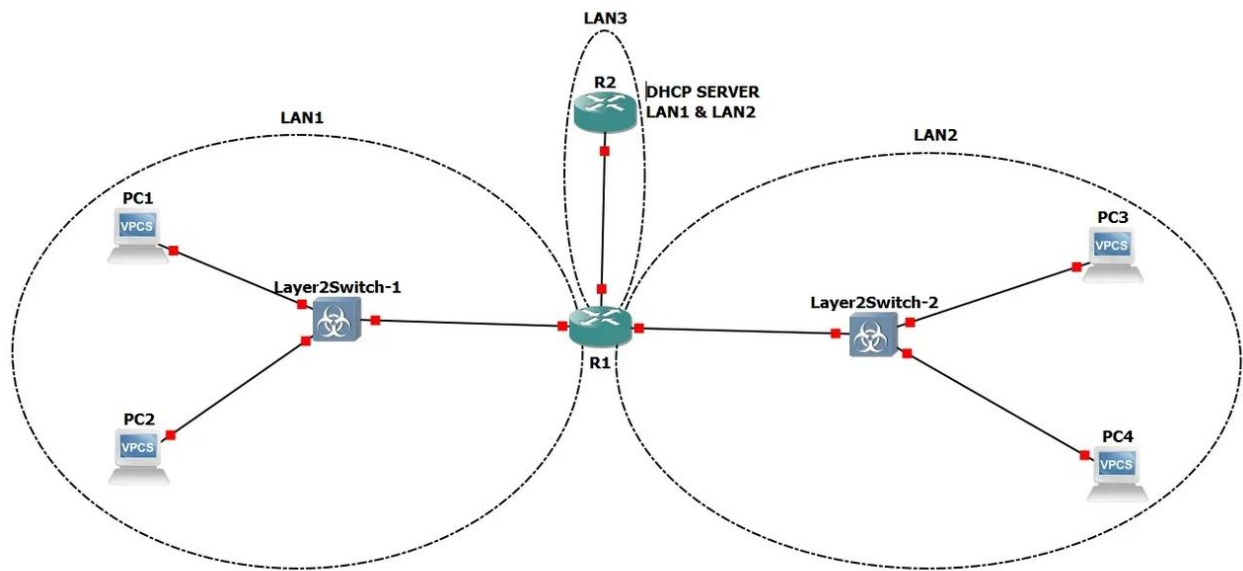


Тема: Настройка протокола DHCP

1) Для заданной на схеме schema-lab4 сети, состоящей из управляемых коммутаторов, маршрутизаторов и персональных компьютеров



выполнить планирование и документирование адресного пространства в подсетях LAN1, LAN2, LAN3 и назначить статические адреса маршрутизаторам и динамическое конфигурирование адресов для VPC

	LAN1	LAN2	LAN3
Подсеть	10.10.1.0/26	10.10.1.128/26	10.10.1.64/26
Маска	255.255.255.192	255.255.255.192	255.255.255.192
Диапазон адресов	.1 – .62	.129 – .190	.65 – .126
Broadcast	.63	.191	.127
Шлюз (Gateway)	10.10.1.5 (R1)	10.10.1.135 (R1)	10.10.1.65 (R1) 10.10.1.70 (R2)
DHCP Pool	10.10.1.0/26	10.10.1.128/26	—

Настройка R1

configure terminal

interface FastEthernet0/0

ip address 10.10.1.5 255.255.255.192

no shutdown

exit

interface FastEthernet1/0

ip address 10.10.1.65 255.255.255.192

no shutdown

```
exit  
  
interface FastEthernet2/0  
  
ip address 10.10.1.135 255.255.255.192  
  
no shutdown  
  
exit  
  
end  
  
write memory
```

Настройка R2

```
configure terminal  
  
interface FastEthernet0/0  
  
ip address 10.10.1.70 255.255.255.192  
  
no shutdown  
  
exit  
  
end  
  
write memory
```

2) Настроить сервер DHCP на маршрутизаторе R2 для обслуживания адресных пулов адресного пространства подсетей LAN1 и LAN2

```
configure terminal  
  
ip dhcp excluded-address 10.10.1.5  
  
ip dhcp excluded-address 10.10.1.135  
  
ip dhcp pool LAN1  
  
network 10.10.1.0 255.255.255.192  
  
default-router 10.10.1.5  
  
dns-server 8.8.8.8  
  
exit
```

```
ip dhcp pool LAN2
network 10.10.1.128 255.255.255.192
default-router 10.10.1.135
dns-server 8.8.8.8
exit
end
write memory
```

DHCP Relay на R1

```
configure terminal
interface FastEthernet0/0
ip helper-address 10.10.1.70
exit
interface FastEthernet2/0
ip helper-address 10.10.1.70
exit
end
write memory
```

3) Настроить статическую (nb!) маршрутизацию между подсетями

На R1

```
configure terminal
ip route 10.10.1.0 255.255.255.192 10.10.1.70
ip route 10.10.1.128 255.255.255.192 10.10.1.70
end
write memory
```

На R2

configure terminal

ip route 10.10.1.0 255.255.255.192 10.10.1.65

ip route 10.10.1.128 255.255.255.192 10.10.1.65

end

write memory

4) Проверить работоспособность протокола DHCP и маршрутизации, выполнив ping между всеми VPC

Автоматически выдадим ip адреса всем PC

ip dhcp

save

```
PC1> ip dhcp
DDORA IP 10.10.1.1/26 GW 10.10.1.5
PC1> █
```

```
PC2> ip dhcp
DDORA IP 10.10.1.2/26 GW 10.10.1.5
PC2> █
```

```
PC3> ip dhcp
DDORA IP 10.10.1.129/26 GW 10.10.1.135
PC3> █
```

```
PC4> ip dhcp
DDORA IP 10.10.1.130/26 GW 10.10.1.135
PC4> █
```

Теперь попробуем ping

PC1

```
PC1> ping 10.10.1.2

84 bytes from 10.10.1.2 icmp_seq=1 ttl=64 time=5.056 ms
84 bytes from 10.10.1.2 icmp_seq=2 ttl=64 time=0.610 ms
84 bytes from 10.10.1.2 icmp_seq=3 ttl=64 time=0.576 ms
84 bytes from 10.10.1.2 icmp_seq=4 ttl=64 time=2.597 ms
84 bytes from 10.10.1.2 icmp_seq=5 ttl=64 time=0.619 ms

PC1> ping 10.10.1.129

84 bytes from 10.10.1.129 icmp_seq=1 ttl=63 time=29.608 ms
84 bytes from 10.10.1.129 icmp_seq=2 ttl=63 time=17.562 ms
84 bytes from 10.10.1.129 icmp_seq=3 ttl=63 time=14.571 ms
84 bytes from 10.10.1.129 icmp_seq=4 ttl=63 time=16.675 ms
84 bytes from 10.10.1.129 icmp_seq=5 ttl=63 time=16.178 ms

PC1> ping 10.10.1.130

84 bytes from 10.10.1.130 icmp_seq=1 ttl=63 time=21.319 ms
84 bytes from 10.10.1.130 icmp_seq=2 ttl=63 time=18.386 ms
84 bytes from 10.10.1.130 icmp_seq=3 ttl=63 time=14.931 ms
84 bytes from 10.10.1.130 icmp_seq=4 ttl=63 time=17.621 ms
84 bytes from 10.10.1.130 icmp_seq=5 ttl=63 time=17.147 ms
```

PC2

```
PC2> ping 10.10.1.1
```

```
84 bytes from 10.10.1.1 icmp_seq=1 ttl=64 time=1.710 ms  
84 bytes from 10.10.1.1 icmp_seq=2 ttl=64 time=6.408 ms  
84 bytes from 10.10.1.1 icmp_seq=3 ttl=64 time=0.765 ms  
84 bytes from 10.10.1.1 icmp_seq=4 ttl=64 time=5.392 ms  
84 bytes from 10.10.1.1 icmp_seq=5 ttl=64 time=1.707 ms
```

```
PC2> ping 10.10.1.129
```

```
84 bytes from 10.10.1.129 icmp_seq=1 ttl=63 time=21.042 ms  
84 bytes from 10.10.1.129 icmp_seq=2 ttl=63 time=15.225 ms  
84 bytes from 10.10.1.129 icmp_seq=3 ttl=63 time=15.762 ms  
84 bytes from 10.10.1.129 icmp_seq=4 ttl=63 time=16.858 ms  
84 bytes from 10.10.1.129 icmp_seq=5 ttl=63 time=17.378 ms
```

```
PC2> ping 10.10.1.130
```

```
84 bytes from 10.10.1.130 icmp_seq=1 ttl=63 time=18.539 ms  
84 bytes from 10.10.1.130 icmp_seq=2 ttl=63 time=16.203 ms  
84 bytes from 10.10.1.130 icmp_seq=3 ttl=63 time=15.642 ms  
84 bytes from 10.10.1.130 icmp_seq=4 ttl=63 time=15.375 ms  
84 bytes from 10.10.1.130 icmp_seq=5 ttl=63 time=15.932 ms
```

PC3

```
PC3> ping 10.10.1.1
```

```
84 bytes from 10.10.1.1 icmp_seq=1 ttl=63 time=29.891 ms
84 bytes from 10.10.1.1 icmp_seq=2 ttl=63 time=15.959 ms
84 bytes from 10.10.1.1 icmp_seq=3 ttl=63 time=16.976 ms
84 bytes from 10.10.1.1 icmp_seq=4 ttl=63 time=16.611 ms
84 bytes from 10.10.1.1 icmp_seq=5 ttl=63 time=16.053 ms
```

```
PC3> ping 10.10.1.2
```

```
84 bytes from 10.10.1.2 icmp_seq=1 ttl=63 time=29.333 ms
84 bytes from 10.10.1.2 icmp_seq=2 ttl=63 time=15.724 ms
84 bytes from 10.10.1.2 icmp_seq=3 ttl=63 time=16.037 ms
84 bytes from 10.10.1.2 icmp_seq=4 ttl=63 time=16.193 ms
84 bytes from 10.10.1.2 icmp_seq=5 ttl=63 time=16.616 ms
```

```
PC3> ping 10.10.1.130
```

```
84 bytes from 10.10.1.130 icmp_seq=1 ttl=64 time=9.286 ms
84 bytes from 10.10.1.130 icmp_seq=2 ttl=64 time=0.897 ms
84 bytes from 10.10.1.130 icmp_seq=3 ttl=64 time=0.756 ms
84 bytes from 10.10.1.130 icmp_seq=4 ttl=64 time=6.951 ms
84 bytes from 10.10.1.130 icmp_seq=5 ttl=64 time=0.863 ms
```

PC4


```

PC4> ping 10.10.1.1

84 bytes from 10.10.1.1 icmp_seq=1 ttl=63 time=29.660 ms
84 bytes from 10.10.1.1 icmp_seq=2 ttl=63 time=16.321 ms
84 bytes from 10.10.1.1 icmp_seq=3 ttl=63 time=15.466 ms
84 bytes from 10.10.1.1 icmp_seq=4 ttl=63 time=15.576 ms
84 bytes from 10.10.1.1 icmp_seq=5 ttl=63 time=16.563 ms

PC4> ping 10.10.1.2

84 bytes from 10.10.1.2 icmp_seq=1 ttl=63 time=30.432 ms
84 bytes from 10.10.1.2 icmp_seq=2 ttl=63 time=16.604 ms
84 bytes from 10.10.1.2 icmp_seq=3 ttl=63 time=16.787 ms
84 bytes from 10.10.1.2 icmp_seq=4 ttl=63 time=16.964 ms
84 bytes from 10.10.1.2 icmp_seq=5 ttl=63 time=16.346 ms

PC4> ping 10.10.1.129

84 bytes from 10.10.1.129 icmp_seq=1 ttl=64 time=0.683 ms
84 bytes from 10.10.1.129 icmp_seq=2 ttl=64 time=0.707 ms
84 bytes from 10.10.1.129 icmp_seq=3 ttl=64 time=0.752 ms
84 bytes from 10.10.1.129 icmp_seq=4 ttl=64 time=4.682 ms
84 bytes from 10.10.1.129 icmp_seq=5 ttl=64 time=7.029 ms

```

5) Перехватить в wireshark диалог одного из VPC с сервером DHCP, разобрать с комментариями

Выполним команду `ip dhcp` на PC1 чтобы захватить DHC пакеты в Wireshark

Захват из Standard input [Layer2Switch-1 Ethernet2 to R1 FastEthernet0/0]

No.	Time	Source	Destination	Protocol	Length	Info
5	4.933919	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0xe0ec1e01
6	4.954422	10.10.1.5	10.10.1.1	DHCP	342	DHCP Offer - Transaction ID 0xe0ec1e01
7	5.933765	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0xe0ec1e01
8	5.950752	10.10.1.5	10.10.1.1	DHCP	342	DHCP ACK - Transaction ID 0xe0ec1e01

Разберём пакеты.

Discover

Захват из Standard input [Layer2Switch-1 Ethernet2 to R1 FastEthernet0/0]						
Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка						
dhcp						
No.	Time	Source	Destination	Protocol	Length	Info
5	4.933919	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0xe0ec1e01
6	4.954422	10.10.1.5	10.10.1.1	DHCP	342	DHCP Offer - Transaction ID 0xe0ec1e01
7	5.933765	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0xe0ec1e01
8	5.950752	10.10.1.5	10.10.1.1	DHCP	342	DHCP ACK - Transaction ID 0xe0ec1e01

> Frame 5: 406 bytes on wire (3248 bits), 406 bytes captured (3248 bits) on interface -, id 0	0000 ff ff ff ff ff ff 00 50 79 66 68 00 00 00 45 10	.....P yfh....E.
> Ethernet II, Src: Private_66:68:00 (00:50:79:66:68:00), Dst: Broadcast (ff:ff:ff:ff:ff:ff)	0010 01 80 00 00 00 00 10 11 a9 56 00 00 00 00 ff ff	.....V.....
> Internet Protocol Version 4, Src: 0.0.0.0, Dst: 255.255.255.255	0020 ff ff 00 44 00 43 01 74 eb 7d 01 01 06 00 e0 ec	....D.C.t.....
> User Datagram Protocol, Src Port: 68, Dst Port: 67	0030 1e 01 00 00 00 00 00 00 00 00 00 00 00 00 00	....P yfh.....
> Dynamic Host Configuration Protocol (Discover)	0040 00 00 00 00 00 00 50 79 66 68 00 00 00 00 00	.....P yfh.....
Message type: Boot Request (1)	0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hardware type: Ethernet (0x01)	0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hardware address length: 6	0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hops: 0	0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Transaction ID: 0xe0ec1e01	0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Seconds elapsed: 0	00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Bootp flags: 0x0000 (Unicast)	00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client IP address: 0.0.0.0	00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Your (client) IP address: 0.0.0.0	00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Next server IP address: 0.0.0.0	00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Relay agent IP address: 0.0.0.0	00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client MAC address: Private_66:68:00 (00:50:79:66:68:00)	0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client hardware address padding: 00	0110 00 00 00 00 00 00 63 82 53 63 35 01 01 0c 03 50c:SeS...P
Server host name not given	0120 43 31 3d 07 01 00 50 79 66 68 00 ff 00 00 00 00	C1...Py fh.....
Boot file name not given	0130 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Magic cookie: DHCP	0140 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Option: (53) DHCP Message Type (Discover)	0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Option: (12) Host Name	0160 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Option: (61) Client identifier	0170 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Option: (255) End	0180 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Padding: 000	0190 00 00 00 00 00 00

Клиент PC начинает процесс получения IP-адреса. Сначала он отправляет в сеть широковещательный запрос DHCP Discover, указывая свой MAC-адрес и уникальный идентификатор транзакции.

Offer

Захват из Standard input [Layer2Switch-1 Ethernet2 to R1 FastEthernet0/0]						
Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка						
dhcp						
No.	Time	Source	Destination	Protocol	Length	Info
5	4.933919	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0xe0ec1e01
6	4.954422	10.10.1.5	10.10.1.1	DHCP	342	DHCP Offer - Transaction ID 0xe0ec1e01
7	5.933765	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0xe0ec1e01
8	5.950752	10.10.1.5	10.10.1.1	DHCP	342	DHCP ACK - Transaction ID 0xe0ec1e01

> Frame 6: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface -, id 0	0000 00 50 79 66 68 00 00 00 00 45 10	.....P yfh....E.
> Ethernet II, Src: cc:01:16:3a:00:00 (cc:01:16:3a:00:00), Dst: Private_66:68:00 (00:50:79:66:68:00)	0010 01 48 00 10 11 a9 56 00 00 00 00 00 00 ff ff	.....V.....
> Internet Protocol Version 4, Src: 10.10.1.5, Dst: 10.10.1.1	0020 01 01 00 00 00 00 00 00 00 00 00 00 00 00 00	....P yfh.....
> User Datagram Protocol, Src Port: 67, Dst Port: 68	0030 1e 01 00 00 00 00 00 00 00 00 00 00 00 00 00	....P yfh.....
> Dynamic Host Configuration Protocol (Offer)	0040 00 00 00 00 00 00 50 79 66 68 00 ff 00 00 00 00	.....P yfh.....
Message type: Boot Reply (2)	0050 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hardware type: Ethernet (0x01)	0060 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hardware address length: 6	0070 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Hops: 0	0080 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Transaction ID: 0xe0ec1e01	0090 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Seconds elapsed: 0	00a0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Bootp flags: 0x0000 (Unicast)	00b0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client IP address: 0.0.0.0	00c0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Your (client) IP address: 10.10.1.1	00d0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Next server IP address: 0.0.0.0	00e0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Relay agent IP address: 10.10.1.5	00f0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client MAC address: Private_66:68:00 (00:50:79:66:68:00)	0100 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
Client hardware address padding: 00	0110 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
Server host name not given	0120 0a 01 46 3a 00 00 00 00 00 00 00 00 00 00 00	.....
Boot file name not given	0130 04 00 01 10 11 a9 56 00 00 00 00 00 00 ff ff	.....
Magic cookie: DHCP	0140 05 06 04 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Option: (53) DHCP Message Type (Offer)	0150 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00	.....
> Option: (54) DHCP Server Identifier (10.10.1.70)		
> Option: (51) IP Address Lease Time		
> Option: (58) Renewal Time Value		
> Option: (59) Rebinding Time Value		
> Option: (1) Subnet Mask (255.255.255.192)		
> Option: (3) Router		
> Option: (6) Domain Name Server		
> Option: (255) End		
Padding: 00		

Сервер DHCP (10.10.1.5) отвечает ему прямым сообщением DHCP Offer, предлагая конкретный IP-адрес (10.10.1.1).

Request

[illegible]

Затем клиент подтверждает принятие этого адреса, снова отправляя широковещательный DHCP Request

ACK

Захват из Standard input [Layer2Switch-1 Ethernet2 to R1 FastEthernet0/0]

Файл Правка Вид Запуск Захват Анализ Статистика Телефония Беспроводная связь Инструменты Справка

dhcp

No.	Time	Source	Destination	Protocol	Length	Info
5	4.933919	0.0.0.0	255.255.255.255	DHCP	406	DHCP Discover - Transaction ID 0xe0ec1e01
6	4.954422	10.10.1.5	10.10.1.1	DHCP	342	DHCP Offer - Transaction ID 0xe0ec1e01
7	5.933765	0.0.0.0	255.255.255.255	DHCP	406	DHCP Request - Transaction ID 0xe0ec1e01
8	5.950752	10.10.1.5	10.10.1.1	DHCP	342	DHCP ACK - Transaction ID 0xe0ec1e01

> Frame 8: 342 bytes on wire (2736 bits), 342 bytes captured (2736 bits) on interface -, id 0
 > Ethernet II, Src: cc:01:16:3a:00:00 (cc:01:16:3a:00:00), Dst: Private_66:68:00 (00:50:79:66:68:00)
 > Internet Protocol Version 4, Src: 10.10.1.5, Dst: 10.10.1.1
 > User Datagram Protocol, Src Port: 67, Dst Port: 68
 ✓ Dynamic Host Configuration Protocol (ACK)

Message type: Boot Reply (2)
 Hardware type: Ethernet (0x01)
 Hardware address length: 6
 Hops: 0
 Transaction ID: 0xe0ec1e01
 Seconds elapsed: 0
 > Boot flags: 0x0000 (Unicast)
 Client IP address: 10.10.1.1
 Your (client) IP address: 10.10.1.1
 Next server IP address: 0.0.0.0
 Relay agent IP address: 10.10.1.5
 Client MAC address: Private_66:68:00 (00:50:79:66:68:00)
 Client hardware address padding: 00000000000000000000
 Server host name not given
 Boot file name not given
 Magic cookie: DHCP
 > Option: (53) DHCP Message Type (ACK)
 > Option: (54) DHCP Server Identifier (10.10.1.70)
 > Option: (51) IP Address Lease Time
 > Option: (58) Renewal Time Value
 > Option: (59) Subbinding Time Value
 > Option: (1) Subnet Mask (255.255.255.192)
 > Option: (3) Router
 > Option: (6) Domain Name Server
 > Option: (255) End
 Padding: 00000000000000000000000000000000

0000 00 50 79
 0010 01 48 00
 0020 01 01 00
 0030 1e 01 00
 0040 00 00 00
 0050 00 00 00
 0060 00 00 00
 0070 00 00 00
 0080 00 00 00
 0090 00 00 00
 00a0 00 00 00
 00b0 00 00 00
 00c0 00 00 00
 00d0 00 00 00
 00e0 00 00 00
 00f0 00 00 00
 0100 00 00 00
 0110 00 00 00
 0120 0a 01 4f
 0130 04 00 01
 0140 05 06 04
 0150 00 00 00