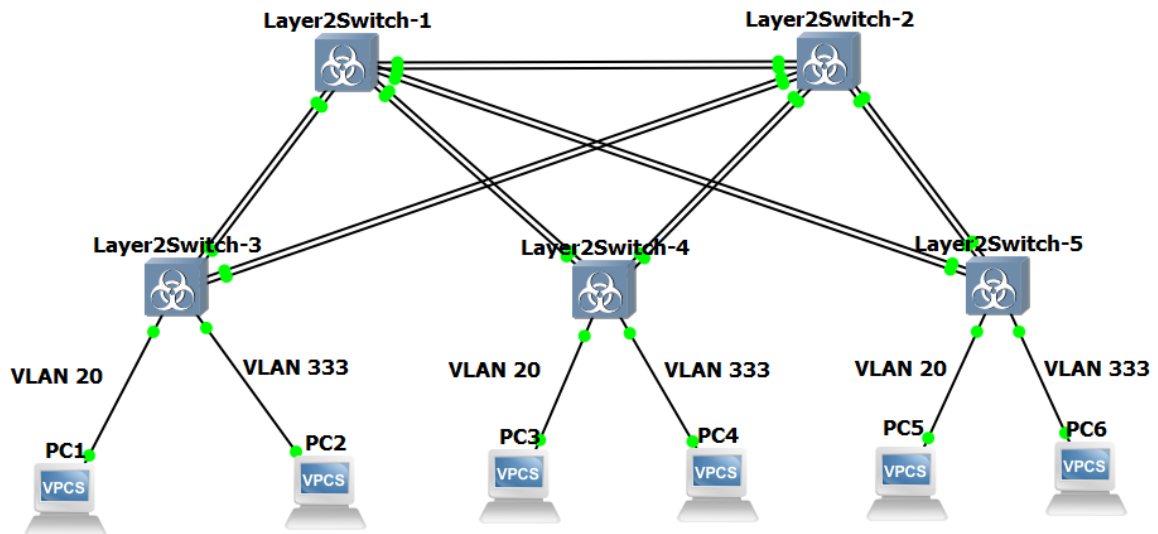


## Лабораторная работа №3

### «Настройка виртуальной локальной сети (VLAN)»

Для начала была построена следующая сеть:



Ниже представлена информация о настройке коммутаторов:

Layer2Switch-1   Layer2Switch-2
<pre>enable configure terminal  vlan 20 name VLAN20 exit  vlan 333 name VLAN333 exit  vlan 334 name BACKUP_VLAN exit  interface range GigabitEthernet 0/0, GigabitEthernet 0/2, GigabitEthernet 1/0, GigabitEthernet 1/2 switchport trunk encapsulation dot1q switchport mode trunk switchport trunk native vlan 333 switchport trunk allowed vlan 20,333 exit  interface range GigabitEthernet 0/1, GigabitEthernet 0/3, GigabitEthernet 1/1, GigabitEthernet 1/3 switchport trunk encapsulation dot1q switchport mode trunk switchport trunk native vlan 334 switchport trunk allowed vlan 334 exit  exit  write memory</pre>

Layer2Switch-3   Layer2Switch-4   Layer2Switch-5
enable configure terminal  vlan 20 name VLAN20 exit  vlan 333 name VLAN333 exit  vlan 334 name BACKUP_VLAN exit  interface range GigabitEthernet 0/0, GigabitEthernet 0/2 switchport trunk encapsulation dot1q switchport mode trunk switchport trunk native vlan 333 switchport trunk allowed vlan 20,333 exit  interface range GigabitEthernet 0/1, GigabitEthernet 0/3 switchport trunk encapsulation dot1q switchport mode trunk switchport trunk native vlan 334 switchport trunk allowed vlan 334 exit  interface GigabitEthernet 1/0 switchport mode access switchport access vlan 20 exit  interface GigabitEthernet 1/1 switchport mode access switchport access vlan 333 exit  exit  write memory

Для ПК с помощью команды «ip» были заданы следующие адреса:

Название ПК	IPv4
PC1	192.168.10.21/24
PC2	192.168.10.31/24
PC3	192.168.10.22/24
PC4	192.168.10.32/24
PC5	192.168.10.23/24
PC6	192.168.10.33/24

Далее была проведена проверка доступности/недоступности разных ПК в сети. Для примера были взяты PC1, PC2 и PC5.

PC1:

```
PC1> ping 192.168.10.31
host (192.168.10.31) not reachable

PC1> ping 192.168.10.22
84 bytes from 192.168.10.22 icmp_seq=1 ttl=64 time=7.400 ms
84 bytes from 192.168.10.22 icmp_seq=2 ttl=64 time=12.426 ms
84 bytes from 192.168.10.22 icmp_seq=3 ttl=64 time=2.150 ms
84 bytes from 192.168.10.22 icmp_seq=4 ttl=64 time=6.122 ms
84 bytes from 192.168.10.22 icmp_seq=5 ttl=64 time=1.947 ms

PC1> ping 192.168.10.32
host (192.168.10.32) not reachable

PC1> ping 192.168.10.23
84 bytes from 192.168.10.23 icmp_seq=1 ttl=64 time=9.483 ms
84 bytes from 192.168.10.23 icmp_seq=2 ttl=64 time=6.925 ms
84 bytes from 192.168.10.23 icmp_seq=3 ttl=64 time=16.137 ms
84 bytes from 192.168.10.23 icmp_seq=4 ttl=64 time=14.713 ms
84 bytes from 192.168.10.23 icmp_seq=5 ttl=64 time=2.086 ms

PC1> ping 192.168.10.33
host (192.168.10.33) not reachable
```

PC2:

```
PC2> ping 192.168.10.21
host (192.168.10.21) not reachable

PC2> ping 192.168.10.22
host (192.168.10.22) not reachable

PC2> ping 192.168.10.32
84 bytes from 192.168.10.32 icmp_seq=1 ttl=64 time=5.252 ms
84 bytes from 192.168.10.32 icmp_seq=2 ttl=64 time=7.363 ms
84 bytes from 192.168.10.32 icmp_seq=3 ttl=64 time=2.049 ms
84 bytes from 192.168.10.32 icmp_seq=4 ttl=64 time=7.395 ms
84 bytes from 192.168.10.32 icmp_seq=5 ttl=64 time=7.604 ms

PC2> ping 192.168.10.23
host (192.168.10.23) not reachable

PC2> ping 192.168.10.33
84 bytes from 192.168.10.33 icmp_seq=1 ttl=64 time=9.048 ms
84 bytes from 192.168.10.33 icmp_seq=2 ttl=64 time=6.944 ms
84 bytes from 192.168.10.33 icmp_seq=3 ttl=64 time=15.283 ms
84 bytes from 192.168.10.33 icmp_seq=4 ttl=64 time=5.839 ms
84 bytes from 192.168.10.33 icmp_seq=5 ttl=64 time=10.844 ms
```

PC5:

```
PC5> ping 192.168.10.21
84 bytes from 192.168.10.21 icmp_seq=1 ttl=64 time=12.310 ms
84 bytes from 192.168.10.21 icmp_seq=2 ttl=64 time=15.376 ms
84 bytes from 192.168.10.21 icmp_seq=3 ttl=64 time=9.866 ms
84 bytes from 192.168.10.21 icmp_seq=4 ttl=64 time=7.866 ms
84 bytes from 192.168.10.21 icmp_seq=5 ttl=64 time=4.049 ms

PC5> ping 192.168.10.31
host (192.168.10.31) not reachable

PC5> ping 192.168.10.22
84 bytes from 192.168.10.22 icmp_seq=1 ttl=64 time=6.351 ms
84 bytes from 192.168.10.22 icmp_seq=2 ttl=64 time=3.899 ms
84 bytes from 192.168.10.22 icmp_seq=3 ttl=64 time=4.216 ms
84 bytes from 192.168.10.22 icmp_seq=4 ttl=64 time=8.894 ms
84 bytes from 192.168.10.22 icmp_seq=5 ttl=64 time=17.362 ms

PC5> ping 192.168.10.32
host (192.168.10.32) not reachable

PC5> ping 192.168.10.33
host (192.168.10.33) not reachable

PC5>
```

По результатам можно заметить, что все работает корректно, и ПК, находящиеся в одинаковых VLAN, могут связаться друг с другом.

Для просмотра тегированного трафика был рассмотрен линк между Layer2Switch-1 и Layer2Switch-3:

Link from Layer2Switch-1 port Ethernet2 to Layer2Switch-3 port Ethernet0  
Packet capture is active

Для vlan 20 ARP запросы тегируются и добавляется 4 дополнительных байта. Два байта (81 00) указывают на наличие 802.1Q тега. Потом идут 3 бита PRI (000), 1 бит DEI (0) и 12 бит VLAN ID (0000 0001 0100).

```

▶ Frame 807: 68 bytes on wire (544 bits), 68 bytes captured (544 bits) on interface -, id 0
▼ Ethernet II, Src: Private_66:68:04 (00:50:79:66:68:04), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  ▶ Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  ▶ Source: Private_66:68:04 (00:50:79:66:68:04)
  Type: 802.1Q Virtual LAN (0x8100)
  [Stream index: 15]
▼ 802.1Q Virtual LAN, PRI: 0, DEI: 0, ID: 20
  000. .... = Priority: Best Effort (default) (0)
  ...0 .... = DEI: Ineligible
  .... 0000 0001 0100 = ID: 20
  Type: ARP (0x0806)
  Padding: 0000000000000000000000000000000000000000
  Trailer: 00000000
▶ Address Resolution Protocol (request)

```

Для vlan 333 тэги к ARP запросам не добавляются.

```

▶ Frame 614: 64 bytes on wire (512 bits), 64 bytes captured (512 bits) on interface -, id 0
▼ Ethernet II, Src: Private_66:68:03 (00:50:79:66:68:03), Dst: Broadcast (ff:ff:ff:ff:ff:ff)
  ▶ Destination: Broadcast (ff:ff:ff:ff:ff:ff)
  ▶ Source: Private_66:68:03 (00:50:79:66:68:03)
    Type: ARP (0x0806)
    [Stream index: 5]
    Padding: 00000000000000000000000000000000
    Frame check sequence: 0x00000000 [unverified]
    [FCS Status: Unverified]
  ▶ Address Resolution Protocol (request)

0000  ff ff ff ff ff ff 00 50  79 66 68 03 08 06 00 01  ..... P yfh.....
0010  08 00 06 04 00 01 00 50  79 66 68 03 c0 a8 0a 1f  ..... P yfh.....
0020  ff ff ff ff ff ff c0 a8  0a 15 00 00 00 00 00 00  .....
0030  00 00 00 00 00 00 00 00  00 00 00 00 00 00 00 00  .....
```

Далее был рассмотрен линк между Layer2Switch-3 и PC1:

Link from Layer2Switch-3 port Ethernet4 to PC1 port Ethernet0  
Packet capture is active

Тегированного графика вообще нет:

arp && vlan.id == 20

No.	Time	Source	Destination	Protocol	Length	Info

Весь трафик без тегов, т.к. коммутатор их удаляет перед отправкой на ПК:

arp && !vlan.id

No.	Time	Source	Destination	Protocol	Length	Info
341	476.922457	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.31? Tell 192.168.10.21
342	477.923149	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.31? Tell 192.168.10.21
344	478.923722	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.31? Tell 192.168.10.21
347	481.910434	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.22? Tell 192.168.10.21
348	481.917514	Private_66:68:05	Private_66:68:01	ARP	64	192.168.10.22 is at 00:50:79:66:68:05
365	490.286443	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.32? Tell 192.168.10.21
368	491.287435	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.32? Tell 192.168.10.21
370	492.288267	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.32? Tell 192.168.10.21
374	498.854440	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.23? Tell 192.168.10.21
375	498.856665	Private_66:68:04	Private_66:68:01	ARP	64	192.168.10.21 is at 00:50:79:66:68:04
390	505.978434	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.33? Tell 192.168.10.21
392	506.978827	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.33? Tell 192.168.10.21
393	507.979735	Private_66:68:01	Broadcast	ARP	64	who has 192.168.10.33? Tell 192.168.10.21
502	665.907702	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.21? Tell 192.168.10.23
503	665.907818	Private_66:68:01	Private_66:68:04	ARP	64	192.168.10.21 is at 00:50:79:66:68:01
522	674.327381	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.31? Tell 192.168.10.23
523	675.328725	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.31? Tell 192.168.10.23
525	676.328356	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.31? Tell 192.168.10.23
527	678.843545	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.22? Tell 192.168.10.23
533	686.283440	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.32? Tell 192.168.10.23
534	687.291214	Private_66:68:04	Broadcast	ARP	64	who has 192.168.10.32? Tell 192.168.10.23

Также был рассмотрен линк между Layer2Switch-3 и PC2:

Link from Layer2Switch-3 port Ethernet5 to PC2 port Ethernet0  
Packet capture is active

Здесь были получены аналогичные результаты:

[illegible]

arp && Ivlan.id						
No.	Time	Source	Destination	Protocol	Length Info	
88	122.252198	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.33? Tell 192.168.10.31
89	122.255131	Private_66:68:00	Private_66:68:03	ARP	64	192.168.10.33 is at 00:50:79:66:68:00
391	539.176194	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.21? Tell 192.168.10.31
393	540.176283	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.21? Tell 192.168.10.31
396	541.176496	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.21? Tell 192.168.10.31
399	545.388217	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.22? Tell 192.168.10.31
401	546.389032	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.22? Tell 192.168.10.31
402	547.389343	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.22? Tell 192.168.10.31
405	550.109995	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.32? Tell 192.168.10.31
406	550.116025	Private_66:68:02	Private_66:68:03	ARP	64	192.168.10.32 is at 00:50:79:66:68:02
421	557.992218	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.23? Tell 192.168.10.31
423	558.992916	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.23? Tell 192.168.10.31
424	559.993314	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.23? Tell 192.168.10.31
430	562.748215	Private_66:68:03	Broadcast	ARP	64	Who has 192.168.10.33? Tell 192.168.10.31
431	562.754030	Private_66:68:00	Private_66:68:03	ARP	64	192.168.10.33 is at 00:50:79:66:68:00