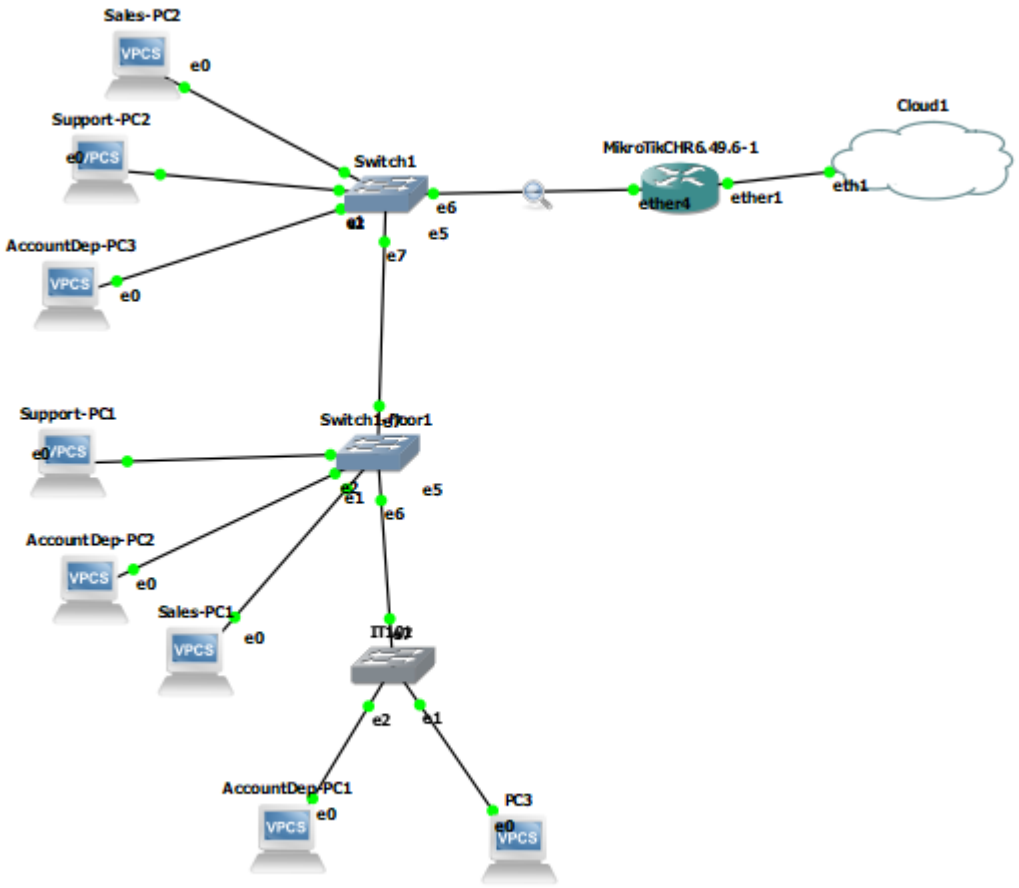
Observations, routing configurations, VPC configurations, switch device configurations using virtual networking GNS3.

Due to an unexpected error I had to restart the lab assignment from the beginning. I have made a typo error when setting configurations for Accounting-vlan setting it up to 192.168.3.2 - 192.168.3.254 instead of setting the range to 192.168.150.2 - 192.168.150.254. I noticed the mistake after a documentation report.

GNS3 simulation map:



Router Configuration Commands:

```
[admin@MikroTik] > ip
[admin@MikroTik] /ip> ..
[admin@MikroTik] > export
# oct/11/2023 19:56:13 by RouterOS 6.49.6
# software id =
#
#
#
/interface ethernet
set [ find default-name=ether1 ] disable-running-check=no
set [ find default-name=ether2 ] disable-running-check=no
set [ find default-name=ether3 ] disable-running-check=no
set [ find default-name=ether4 ] disable-running-check=no
/interface wireless security-profiles
set [ find default=yes ] supplicant-identity=MikroTik
/ip dhcp-client
add disabled=no interface=ether1
[admin@MikroTik] > /interface vlan
[admin@MikroTik] /interface vlan> add interface=ether4 name=Sales-vlan vlan-id=100
[admin@MikroTik] /interface vlan> add interface=ether4 name=Support-vlan vlan-id=200
[admin@MikroTik] /interface vlan> add interface=ether4 name=Accounting-vlan vlan-id=150
[admin@MikroTik] /interface vlan> /interface wireless security-profiles
[admin@MikroTik] /interface wireless security-profiles> set [
add  comment  edit  export  find  print  remove  set
[admin@MikroTik] /interface wireless security-profiles> set [ find default=yes ] supplicant-identity=MikroTik
[admin@MikroTik] /interface wireless security-profiles> /ip pool
[admin@MikroTik] /ip pool> add name=dhcp_pool0 ranges=192.168.1.2-192.168.1.254
[admin@MikroTik] /ip pool> add name=dhcp_pool1 ranges=192.168.2.2-192.168.2.254
[admin@MikroTik] /ip pool> add name=dhcp_pool2 ranges=192.168.3.2-192.168.3.254
[admin@MikroTik] /ip pool> /ip dhcp-server
[admin@MikroTik] /ip dhcp-server> add address-pool=dhcp_pool0 disabled=no interface=Sales-vlan name=dhcp1
[admin@MikroTik] /ip dhcp-server> add address-pool=dhcp_pool1 disabled=no interface=Support-vlan name=dhcp2
[admin@MikroTik] /ip dhcp-server> add address-pool=dhcp_pool2 disabled=no interface=Accounting-vlan name=dhcp3
[admin@MikroTik] /ip dhcp-server> /ip address
[admin@MikroTik] /ip address> add address=192.168.1.1/24 interface=Sales-vlan network=192.168.1.0
[admin@MikroTik] /ip address> add address=192.168.2.1/24 interface=Support-vlan network=192.168.2.0
[admin@MikroTik] /ip address> add address=192.168.3.1/24 interface=Accounting-vlan network=192.168.3.0
[admin@MikroTik] /ip address> /ip dhcp-client
[admin@MikroTik] /ip dhcp-client> add disabled=no interface=ether1
failure: dhcp-client on that interface already exists
[admin@MikroTik] /ip dhcp-client> /ip dhcp-server  network
[admin@MikroTik] /ip dhcp-server network> add address=192.168.1.0/24 dns-server=8.8.8.8 gateway=192.168.1.1
[admin@MikroTik] /ip dhcp-server network> add address=192.168.2.0/24 dns-server=8.8.8.8 gateway=192.168.2.1
[admin@MikroTik] /ip dhcp-server network> add address=192.168.3.0/24 dns-server=8.8.8.8 gateway=192.168.3.1
[admin@MikroTik] /ip dhcp-server network> /ip firewall nat
[admin@MikroTik] /ip firewall nat> add action=masquerade chain=srcnat out-interface=ether1
[admin@MikroTik] /ip firewall nat>
```

Router “export” Command:

```
#
/interface ethernet
set [ find default-name=ether1 ] disable-running-check=no
set [ find default-name=ether2 ] disable-running-check=no
set [ find default-name=ether3 ] disable-running-check=no
set [ find default-name=ether4 ] disable-running-check=no
/interface vlan
add interface=ether4 name=Accounting-vlan vlan-id=150
add interface=ether4 name=Sales-vlan vlan-id=100
add interface=ether4 name=Support-vlan vlan-id=200
/interface wireless security-profiles
set [ find default=yes ] supplicant-identity=MikroTik
/ip pool
add name=dhcp_pool0 ranges=192.168.1.2-192.168.1.254
add name=dhcp_pool1 ranges=192.168.2.2-192.168.2.254
add name=dhcp_pool2 ranges=192.168.3.2-192.168.3.254
/ip dhcp-server
add address-pool=dhcp_pool0 disabled=no interface=Sales-vlan name=dhcp1
add address-pool=dhcp_pool1 disabled=no interface=Support-vlan name=dhcp2
add address-pool=dhcp_pool2 disabled=no interface=Accounting-vlan name=dhcp3
/ip address
add address=192.168.1.1/24 interface=Sales-vlan network=192.168.1.0
add address=192.168.2.1/24 interface=Support-vlan network=192.168.2.0
add address=192.168.3.1/24 interface=Accounting-vlan network=192.168.3.0
/ip dhcp-client
add disabled=no interface=ether1
/ip dhcp-server network
add address=192.168.1.0/24 dns-server=8.8.8.8 gateway=192.168.1.1
add address=192.168.2.0/24 dns-server=8.8.8.8 gateway=192.168.2.1
add address=192.168.3.0/24 dns-server=8.8.8.8 gateway=192.168.3.1
/ip firewall nat
add action=masquerade chain=srcnat out-interface=ether1
[admin@MikroTik] >
```

Accounting-PC1 pinging Accounting-PC3:

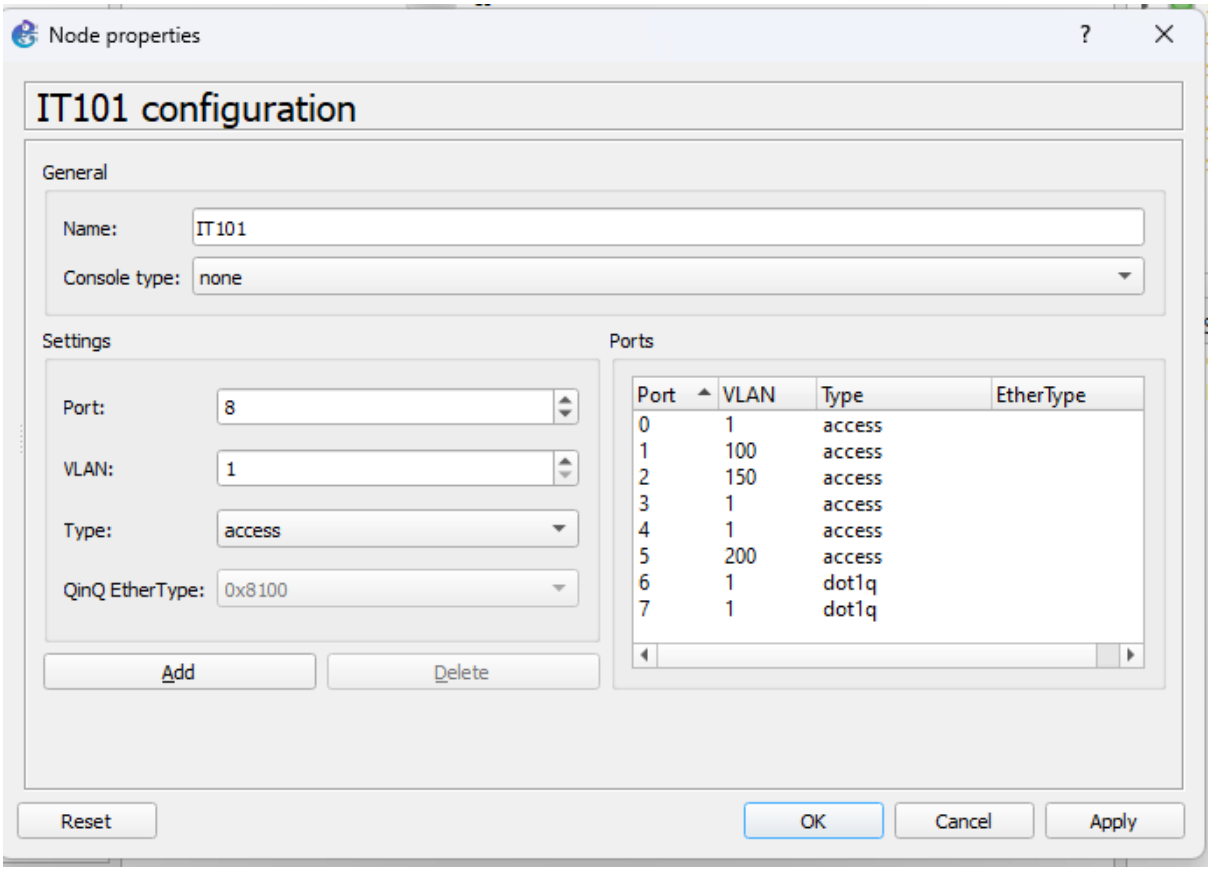
```
PC1> dhcp
DORA IP 192.168.3.253/24 GW 192.168.3.1

PC1> ping 192.168.3.254

84 bytes from 192.168.3.254 icmp_seq=1 ttl=64 time=0.307 ms
84 bytes from 192.168.3.254 icmp_seq=2 ttl=64 time=0.400 ms
84 bytes from 192.168.3.254 icmp_seq=3 ttl=64 time=0.613 ms
84 bytes from 192.168.3.254 icmp_seq=4 ttl=64 time=0.497 ms
84 bytes from 192.168.3.254 icmp_seq=5 ttl=64 time=0.638 ms

PC1>
```

New Switch Configurations:



6: Run a trace route from a VPC to another VPC in the same VLAN and explain the results (this can be done using e.g. the VPC console command trace 192.168.150.254 -P 1 to trace the route to the IP address 192.168.150.254 using the ICMP protocol)

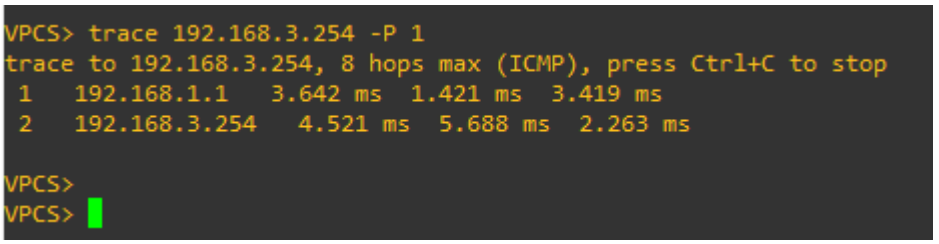
Both VPCs are on the same VLAN, which implies they are on the same broadcast domain and subnet. This setup allows for direct communication between the VPCs without the need to go through multiple routing hops.

```
PC1> trace 192.168.3.254 -P 1
trace to 192.168.3.254, 8 hops max (ICMP), press Ctrl+C to stop
 1   192.168.3.254   0.596 ms  0.401 ms  0.387 ms

PC1>
```

7: Run a trace route from a VPC to another VPC in a different VLAN and explain the result (similar command to step 6 but the target IP address will be in a different VLAN)

Alternatively, using “trace” command from another VLAN results add extra hop, adding to two hops.



The first hop is the router's interface that serves as the gateway out of current VLAN (in this case Sales-PC1). The packet exits the source VLAN and enters the routing domain. Router examines the destination IP address of the packet, compares it against its routing table, and then forwards the packet to the appropriate network based on this information. The second hop represents the point where the packet enters the destination VLAN and reaches AccountingDep-PC1.

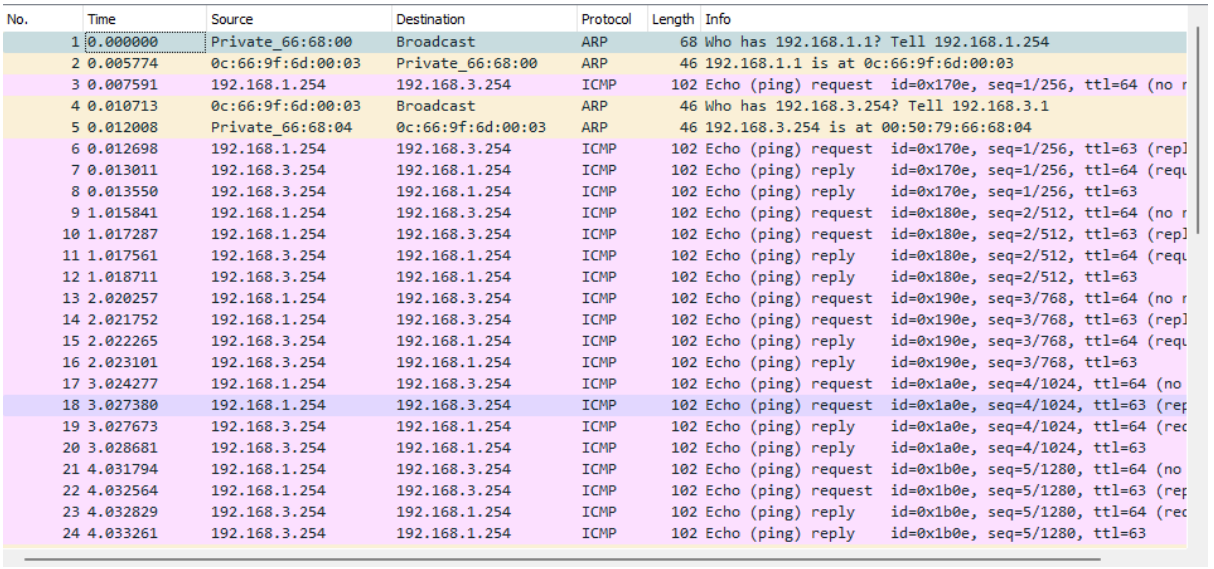
8: Do a packet capture on the link connecting the switch to the router - then run a ping from a VPC to a VPC in a different VLAN and explain the resulting packet capture, especially the use of the 802.1q protocol

Broadcast is sent to the Router as ARP including source IP and 802.1Q (VLAN) information.

When a ping is sent from VPC in VLAN0 to VPC in VLAN1 an ICMP echo request packet is created. This packet is encapsulated in an IP datagram, which is encapsulated in an Ethernet frame. Before the frame exits the VPC VLAN0 switch, a VLAN tag is added to the frame using the 802.1Q protocol (ID: 100 in my case). This tag carries information about what VLAN VPC belongs to.

Broadcast is sent from the router to find VPC in VLAN1. The packet is encapsulated in ARP datagram, which is encapsulated in 802.1Q protocol containing the current VLAN ID (ID: 150 in my case). The Router has created a new Ethernet frame corresponding to VLAN1 (ID: 150).

New frame is transmitted back to the Router, which then forwards the packet to VCP in VLAN1. Then VPC generates an ICMP echo reply back to VPC in VLAN0 in reverse. Then the reply reaches the VPC in VLAN0.



No.	Time	Source	Destination	Protocol	Length	Info
1	0.000000	Private_66:68:00	Broadcast	ARP	68	Who has 192.168.1.1? Tell 192.168.1.254
2	0.005774	0c:66:9f:6d:00:03	Private_66:68:00	ARP	46	192.168.1.1 is at 0c:66:9f:6d:00:03
3	0.007591	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x170e, seq=1/256, ttl=64 (no r
4	0.010713	0c:66:9f:6d:00:03	Broadcast	ARP	46	Who has 192.168.3.254? Tell 192.168.3.1
5	0.012008	Private_66:68:04	0c:66:9f:6d:00:03	ARP	46	192.168.3.254 is at 00:50:79:66:68:04
6	0.012698	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x170e, seq=1/256, ttl=63 (repl
7	0.013011	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x170e, seq=1/256, ttl=64 (requ
8	0.013550	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x170e, seq=1/256, ttl=63
9	1.015841	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x180e, seq=2/512, ttl=64 (no r
10	1.017287	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x180e, seq=2/512, ttl=63 (repl
11	1.017561	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x180e, seq=2/512, ttl=64 (requ
12	1.018711	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x180e, seq=2/512, ttl=63
13	2.020257	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x190e, seq=3/768, ttl=64 (no r
14	2.021752	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x190e, seq=3/768, ttl=63 (repl
15	2.022265	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x190e, seq=3/768, ttl=64 (requ
16	2.023101	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x190e, seq=3/768, ttl=63
17	3.024277	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x1a0e, seq=4/1024, ttl=64 (no
18	3.027380	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x1a0e, seq=4/1024, ttl=63 (rep
19	3.027673	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x1a0e, seq=4/1024, ttl=64 (rec
20	3.028681	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x1a0e, seq=4/1024, ttl=63
21	4.031794	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x1b0e, seq=5/1280, ttl=64 (no
22	4.032564	192.168.1.254	192.168.3.254	ICMP	102	Echo (ping) request id=0x1b0e, seq=5/1280, ttl=63 (rep
23	4.032829	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x1b0e, seq=5/1280, ttl=64 (rec
24	4.033261	192.168.3.254	192.168.1.254	ICMP	102	Echo (ping) reply id=0x1b0e, seq=5/1280, ttl=63