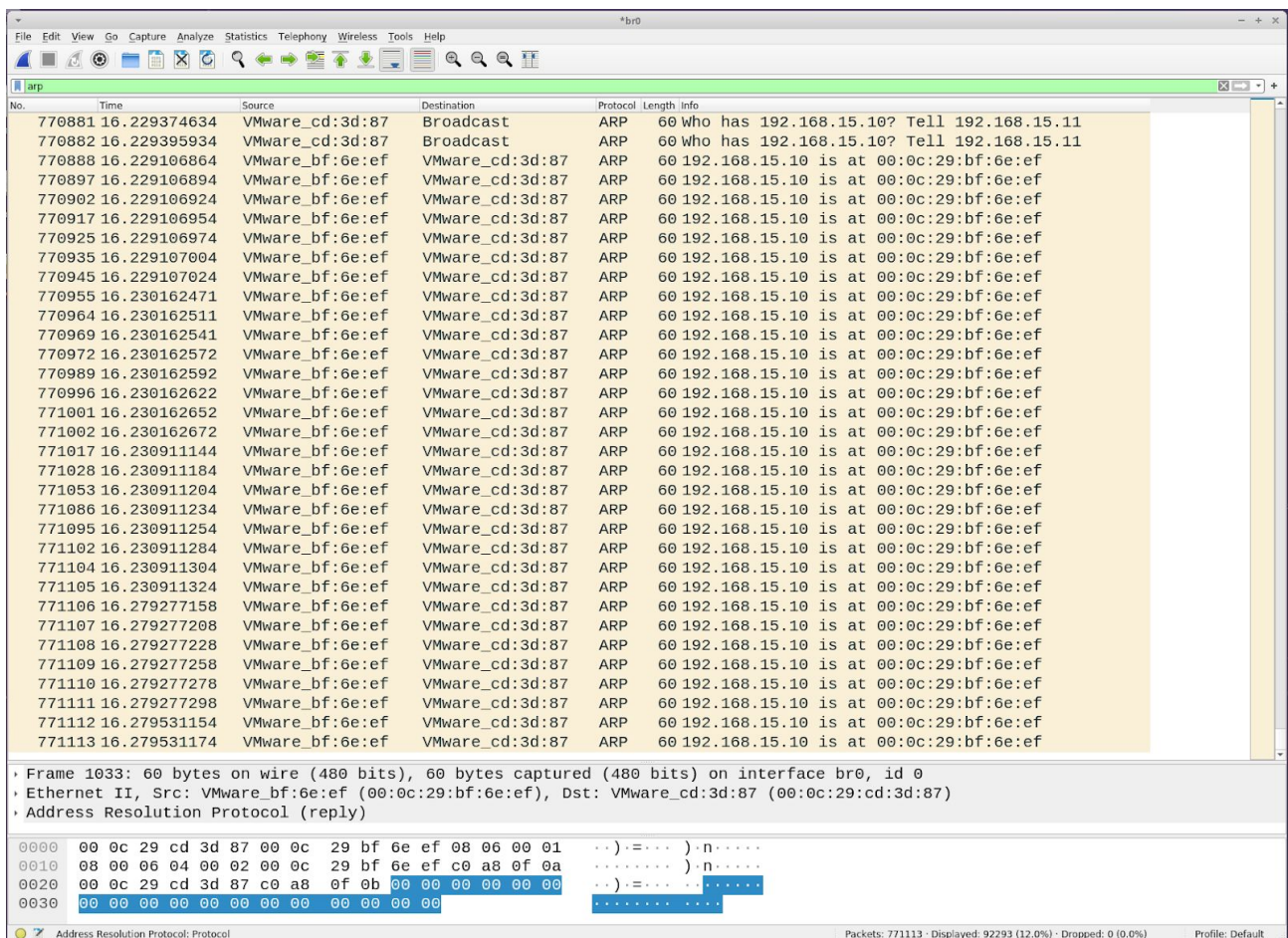
Unstable mac address table - When the loop starts e.g when switch B sends a broadcast message to switch A, switch will learn the mac address and add the receiving port. When switch C also sends the same broadcast message to A, switch A will learn and add that

mac address but different port number. The constant changes will lead to an unstable mac address table.

Duplicates of frame will also occur. Devices will keep getting duplicate frames.

## 7 Using wireshark to detect problems

Task: Use wireshark to prove that there is a problem when there is a switch loop and STP is switched off.

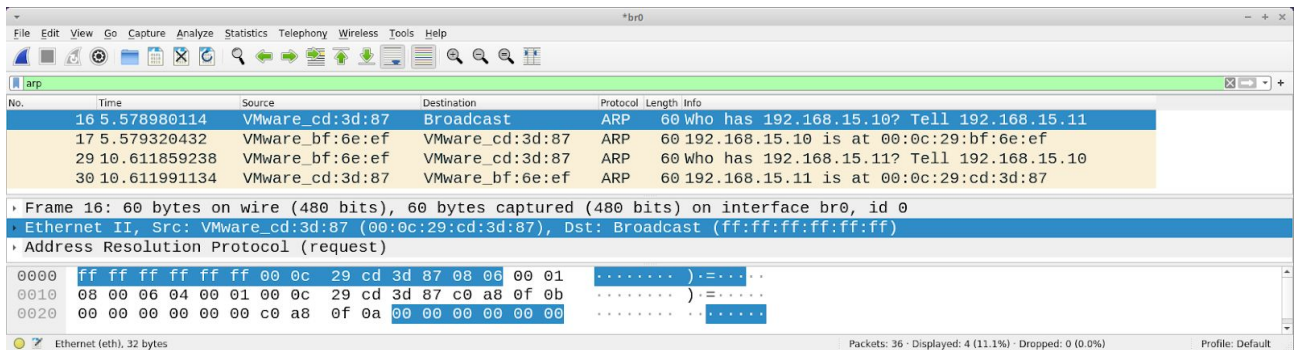


When the STP is turned off, a switch loop will occur as shown in the above diagram.

PC1 will send a broadcast message asking for the location of PC2 since it doesn't know its mac address. PC1 will keep receiving and sending the same ARP message over and over, this will lead to a broadcast storm. The broadcast storm will increase and will not stop by itself unless the connection has been terminated or one of the switches gets restarted.

## 8 Eliminating loop problems

Task: Show that the switch loop problem is eliminated when STP is switched on.



The image shows a Wireshark packet capture window titled '\*br0'. The packet list pane shows four ARP packets. The packet details pane shows the selected packet (No. 16) as an Ethernet II frame with source VMWare\_cd:3d:87 and destination Broadcast (ff:ff:ff:ff:ff:ff). The packet bytes pane shows the raw data of the ARP request.

No.	Time	Source	Destination	Protocol	Length	Info
16	5.578980114	VMware_cd:3d:87	Broadcast	ARP	60	Who has 192.168.15.10? Tell 192.168.15.11
17	5.579320432	VMware_bf:6e:ef	VMware_cd:3d:87	ARP	60	192.168.15.10 is at 00:0c:29:bf:6e:ef
29	10.611859238	VMware_bf:6e:ef	VMware_cd:3d:87	ARP	60	Who has 192.168.15.11? Tell 192.168.15.10
30	10.611991134	VMware_cd:3d:87	VMware_bf:6e:ef	ARP	60	192.168.15.11 is at 00:0c:29:cd:3d:87

Frame 16: 60 bytes on wire (480 bits), 60 bytes captured (480 bits) on interface br0, id 0  
Ethernet II, Src: VMware\_cd:3d:87 (00:0c:29:cd:3d:87), Dst: Broadcast (ff:ff:ff:ff:ff:ff)  
Address Resolution Protocol (request)

0000 ff ff ff ff ff ff 00 0c 29 cd 3d 87 08 06 00 01 ..... )=.....  
0010 08 00 06 04 00 01 00 0c 29 cd 3d 87 c0 a8 0f 0b ..... )=.....  
0020 00 00 00 00 00 00 c0 a8 0f 0a 00 00 00 00 00 00 ..... )=.....

Ethernet (eth), 32 bytes Packets: 36 · Displayed: 4 (11.1%) · Dropped: 0 (0.0%) Profile: Default

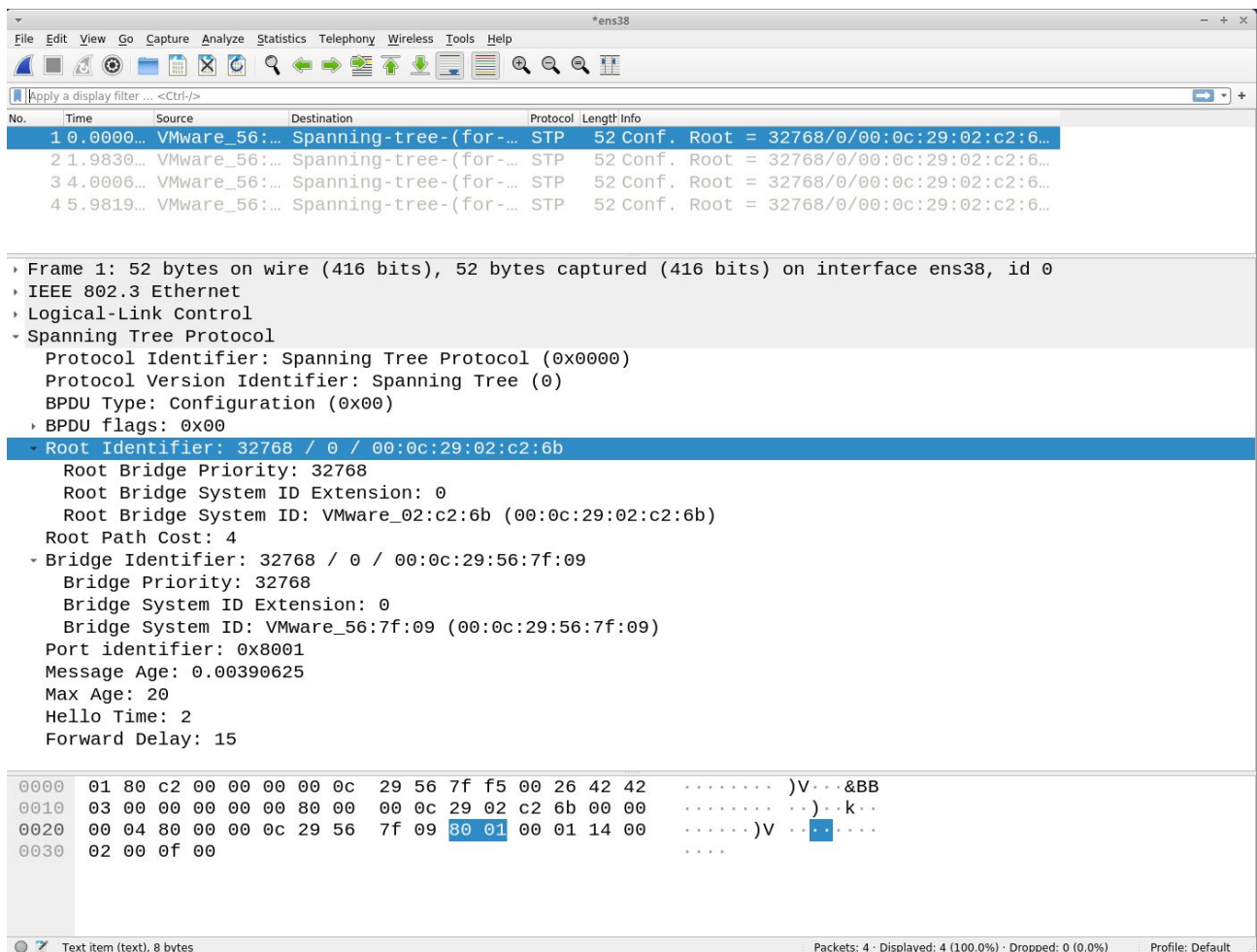
In the diagram above, switch1 is the root bridge. Since it has 2 ports, both connected switch2 and PC1, all its ports are assigned as designated ports and will be set to forwarding states.

Looking at switch2 one of its ports is a blocking state and the other one is the root bridge port.



## 9 Challenge: Show STP traffic using Wireshark

Task: Wireshark on SW1 and show some of the STP traffic. Comment on one or more STP traffic packets.



Pictured above is a screenshot of an STP packet. Highlighted is the part of the packet that identifies the root bridge, also known as the switchport that is in a forwarding state. The MAC address here corresponds with the MAC address on switch1's switchport, which means that that connection is the root, and the other connection between switch1 and switch 2 is in a blocking state.

## 10 What is a switch loop?

Task: Explain superficially very brief what a switch loop is, why it occurs and what the symptoms in a network is. Remember the behaviour of the switch with flooding out frames.

A switch loop is when redundant links between two switches are both active at the same time, resulting in a logical loop where any broadcast message will keep getting forwarded between the switches.

## 11 Challenge: Spanning Tree Protocol explanation

Task: Explain superficially very brief how the Spanning Tree Protocol STP prevents loops in a switch network. Explain why switch ports have MAC addresses.

The function of the Spanning Tree Protocol(STP) is to prevent switch loops by blocking redundant paths or links. The redundant links can be used to keep the network operational if the primary link fails.

The spanning Tree protocol (STP) can be structured like this:

- \* Select a Root bridge
- \* Place all the root interfaces into a forwarding state
- \* All non-root switch selects its port
- \* All other ports are not in use and will be in a blocking state
- \* Remaining links choose a designated port

Since switches are in layer2, devices the switch needs MAC addresses to send data between 2 devices. The MAC addresses are saved in MAC address tables which means that the switch will always know the destination of the devices connected to the closed network.

## 12 Conclusion

Having multiple switches and multiple connections between them in a network can create problems, namely a broadcast storm. By following the proper protocols, and enabling STP, broadcast storms won't be a problem anymore.

Wireshark is used to display the connections in a network, and also the STP packages on the switches, which allows the user to see how the STP is working.