

**МДК.01.01**

**Организация, принципы  
построения и функционирования  
компьютерных сетей  
3-курс**

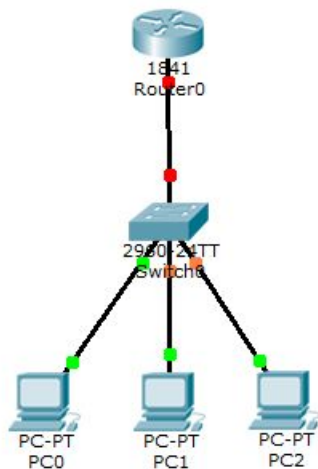
**Практические занятия**

Занятие 08



Logical [Root]

New Cluster Move Object Set Tiled Background Viewport



Создадим простую сеть из 3-х компьютеров, коммутатора 2960 и маршрутизатора 1841.

Все компьютеры принадлежат одной подсети, т.е. у них общий VLAN.

Настроим на маршрутизаторе протокол DHCP для автоматического получения IP-адресов.



Time: 00:01:38 Power Cycle Devices Fast Forward Time

Realtime

Connections



Automatically Choose Connection Type

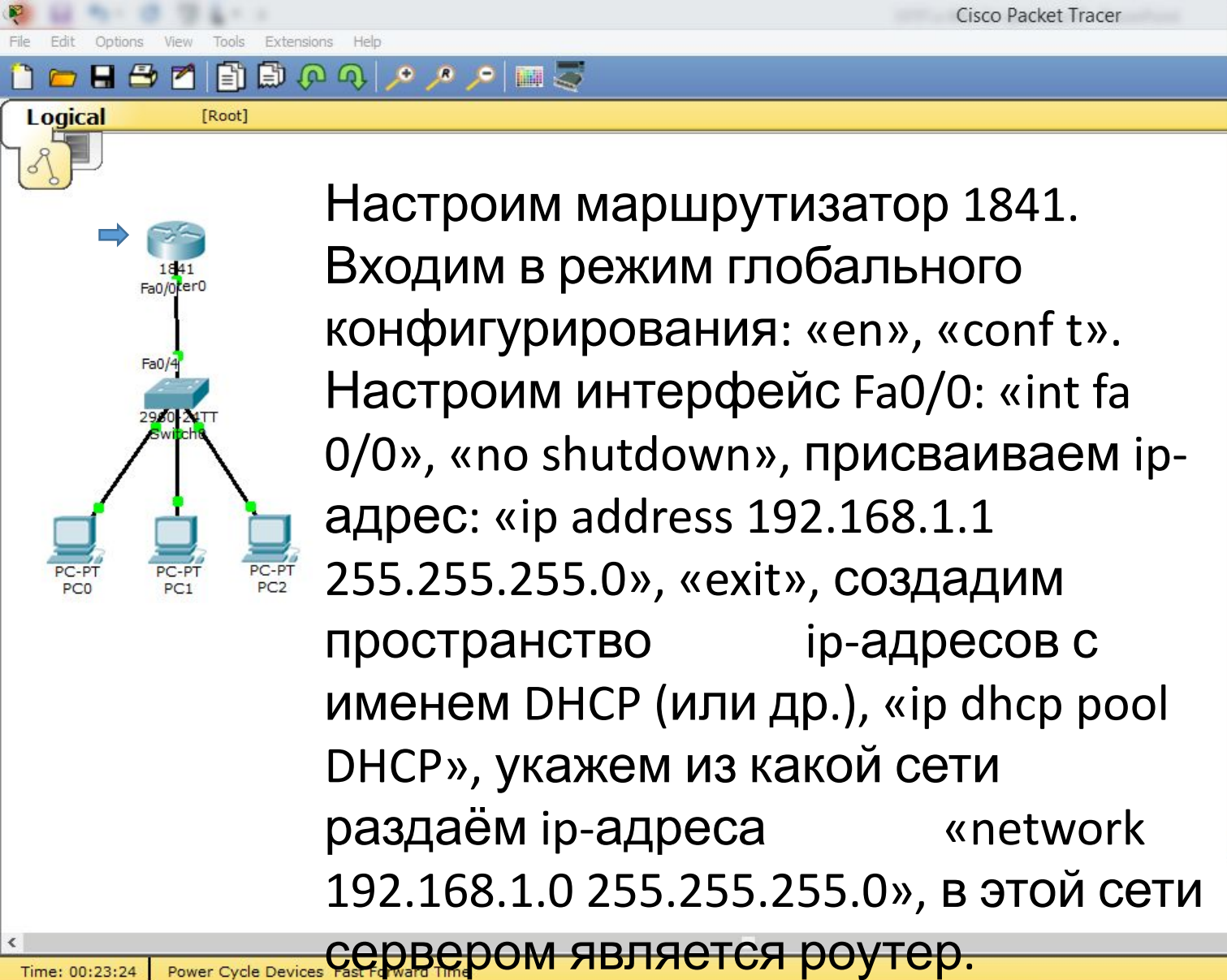
Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
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```
Router0
Physical Config CLI
IOS Command Line Interface

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int fa 0/0
Router(config-if)#no sh
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#ip address 192.168.1.1
% Incomplete command.
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#exit
Router(config)#ip dhcp pool DHCP
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#defa
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#dns
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#exit
Router(config)#ip dhcp ex
Router(config)#ip dhcp excluded-address 192.168.1.100
Router(config)#ip dhcp excluded-address 192.168.1.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr mem
Building configuration...
[OK]
Router#
```

Time: 00:23:24 | Power Cycle Devices | Fast Forward Time

Connections

Automatically Choose Connection Type

Scenario 0

New Delete

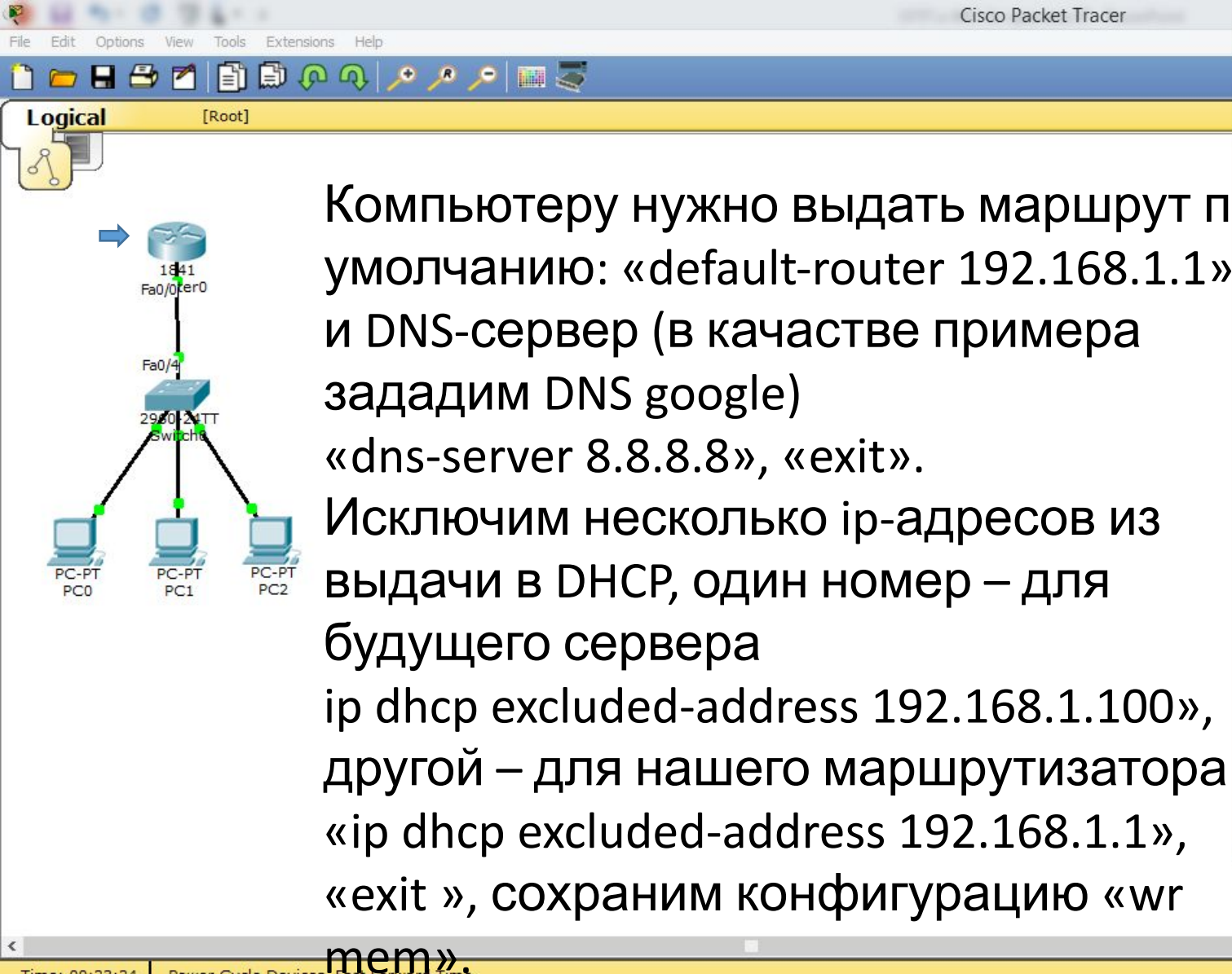
Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Realtime

Windows taskbar: ENG 18:01 11.11.2019





Компьютеру нужно выдать маршрут по умолчанию: «default-router 192.168.1.1» и DNS-сервер (в качестве примера зададим DNS google) «dns-server 8.8.8.8», «exit». Исклучим несколько ip-адресов из выдачи в DHCP, один номер – для будущего сервера ip dhcp excluded-address 192.168.1.100», другой – для нашего маршрутизатора «ip dhcp excluded-address 192.168.1.1», «exit », сохраним конфигурацию «wr mem».

```

Router0
Physical Config CLI
IOS Command Line Interface

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int fa 0/0
Router(config-if)#no sh
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#ip address 192.168.1.1
% Incomplete command.
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#exit
Router(config)#ip dhcp pool DHCP
Router(dhcp-config)#network 192.168.1.0 255.255.255.0
Router(dhcp-config)#defa
Router(dhcp-config)#default-router 192.168.1.1
Router(dhcp-config)#dns
Router(dhcp-config)#dns-server 8.8.8.8
Router(dhcp-config)#exit
Router(config)#ip dhcp ex
Router(config)#ip dhcp excluded-address 192.168.1.100
Router(config)#ip dhcp excluded-address 192.168.1.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr mem
Building configuration...
[OK]
Router#

```

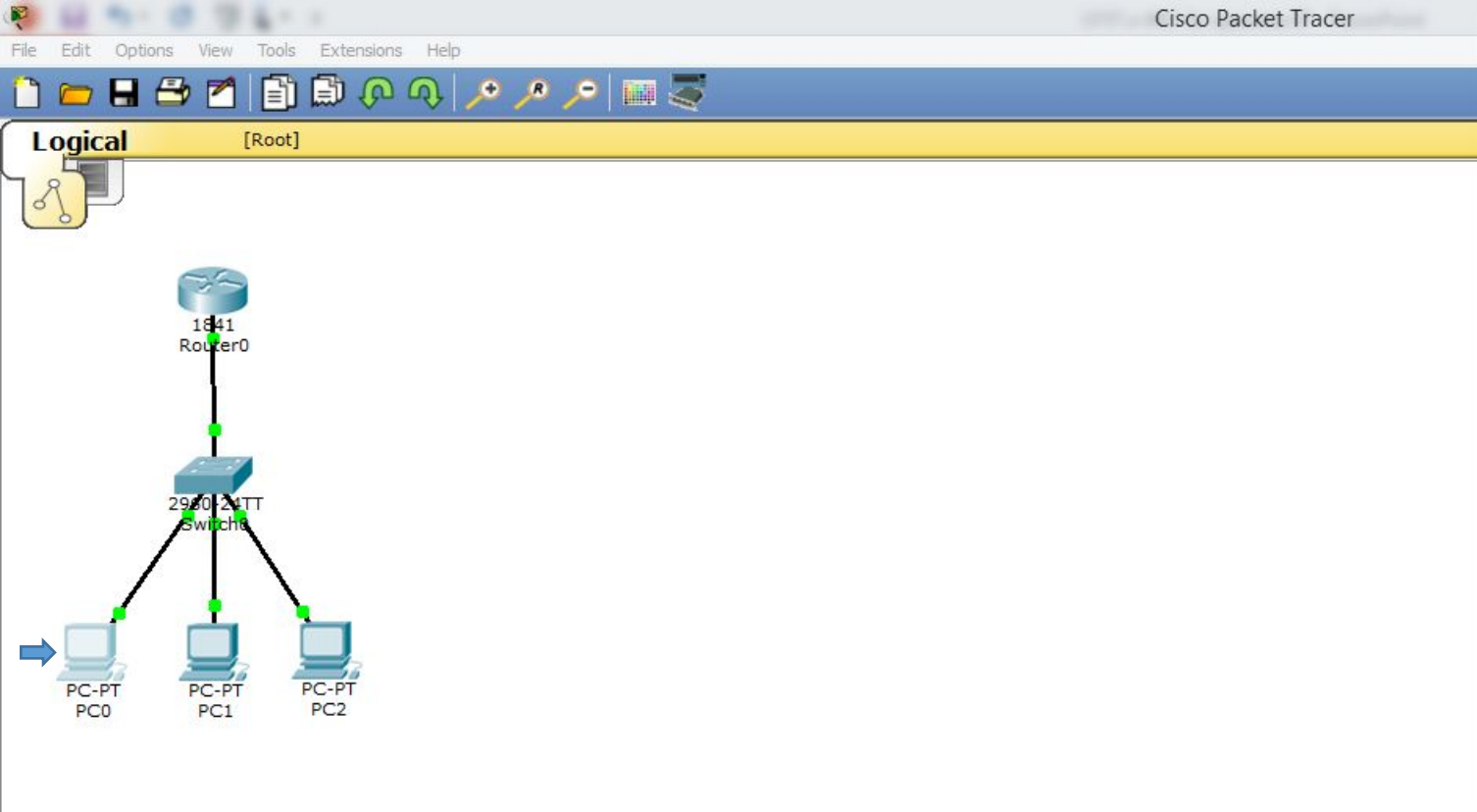
Time: 00:23:24 | Power Cycle Devices | Fast Forward Time | Realtime

Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete

Automatically Choose Connection Type

Windows taskbar: 18:01 11.11.2019



### IP Configuration

IP Configuration

DHCP  Static DHCP request successful.

IP Address: 192.168.1.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 8.8.8.8

IPv6 Configuration

DHCP  Auto Config  Static

IPv6 Address: /

Link Local Address: FE80::260:2FFF:FEED:5987

IPv6 Gateway:

IPv6 DNS Server:

Web Browser

Cisco IP Communicator

Настроим компьютер PC0, выбираем IP Configuration «DHCP».  
Видим ip-address: 192.168.1.2, маршрут по умолчанию: 192.168.1.1, и DNS-Server: 8.8.8.8.

Time: 00:53:12 | Power Cycle Devices Fast Forward Time

Realtime

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

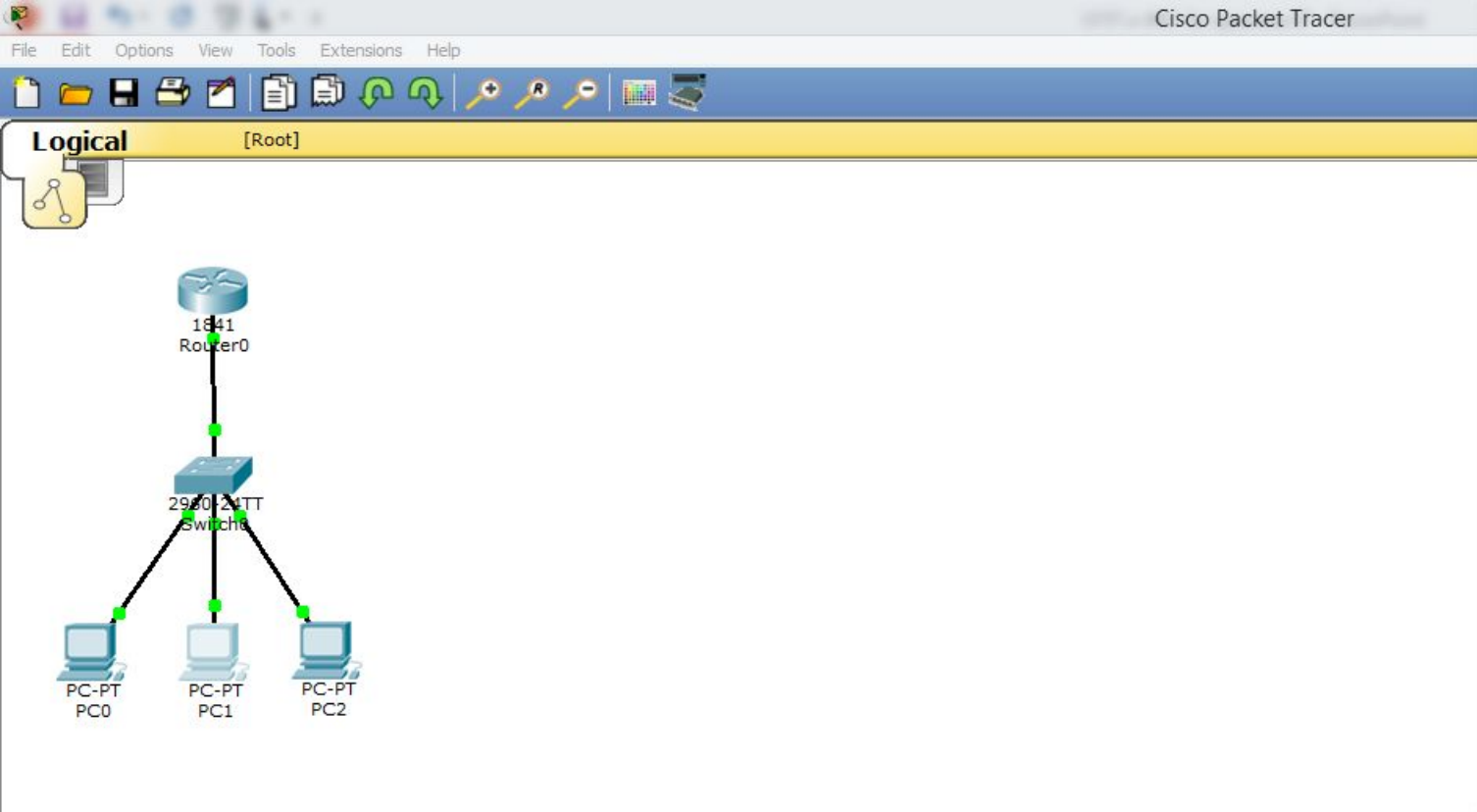
Scenario 0

New Delete

Toggle PDU List Window

Automatically Choose Connection Type

Windows taskbar: 18:30 11.11.2019



### IP Configuration

IP Configuration

DHCP     Static    DHCP request successful.

IP Address: 192.168.1.3

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server: 8.8.8.8

---

IPv6 Configuration


DHCP     Auto Config     Static

IPv6 Address: [ ] / [ ]


Link Local Address: FE80::2D0:FFFF:FEE2:4590

IPv6 Gateway: [ ]

IPv6 DNS Server: [ ]



Web Browser



Cisco IP Communicator

Аналогичные действия проводим для компьютеров PC1 и PC2.  
Видим, что ip-адреса есть.

Time: 01:05:17    Power Cycle Devices    Fast Forward Time    **Realtime**

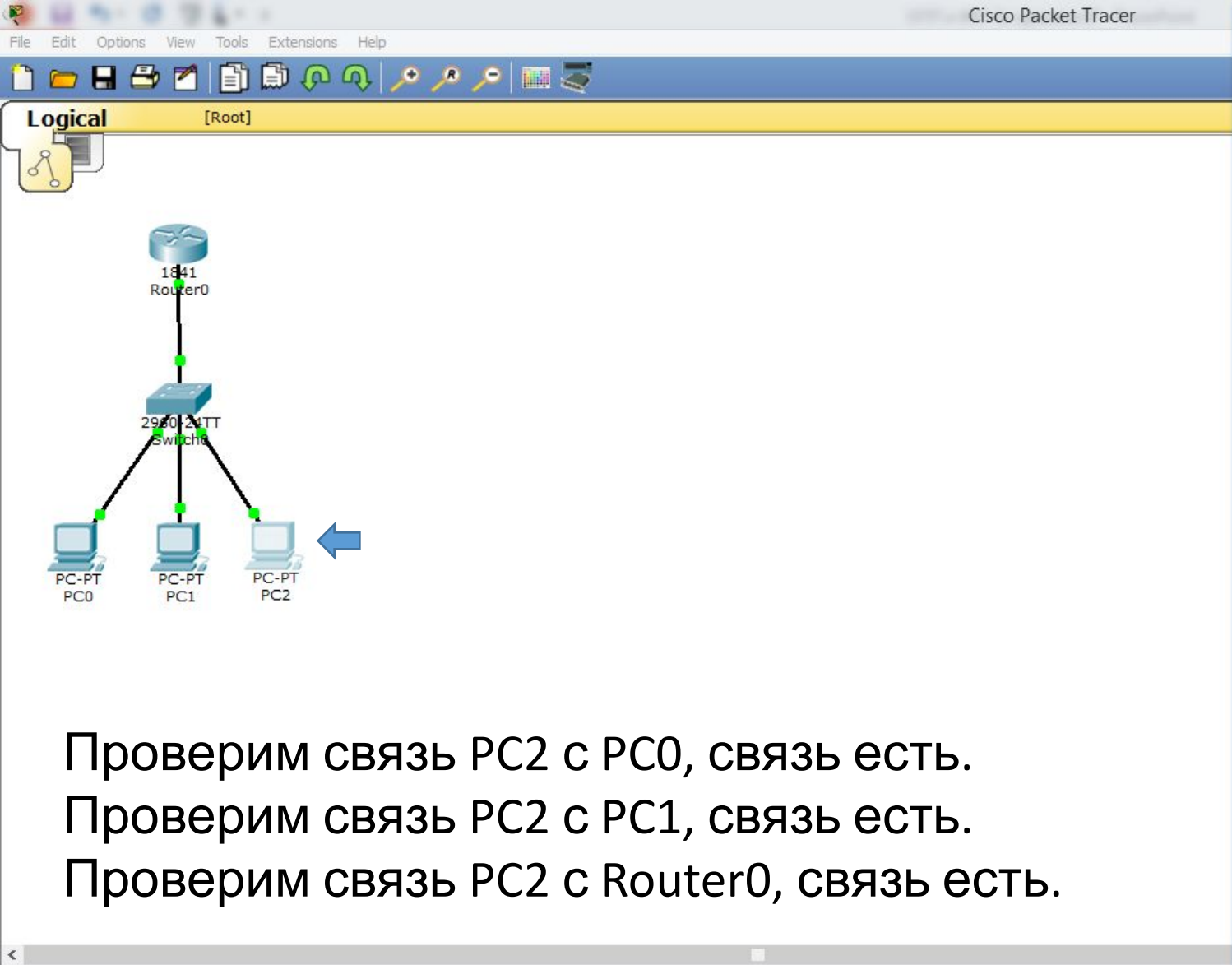
Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows taskbar: 18:43 11.11.2019





Проверим связь PC2 с PC0, связь есть.  
Проверим связь PC2 с PC1, связь есть.  
Проверим связь PC2 с Router0, связь есть.

```
Packet Tracer PC Command Line 1.0
PC>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=1ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128
Reply from 192.168.1.2: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.2:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128
Reply from 192.168.1.3: bytes=32 time=0ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.1.1

Pinging 192.168.1.1 with 32 bytes of data:

Reply from 192.168.1.1: bytes=32 time=13ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255
Reply from 192.168.1.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.1.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 13ms, Average = 3ms

PC>
```

Time: 01:10:45 | Power Cycle Devices | Fast Forward Time

Connections

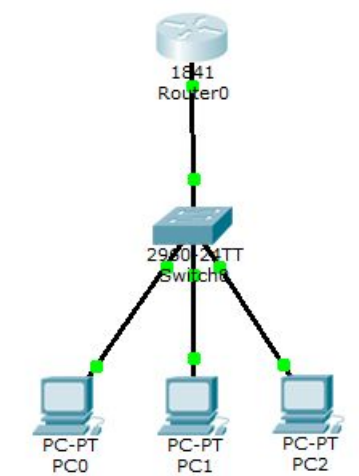
Scenario 0

New | Delete

Toggle PDU List Wind

Automatically Choose Connection Type

Windows taskbar: 18:48 11.11.2019



Router0

Physical Config CLI

IOS Command Line Interface

```
Router>en
Router#show ip dhcp ?
  binding DHCP address bindings
Router#show ip dhcp bin
Router#show ip dhcp binding
IP address      Client-ID/
                Hardware address
192.168.1.2     0060.2FED.5987  --
192.168.1.3     00D0.FFE2.4590  --
192.168.1.4     00E0.8FDD.6163  --
                Automatic
Router#
Router#
Router#
Router#
Router#
Router#
Router#
Router#
```

Copy Paste

В привилегированном режиме команда: «show ip dhcp binding» показывает, какой ip-адрес принадлежит каждому компьютеру.

Connections

Automatically Choose Connection Type

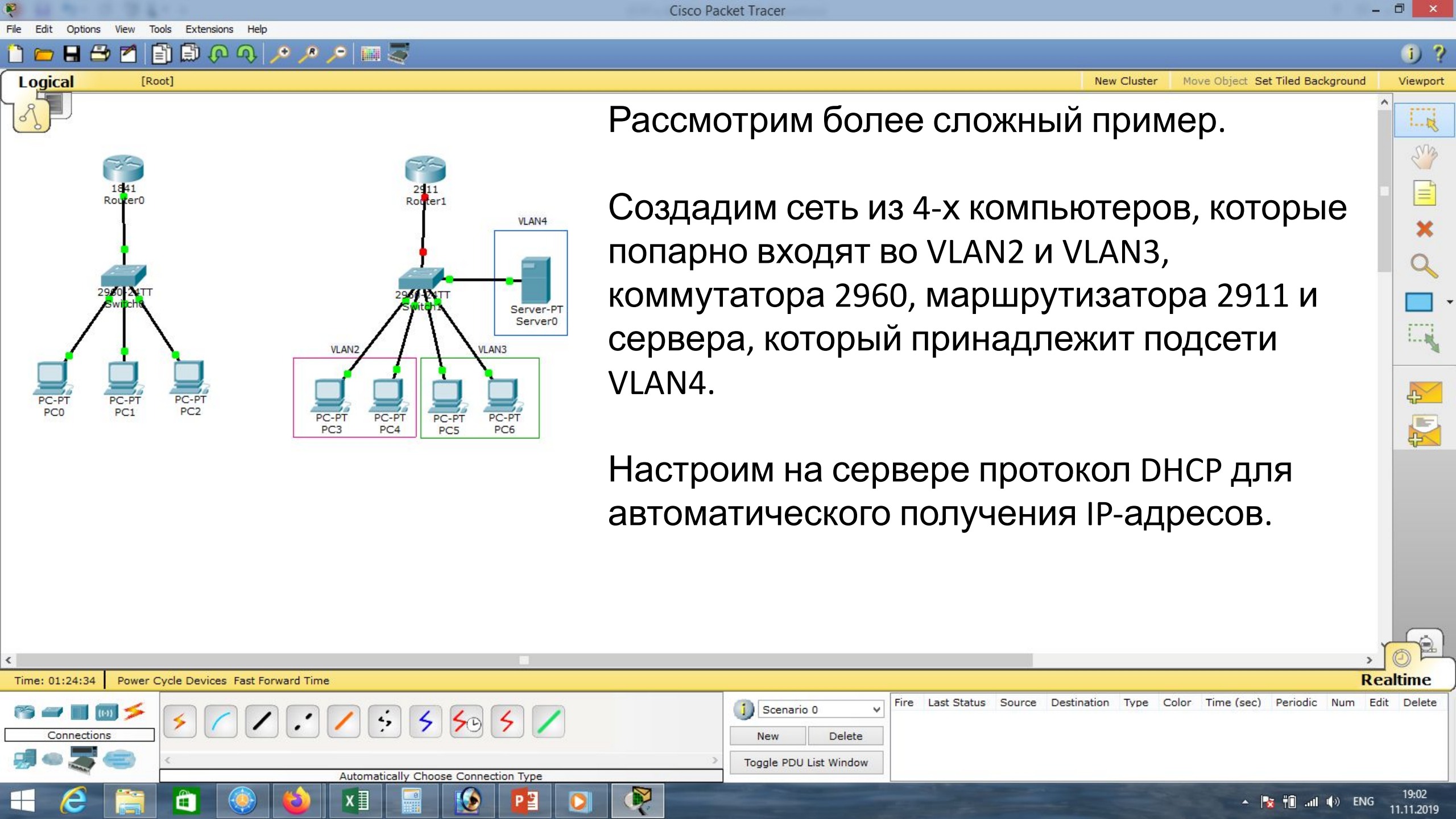
Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

New Delete

Toggle PDU List Window



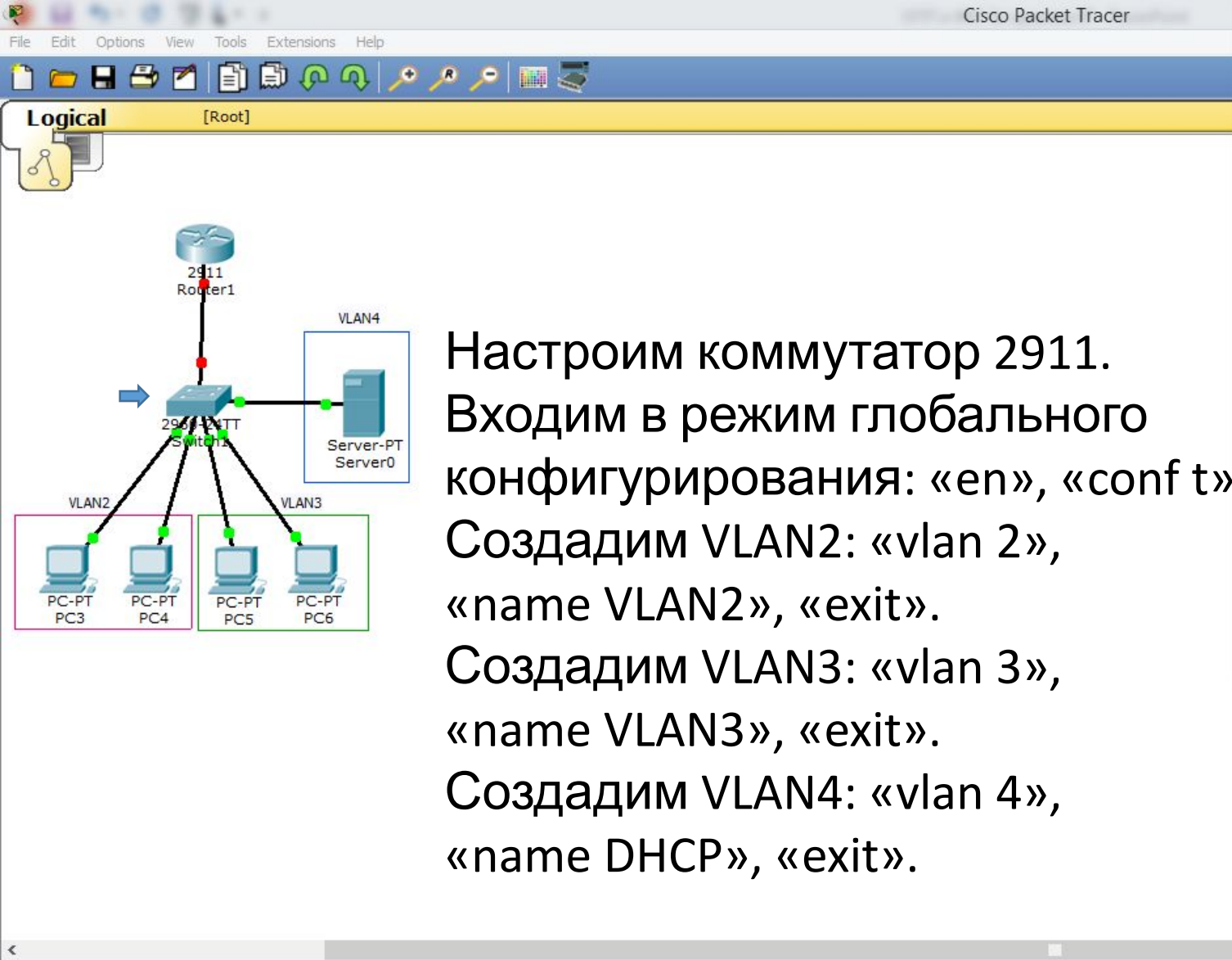


Рассмотрим более сложный пример.

Создадим сеть из 4-х компьютеров, которые попарно входят во VLAN2 и VLAN3, коммутатора 2960, маршрутизатора 2911 и сервера, который принадлежит подсети VLAN4.

Настроим на сервере протокол DHCP для автоматического получения IP-адресов.

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete



Настроим коммутатор 2911.  
Входим в режим глобального  
конфигурирования: «en», «conf t».  
Создадим VLAN2: «vlan 2»,  
«name VLAN2», «exit».  
Создадим VLAN3: «vlan 3»,  
«name VLAN3», «exit».  
Создадим VLAN4: «vlan 4»,  
«name DHCP», «exit».

```
Switch1
Physical Config CLI
IOS Command Line Interface
o up
%LINK-5-CHANGED: Interface FastEthernet0/5, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/5, changed state t
o up
%LINK-5-CHANGED: Interface FastEthernet0/6, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/6, changed state t
o up
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#name VLAN2
Switch(config-vlan)#exit
Switch(config)#vlan 3
Switch(config-vlan)#name VLAN3
Switch(config-vlan)#exit
Switch(config)#vlan 4
Switch(config-vlan)#name DHCP
Switch(config-vlan)#exit
Switch(config)#
```

Time: 01:36:14 | Power Cycle Devices Fast Forward Time

Connections

Automatically Choose Connection Type

Scenario 0

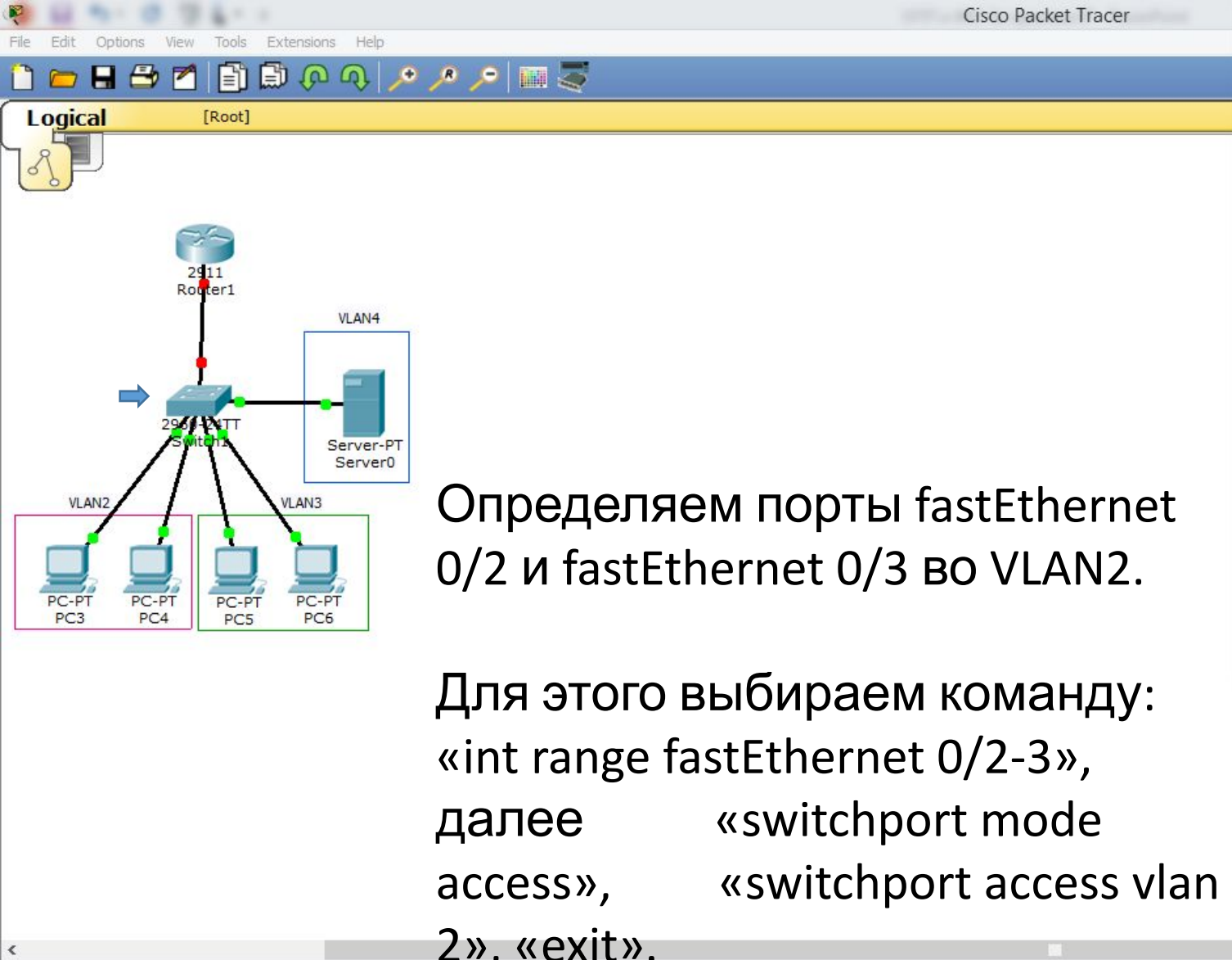
Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

New Delete

Toggle PDU List Window

Realtime

19:13 11.11.2019



Определяем порты fastEthernet 0/2 и fastEthernet 0/3 во VLAN2.

Для этого выбираем команду:  
«int range fastEthernet 0/2-3»,  
далее «switchport mode  
access», «switchport access vlan  
2», «exit».

```
Switch1
Physical Config CLI
IOS Command Line Interface

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/6, changed state to up

Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#name VLAN2
Switch(config-vlan)#exit
Switch(config)#vlan 3
Switch(config-vlan)#name VLAN3
Switch(config-vlan)#exit
Switch(config)#vlan 4
Switch(config-vlan)#name DHCP
Switch(config-vlan)#exit
Switch(config)#int ra
Switch(config)#int range fa
Switch(config)#int range fastEthernet 0/2-3
Switch(config-if-range)#sw
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#sw
Switch(config-if-range)#switchport access vlan 2
Switch(config-if-range)#exit
Switch(config)#
```

Time: 01:46:15 | Power Cycle Devices Fast Forward Time | Realtime

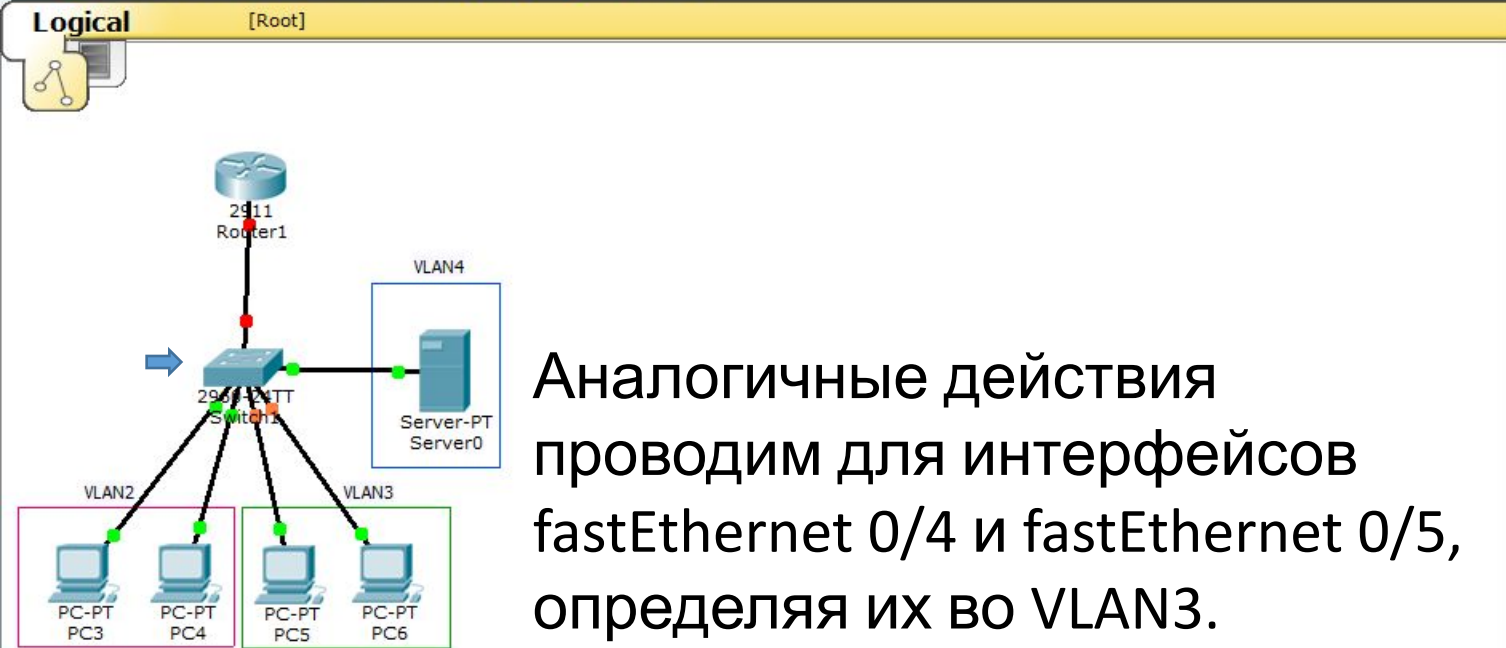
Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows taskbar: 19:24 11.11.2019





Аналогичные действия проводим для интерфейсов fastEthernet 0/4 и fastEthernet 0/5, определяя их во VLAN3.

Для этого выбираем команду: «int range fastEthernet 0/4-5», далее «switchport mode access», «switchport access vlan 3», «exit».

```
Switch1
Physical Config CLI
IOS Command Line Interface

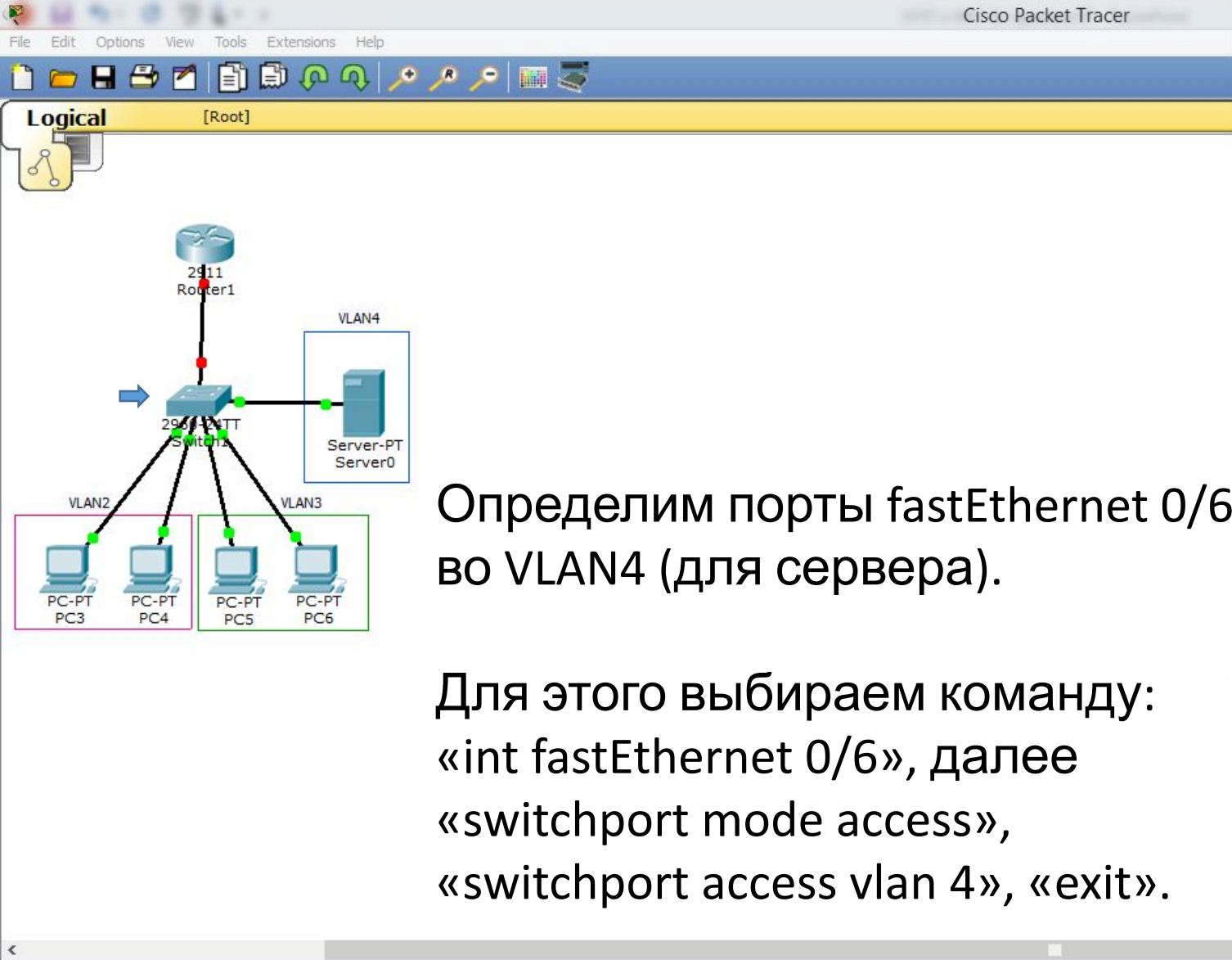
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#name VLAN2
Switch(config-vlan)#exit
Switch(config)#vlan 3
Switch(config-vlan)#name VLAN3
Switch(config-vlan)#exit
Switch(config)#vlan 4
Switch(config-vlan)#name DHCP
Switch(config-vlan)#exit
Switch(config)#int ra
Switch(config)#int range fa
Switch(config)#int range fastEthernet 0/2-3
Switch(config-if-range)#sw
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#sw
Switch(config-if-range)#switchport access vlan 2
Switch(config-if-range)#exit
Switch(config)#int range fastEthernet 0/4-5
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 3
Switch(config-if-range)#exit
Switch(config)#
```

Connections

Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Toggle PDU List Window



Определим порты fastEthernet 0/6 во VLAN4 (для сервера).

Для этого выбираем команду:  
«int fastEthernet 0/6», далее  
«switchport mode access»,  
«switchport access vlan 4», «exit».

```
Switch1
Physical Config CLI
IOS Command Line Interface
Switch(config)#vlan 2
Switch(config-vlan)#name VLAN2
Switch(config-vlan)#exit
Switch(config)#vlan 3
Switch(config-vlan)#name VLAN3
Switch(config-vlan)#exit
Switch(config)#vlan 4
Switch(config-vlan)#name DHCP
Switch(config-vlan)#exit
Switch(config)#int ra
Switch(config)#int range fa
Switch(config)#int range fastEthernet 0/2-3
Switch(config-if-range)#sw
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#sw
Switch(config-if-range)#switchport access vlan 2
Switch(config-if-range)#exit
Switch(config)#int range fastEthernet 0/4-5
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 3
Switch(config-if-range)#exit
Switch(config)#int fa 0/6
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 4
Switch(config-if)#exit
Switch(config)#
```

Time: 01:58:41 | Power Cycle Devices Fast Forward Time

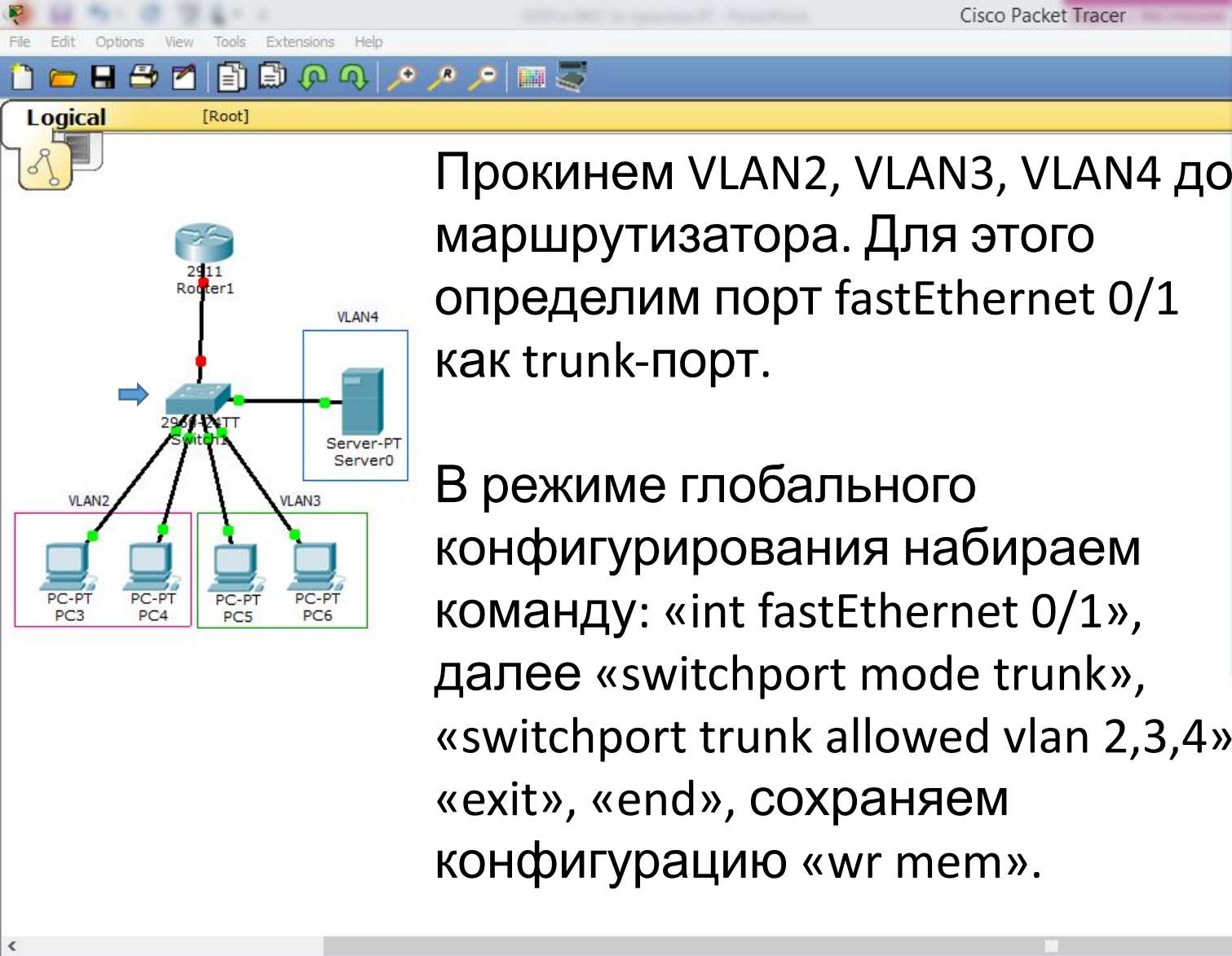
Connections

Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows Taskbar: 19:36 11.11.2019



Прокинем VLAN2, VLAN3, VLAN4 до маршрутизатора. Для этого определим порт fastEthernet 0/1 как trunk-порт.

В режиме глобального конфигурирования набираем команду: «int fastEthernet 0/1», далее «switchport mode trunk», «switchport trunk allowed vlan 2,3,4», «exit», «end», сохраняем конфигурацию «wr mem».

```
Switch1
Physical Config CLI
IOS Command Line Interface

Switch>
Switch>en
Switch#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Switch(config)#int fa0/1
Switch(config-if)#sw
Switch(config-if)#switchport mode trunk
Switch(config-if)#sw
Switch(config-if)#switchport trunk allowed vlan 2,3,4
Switch(config-if)#exit
Switch(config)#end
Switch#
%SYS-5-CONFIG_I: Configured from console by console

Switch#wr mem
Building configuration...
[OK]
Switch#
```

Time: 02:19:41 | Power Cycle Devices Fast Forward Time | Realtime

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Scenario 0

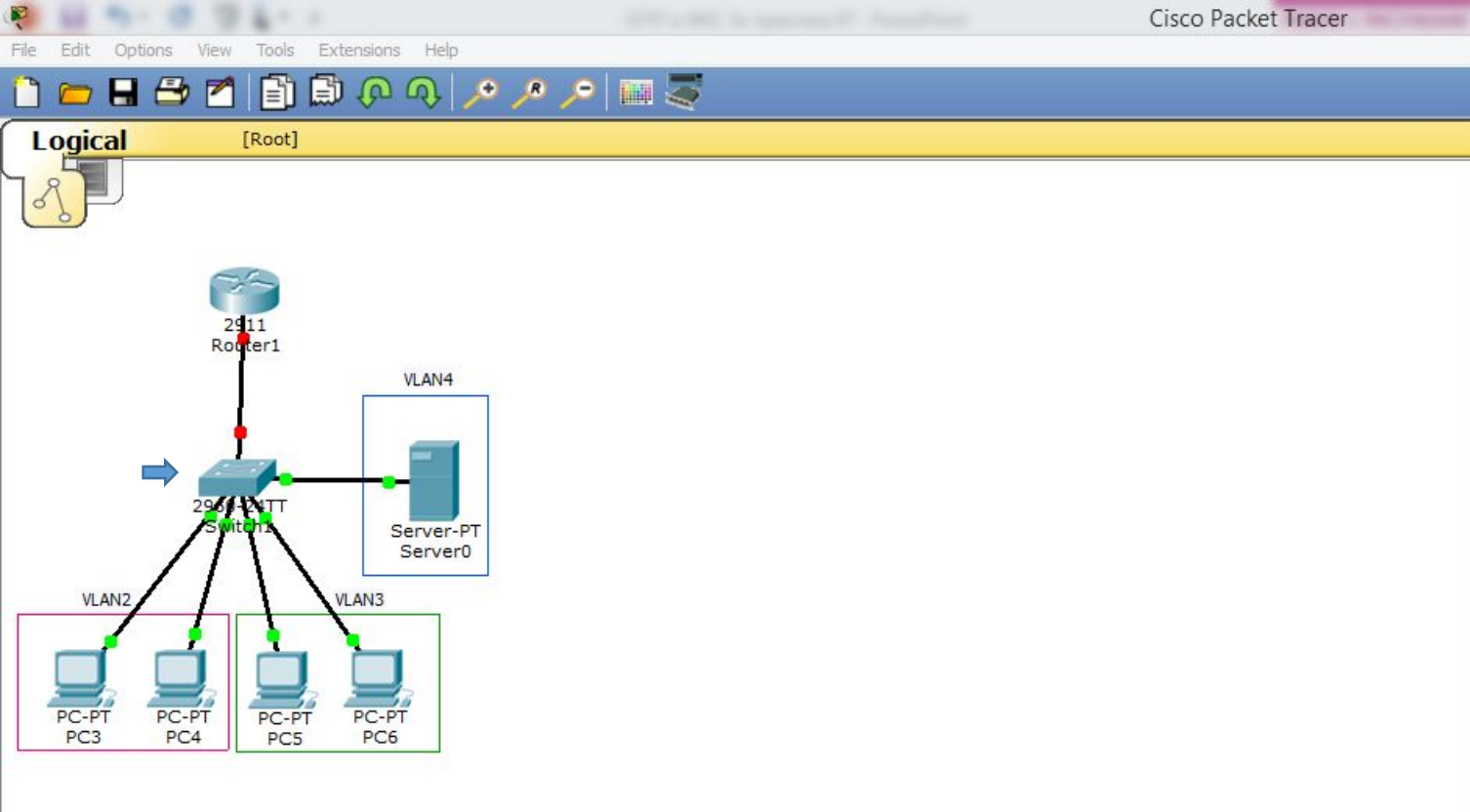
New Delete

Toggle PDU List Window

Automatically Choose Connection Type

Windows taskbar: 19:57 11.11.2019





```
Switch1
Physical Config CLI
IOS Command Line Interface
!
interface FastEthernet0/1
switchport trunk allowed vlan 2-4
switchport mode trunk
!
interface FastEthernet0/2
switchport access vlan 2
switchport mode access
!
interface FastEthernet0/3
switchport access vlan 2
switchport mode access
!
interface FastEthernet0/4
switchport access vlan 3
switchport mode access
!
interface FastEthernet0/5
switchport access vlan 3
switchport mode access
!
interface FastEthernet0/6
switchport access vlan 4
switchport mode access
!
interface FastEthernet0/7
```

Проверим конфигурацию командой «show run», жмём <Пробел>, видим наши интерфейсы.

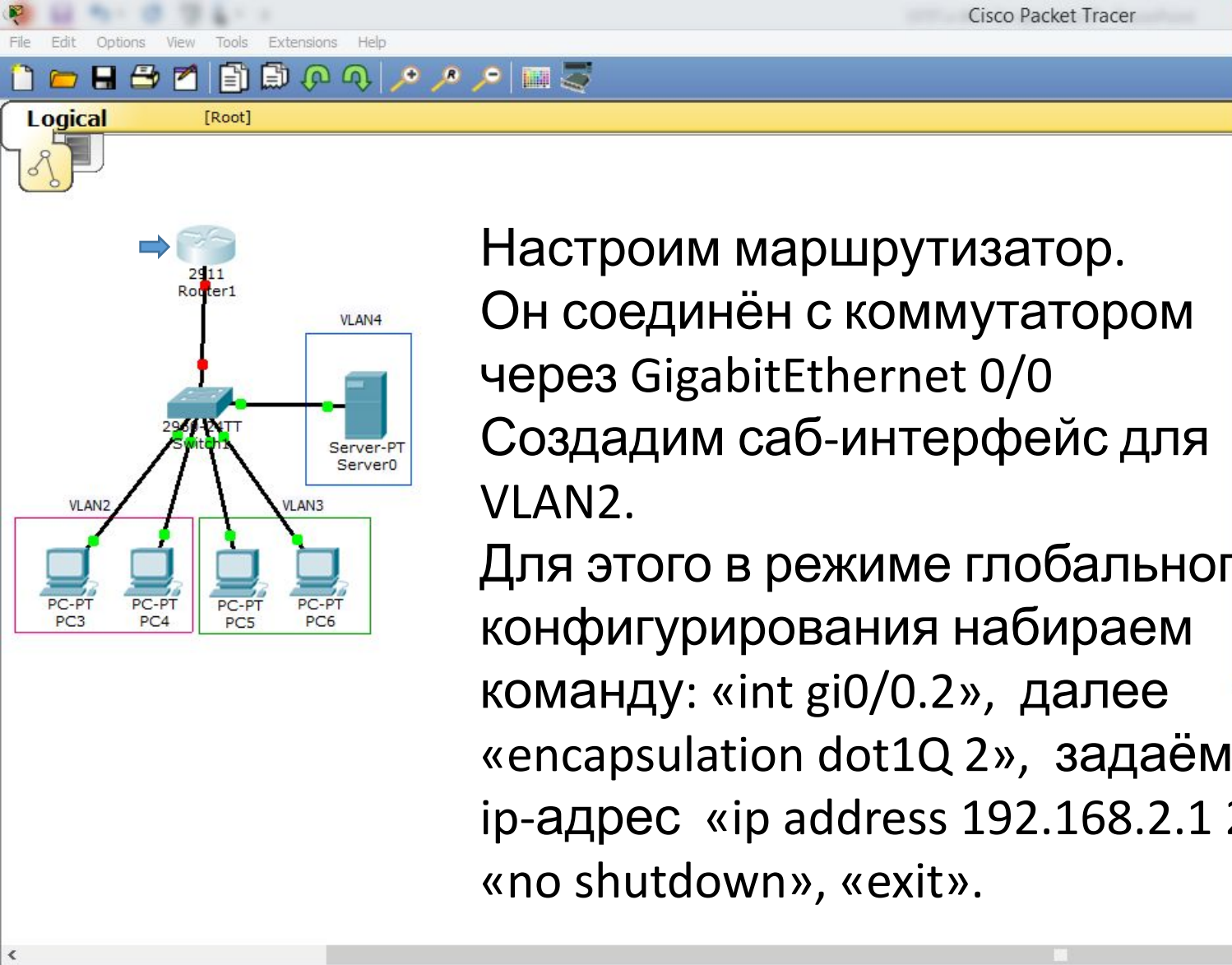
Time: 02:30:01 | Power Cycle Devices Fast Forward Time | Realtime

Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows taskbar: 20:07 11.11.2019



Настроим маршрутизатор.  
Он соединён с коммутатором  
через GigabitEthernet 0/0  
Создадим суб-интерфейс для  
VLAN2.  
Для этого в режиме глобального  
конфигурирования набираем  
команду: «int gi0/0.2», далее  
«encapsulation dot1Q 2», задаём  
ip-адрес «ip address 192.168.2.1 255.255.255.0»,  
«no shutdown», «exit».

```
Router1
Physical Config CLI
IOS Command Line Interface
DRAM configuration is 64 bits wide with parity disabled.
255K bytes of non-volatile configuration memory.
249856K bytes of ATA System CompactFlash 0 (Read/Write)

--- System Configuration Dialog ---
Continue with configuration dialog? [yes/no]: n

Press RETURN to get started!

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gi0/0.2
Router(config-subif)#enc
Router(config-subif)#encapsulation do
Router(config-subif)#encapsulation dot1Q 2
Router(config-subif)#ip address 192.168.2.1 255.255.255.0
Router(config-subif)#no shut
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#
```

Time: 02:56:07 | Power Cycle Devices Fast Forward Time

Connections

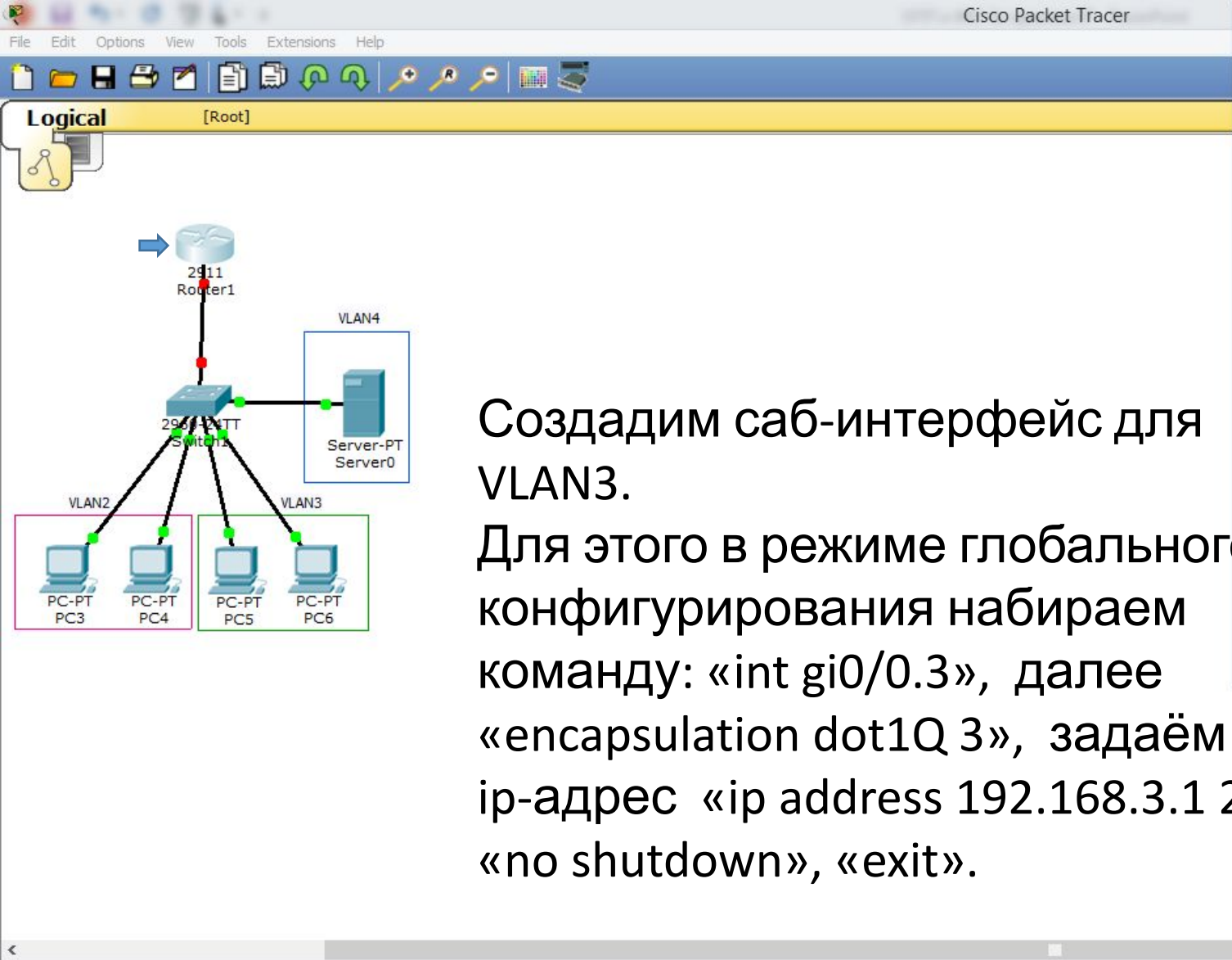
Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Realtime

20:34 11.11.2019



Создадим саб-интерфейс для VLAN3.  
Для этого в режиме глобального конфигурирования набираем команду: «int gi0/0.3», далее «encapsulation dot1Q 3», задаём ip-адрес «ip address 192.168.3.1 255.255.255.0», «no shutdown», «exit».

```
Router1
Physical Config CLI
IOS Command Line Interface
--- System Configuration Dialog ---
Continue with configuration dialog? [yes/no]: n
Press RETURN to get started!
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gi0/0.2
Router(config-subif)#encapsulation do
Router(config-subif)#encapsulation dot1Q 2
Router(config-subif)#ip address 192.168.2.1 255.255.255.0
Router(config-subif)#no shut
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#int gi0/0.3
Router(config-subif)#encapsulation dot1Q 3
Router(config-subif)#ip address 192.168.3.1 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#
```

Time: 03:06:54 | Power Cycle Devices | Fast Forward Time | Realtime

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Scenario 0

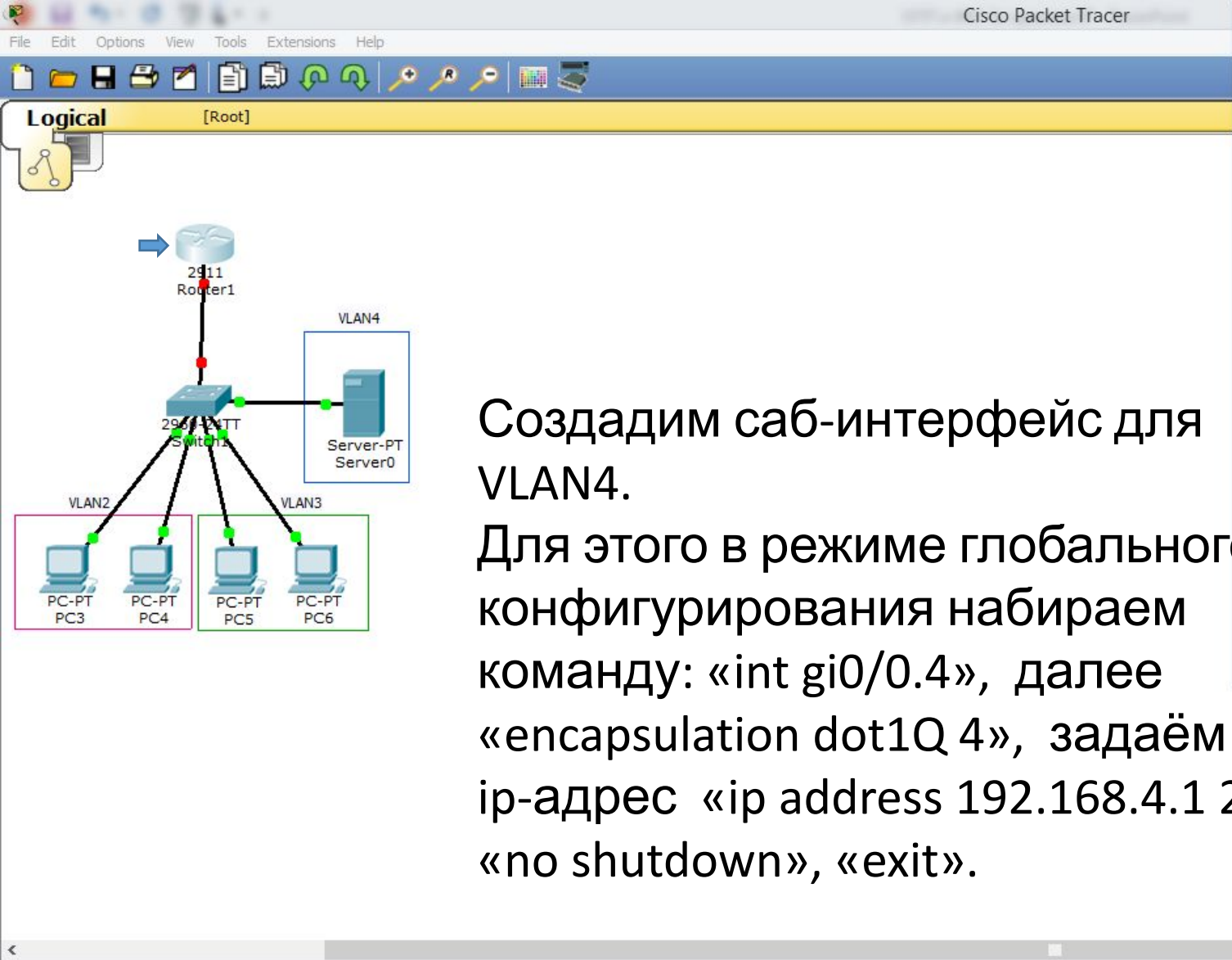
New Delete

Toggle PDU List Window

Automatically Choose Connection Type

Windows taskbar: 20:44 11.11.2019





Создадим саб-интерфейс для VLAN4.  
Для этого в режиме глобального конфигурирования набираем команду: «int gi0/0.4», далее «encapsulation dot1Q 4», задаём ip-адрес «ip address 192.168.4.1 255.255.255.0», «no shutdown», «exit».

```
Router1
Physical Config CLI
IOS Command Line Interface
Press RETURN to get started!

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gi0/0.2
Router(config-subif)#encapsulation do
Router(config-subif)#encapsulation dot1Q 2
Router(config-subif)#ip address 192.168.2.1 255.255.255.0
Router(config-subif)#no shut
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#int gi0/0.3
Router(config-subif)#encapsulation dot1Q 3
Router(config-subif)#ip address 192.168.3.1 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#int gi0/0.4
Router(config-subif)#encapsulation dot1Q 4
Router(config-subif)#ip address 192.168.4.1 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#
```

Time: 03:10:11 | Power Cycle Devices Fast Forward Time

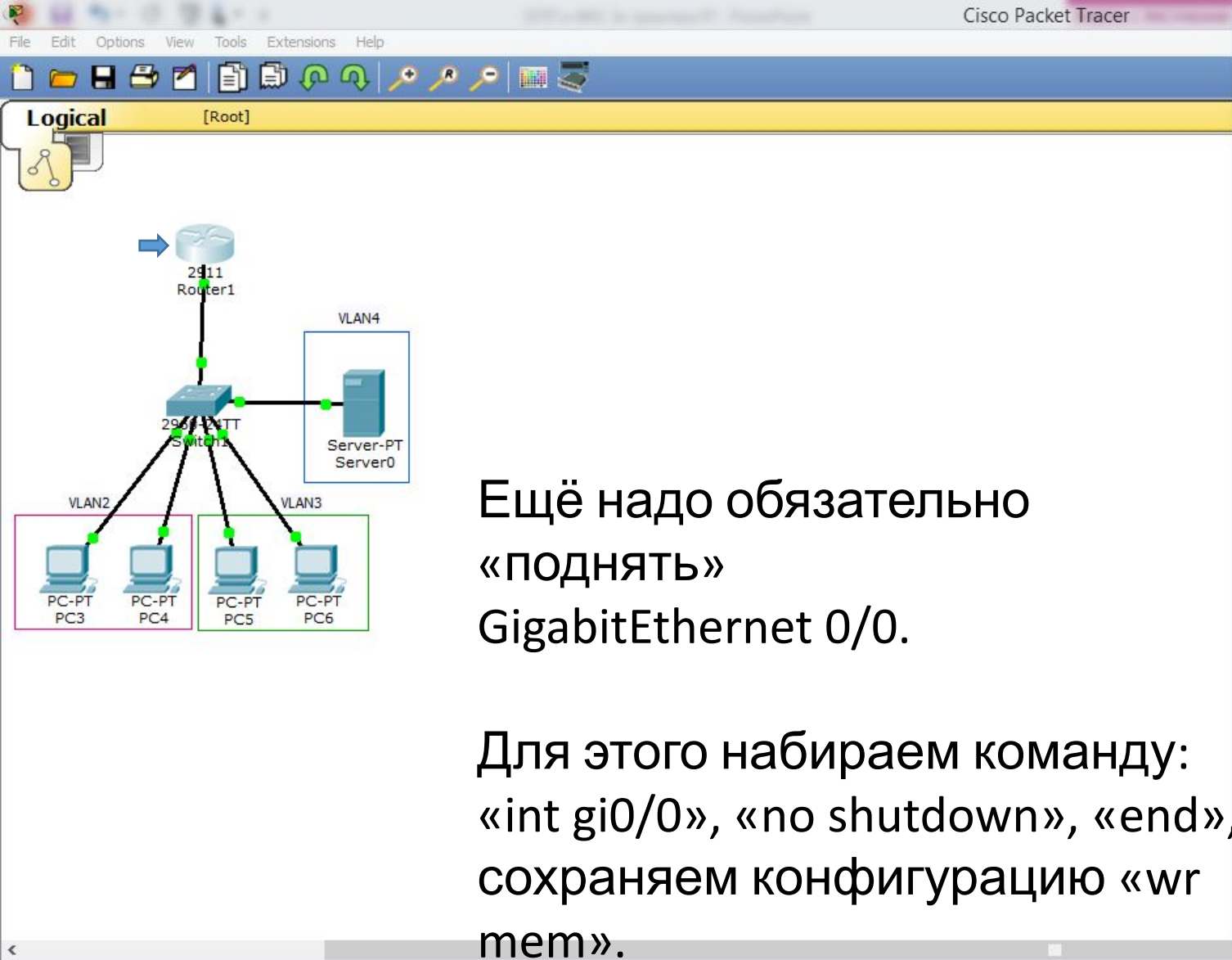
Connections

Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows taskbar: 20:48 11.11.2019



Ещё надо обязательно  
«поднять»  
GigabitEthernet 0/0.

Для этого набираем команду:  
«int gi0/0», «no shutdown», «end»,  
сохраняем конфигурацию «wr mem».

```

Router1
Physical Config CLI
IOS Command Line Interface
Router(config-subif)#ip address 192.168.3.1 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#int gi0/0.4
Router(config-subif)#encapsulation dot1Q 4
Router(config-subif)#ip address 192.168.4.1 255.255.255.0
Router(config-subif)#no shutdown
Router(config-subif)#exit
Router(config)#int gi0/0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up

%LINK-5-CHANGED: Interface GigabitEthernet0/0.2, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.2, changed state to up

%LINK-5-CHANGED: Interface GigabitEthernet0/0.3, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.3, changed state to up

%LINK-5-CHANGED: Interface GigabitEthernet0/0.4, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0.4, changed state to up

Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr mem
Building configuration...
[OK]
Router#

```

Time: 03:12:52 | Power Cycle Devices Fast Forward Time

Connections

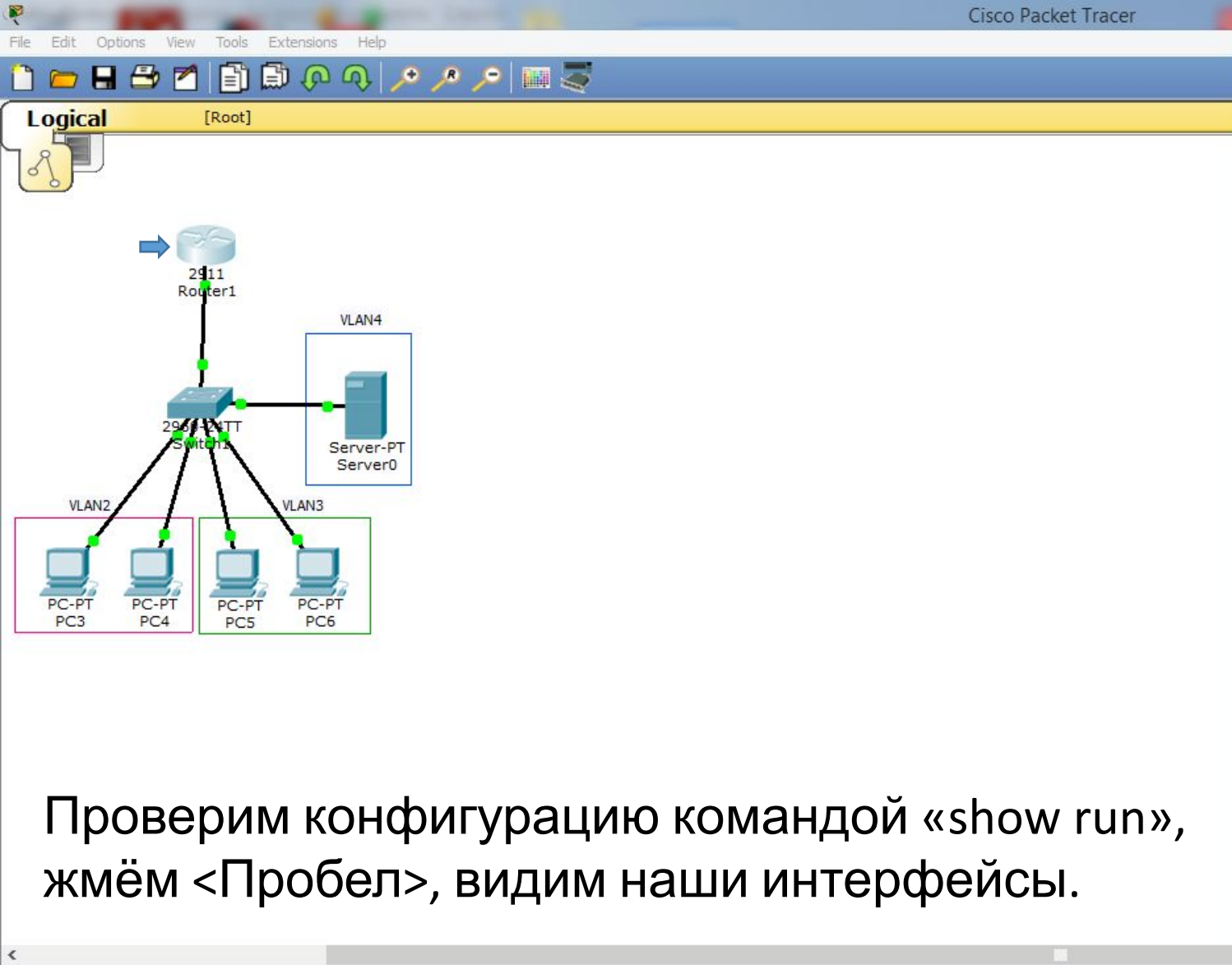
Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete

Automatically Choose Connection Type

Windows taskbar: 20:50 11.11.2019





Router1

Physical Config CLI

IOS Command Line Interface

```

!
!
spanning-tree mode pvst
!
!
!
!
interface GigabitEthernet0/0
no ip address
duplex auto
speed auto
!
interface GigabitEthernet0/0.2
encapsulation dot1Q 2
ip address 192.168.2.1 255.255.255.0
!
interface GigabitEthernet0/0.3
encapsulation dot1Q 3
ip address 192.168.3.1 255.255.255.0
!
interface GigabitEthernet0/0.4
encapsulation dot1Q 4
ip address 192.168.4.1 255.255.255.0
!
interface GigabitEthernet0/1
no ip address
duplex auto
speed auto
shutdown
!
interface GigabitEthernet0/2
no ip address
duplex auto
speed auto
shutdown
!
interface Vlan1
no ip address
shutdown
!
    
```

Copy Paste

Проверим конфигурацию командой «show run», жмём <Пробел>, видим наши интерфейсы.

Time: 03:20:41 | Power Cycle Devices Fast Forward Time

Connections

Scenario 0

New Delete

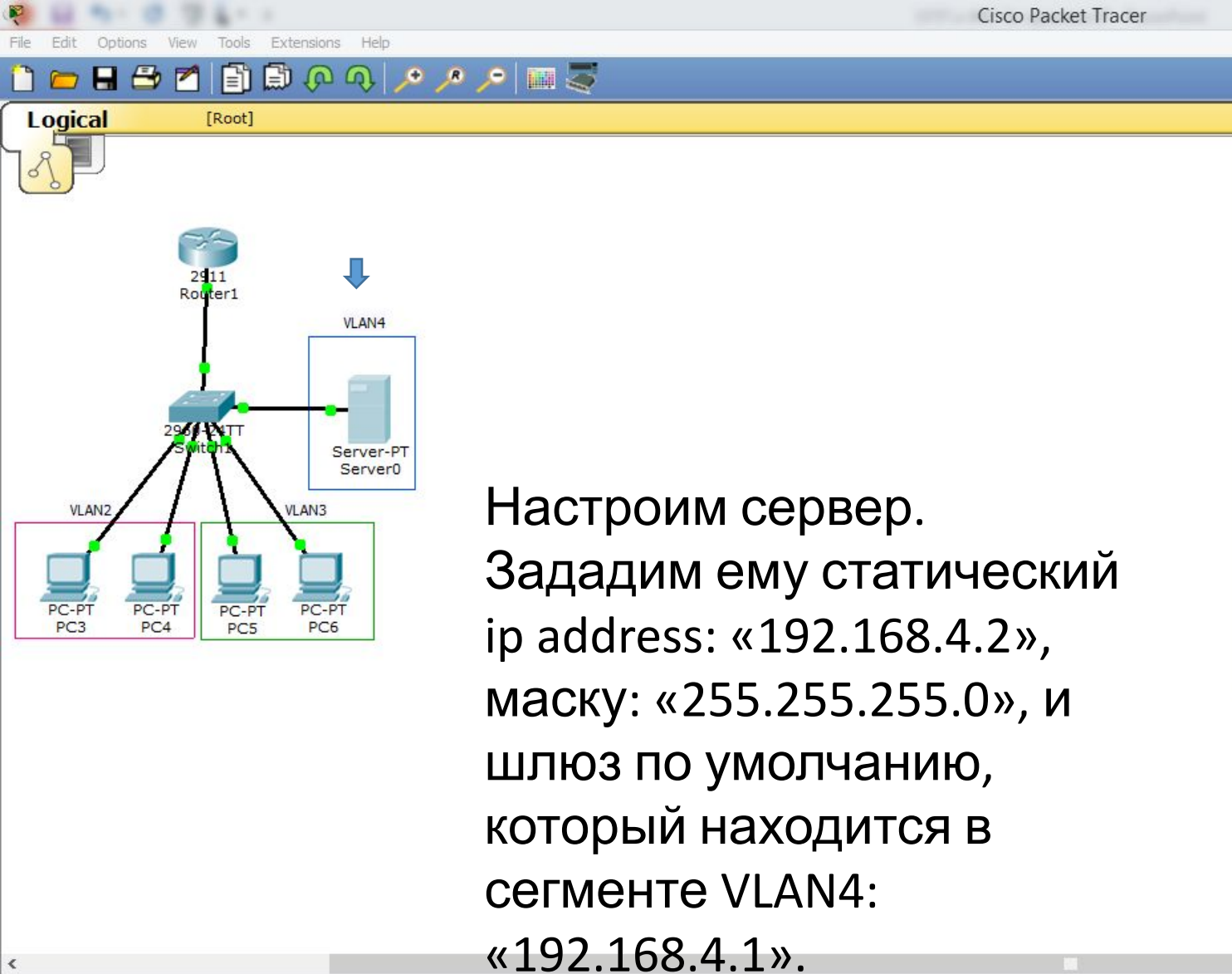
Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete

Automatically Choose Connection Type

ENG 20:58 11.11.2019





Настроим сервер.  
Зададим ему статический  
ip address: «192.168.4.2»,  
маску: «255.255.255.0», и  
шлюз по умолчанию,  
который находится в  
сегменте VLAN4:  
«192.168.4.1».

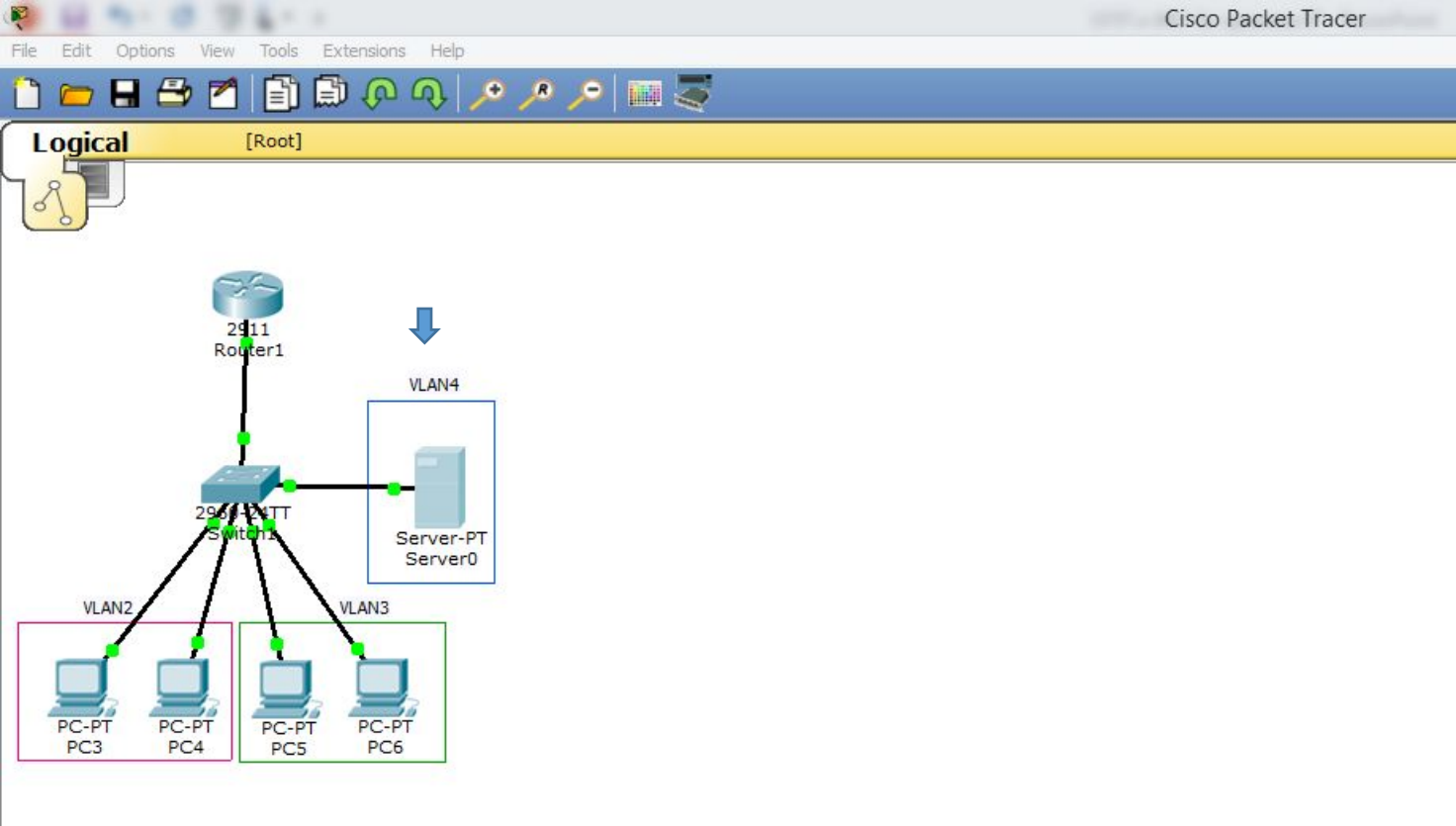
The screenshot shows the 'IP Configuration' window for 'Server0' in Cisco Packet Tracer. The window is titled 'Server0' and has tabs for 'Physical', 'Config', 'Desktop', and 'Custom Interface'. The 'Config' tab is active, showing the configuration for the 'FastEthernet0' interface. The 'IP Configuration' section is expanded, showing the following settings:

- Interface: FastEthernet0
- IP Configuration:  DHCP  Static
- IP Address: 192.168.4.2
- Subnet Mask: 255.255.255.0
- Default Gateway: 192.168.4.1
- DNS Server: (empty)

The 'IPv6 Configuration' section is also visible, showing the following settings:

- IPv6 Configuration:  DHCP  Auto Config  Static
- IPv6 Address: (empty)
- Link Local Address: FE80::202:4AFF:FEB4:7A4B
- IPv6 Gateway: (empty)
- IPv6 DNS Server: (empty)

The screenshot shows the bottom part of the Cisco Packet Tracer interface. The 'Realtime' tab is active, displaying a table with the following columns: Fire, Last Status, Source, Destination, Type, Color, Time (sec), Periodic, Num, Edit, and Delete. The table is currently empty. Below the table, there are buttons for 'New', 'Delete', and 'Toggle PDU List Window'. The bottom status bar shows the time as 03:24:08, the scenario as 'Scenario 0', and the date as 11.11.2019.



```
Packet Tracer SERVER Command Line 1.0
SERVER>ping 192.168.4.1

Pinging 192.168.4.1 with 32 bytes of data:

Reply from 192.168.4.1: bytes=32 time=1ms TTL=255
Reply from 192.168.4.1: bytes=32 time=0ms TTL=255
Reply from 192.168.4.1: bytes=32 time=0ms TTL=255
Reply from 192.168.4.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.4.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

SERVER>
```

Проверим связь сервера с маршрутизатором, связь есть.

Time: 03:30:44 | Power Cycle Devices | Fast Forward Time | Realtime

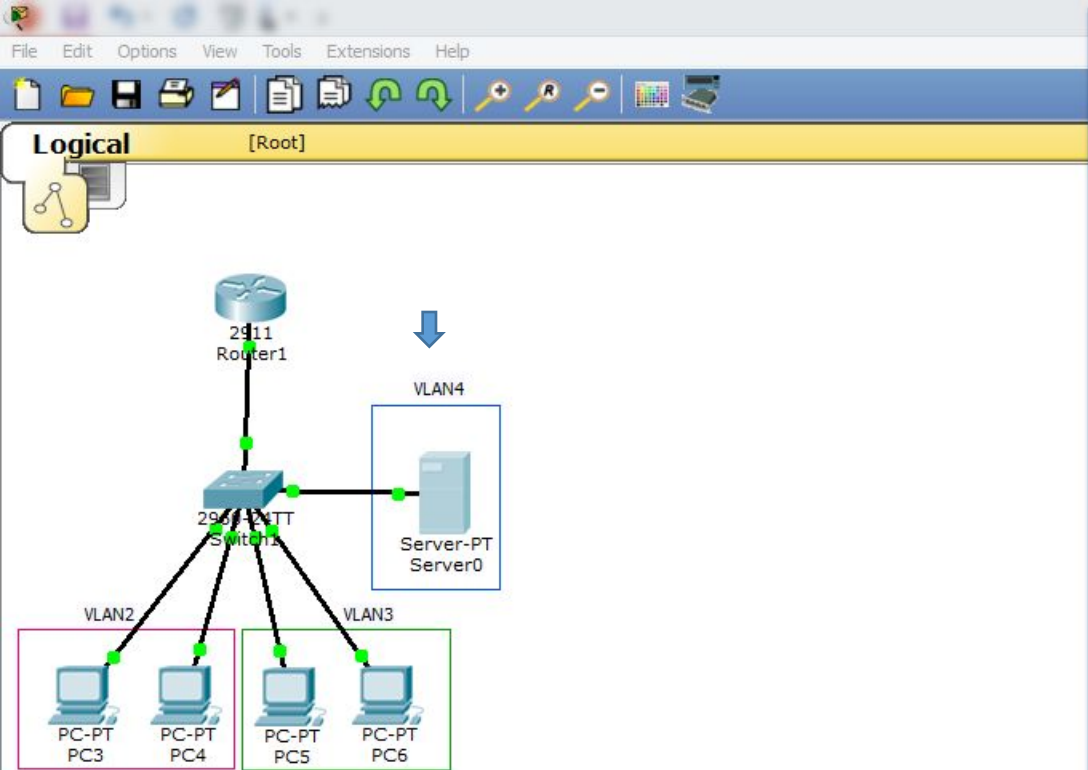
Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Scenario 0

New Delete

Toggle PDU List Window

Windows taskbar: ENG 21:08 11.11.2019



Server0

Physical Config Desktop Custom Interface

GLOBAL

Settings

Algorithm Settings

SERVICES

HTTP

DHCP

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

FIREWALL

IPv6 FIREWALL

INTERFACE

FastEthernet0

DHCP

Service  On  Off

Pool Name: serverPool

Default Gateway: 0.0.0.0

DNS Server: 0.0.0.0

Start IP Address: 192 168 4 0

Subnet Mask: 255 255 255 0

Maximum number of Users: 512

TFTP Server: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max Number	TFTP Server
serverPool	0.0.0.0	0.0.0.0	192.168.4.0	255.255.255.0	512	0.0.0.0

Переходим на вкладку Config / DHCP, видим один ServerPool по умолчанию. Мы его оставляем и создаём новый.

Time: 03:34:10 | Power Cycle Devices Fast Forward Time

Realtime

Scenario 0

New Delete

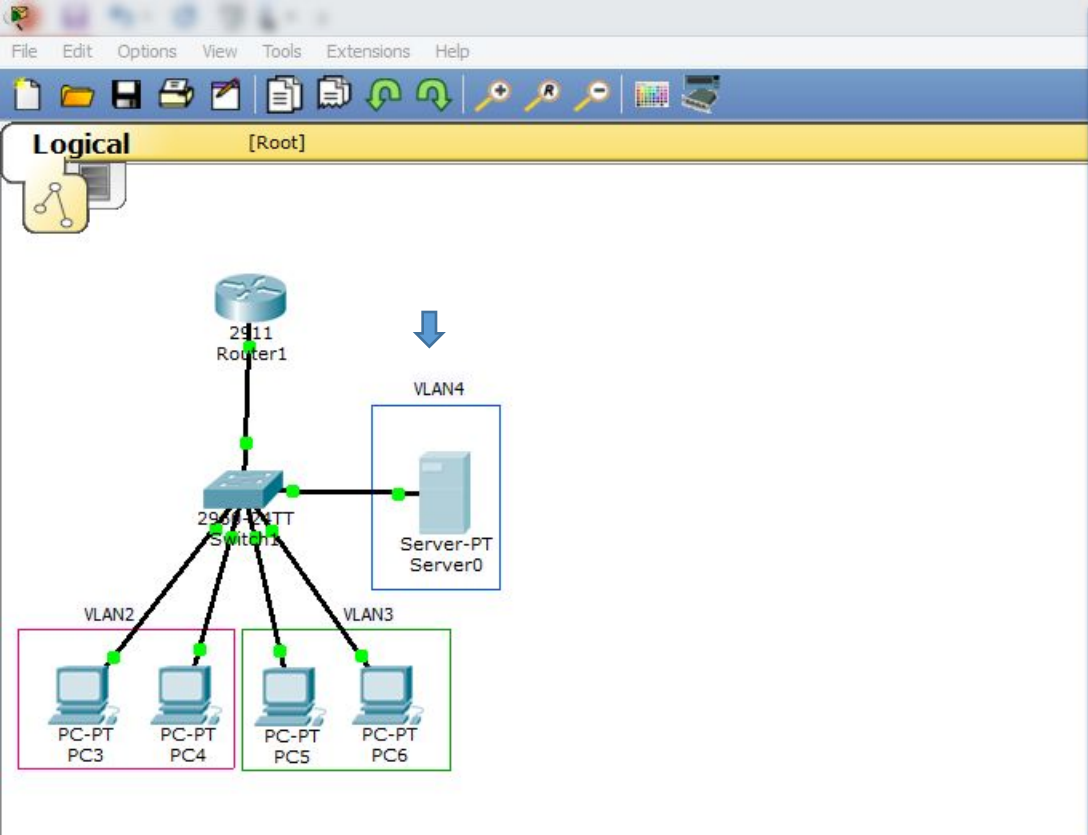
Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows taskbar: 21:12 11.11.2019





Server0

Physical Config Desktop Custom Interface

GLOBAL

Settings

Algorithm Settings

SERVICES

HTTP

DHCP

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

FIREWALL

IPv6 FIREWALL

INTERFACE

FastEthernet0

DHCP

Service  On  Off

Pool Name: DHCP-VLAN2

Default Gateway: 192.168.2.1

DNS Server: 8.8.8.8

Start IP Address: 192 168 2 0

Subnet Mask: 255 255 255 0

Maximum number of Users: 512

TFTP Server: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max Number	TFTP Sever
serverPool	0.0.0.0	0.0.0.0	192.168.4.0	255.255.255.0	512	0.0.0.0

Для VLAN2 заполняем Pool Name: DHCP-VLAN2, шлюз по умолчанию: 192.168.2.1, DNS Server: 8.8.8.8, Start IP Address: 192.168.2.0, маску оставляем по умолчанию, выбираем <On> и жмём <Add>.

Time: 03:42:10 | Power Cycle Devices Fast Forward Time

Connections

Scenario 0

New Delete

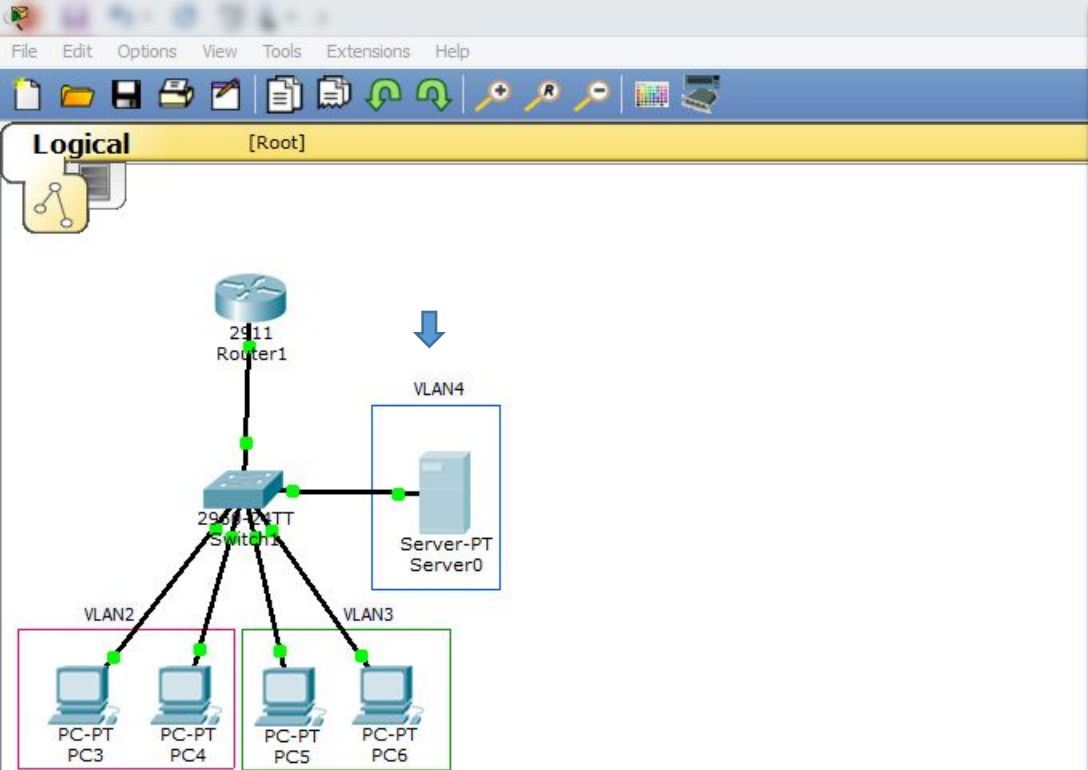
Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Realtime

Windows taskbar: 21:20 11.11.2019



Server0

Physical Config Desktop Custom Interface

GLOBAL

Settings

Algorithm Settings

SERVICES

HTTP

DHCP

TFTP

DNS

SYSLOG

AAA

NTP

EMAIL

FTP

FIREWALL

IPv6 FIREWALL

INTERFACE

FastEthernet0

DHCP

Service  On  Off

Pool Name: serverPool

Default Gateway: 0.0.0.0

DNS Server: 0.0.0.0

Start IP Address: 192 168 4 0

Subnet Mask: 255 255 255 0

Maximum number of Users: 512

TFTP Server: 0.0.0.0

Add Save Remove

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max Number	TFTP Server
serverPool	0.0.0.0	0.0.0.0	192.168.4.0	255.255.255.0	512	0.0.0.0
DHCP-VLAN2	192.168.2.1	8.8.8.8	192.168.2.0	255.255.255.0	256	0.0.0.0
DHCP-VLAN3	192.168.3.1	8.8.8.8	192.168.3.0	255.255.255.0	256	0.0.0.0

Для VLAN3 заполняем Pool Name: DHCP-VLAN3, шлюз по умолчанию: 192.168.3.1, DNS Server: 8.8.8.8, Start IP Address: 192.168.3.0, маску оставляем по умолчанию, выбираем <On> и жмём <Add>. Видим два новых сервис-пула.

Time: 03:52:52 | Power Cycle Devices Fast Forward Time

Realtime

Scenario 0

New Delete

Toggle PDU List Window

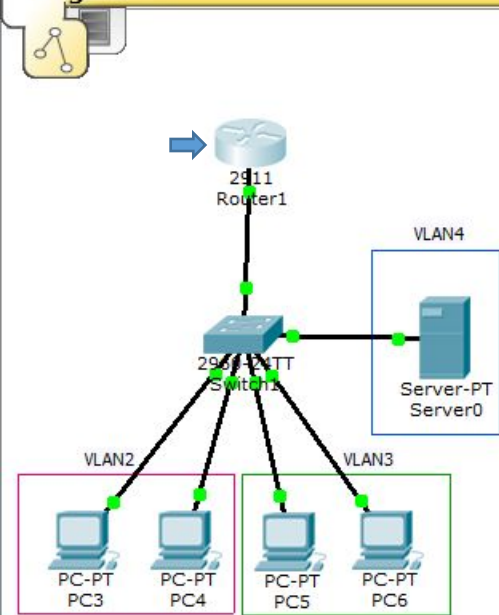
Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

Automatically Choose Connection Type

Windows taskbar: 21:31 11.11.2019



Logical [Root]



Вернёмся к настройке маршрутизатора.

Нужно перенаправить DNS-запросы из VLAN2 и VLAN3 с маршрутизатора на сервер.

Для этого в режиме глобального

конфигурирования набираем команду: «int gi0/0.2», «ip helper-address 192.168.4.2», «exit», далее «int gi0/0.3», «ip helper-address 192.168.4.2», «end», «wr mem».

Router1

Physical Config CLI

IOS Command Line Interface

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int gi0/0.2
Router(config-subif)#ip help
Router(config-subif)#ip helper-address 192.168.4.2
Router(config-subif)#exit
Router(config)#int gi0/0.3
Router(config-subif)#ip helper-address 192.168.4.2
Router(config-subif)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#wr mem
Building configuration...
[OK]
Router#
```

Copy Paste

Time: 04:00:50 Power Cycle Devices Fast Forward Time

Realtime



Automatically Choose Connection Type

Scenario 0

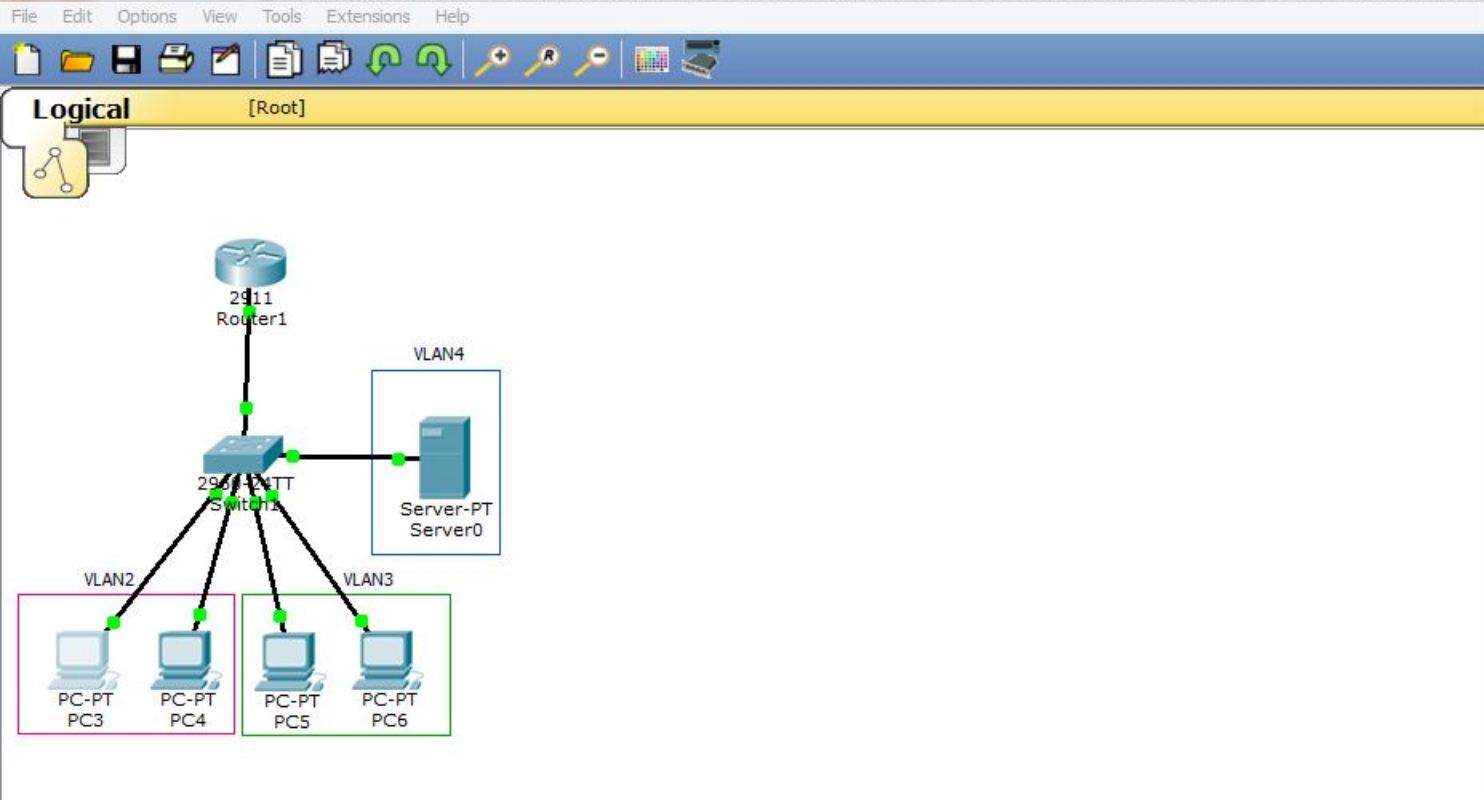
New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------







### IP Configuration

IP Configuration

DHCP     Static    DHCP request successful.

IP Address: 192.168.2.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.2.1

DNS Server: 8.8.8.8

IPv6 Configuration

DHCP     Auto Config     Static

IPv6 Address: /

Link Local Address: FE80::2D0:BAFF:FE00:B546

IPv6 Gateway:

IPv6 DNS Server:

Web Browser

Cisco IP Communicator

Пробуем получить DNS-адрес, для компьютера PC3. Видим, что ip-адрес есть.

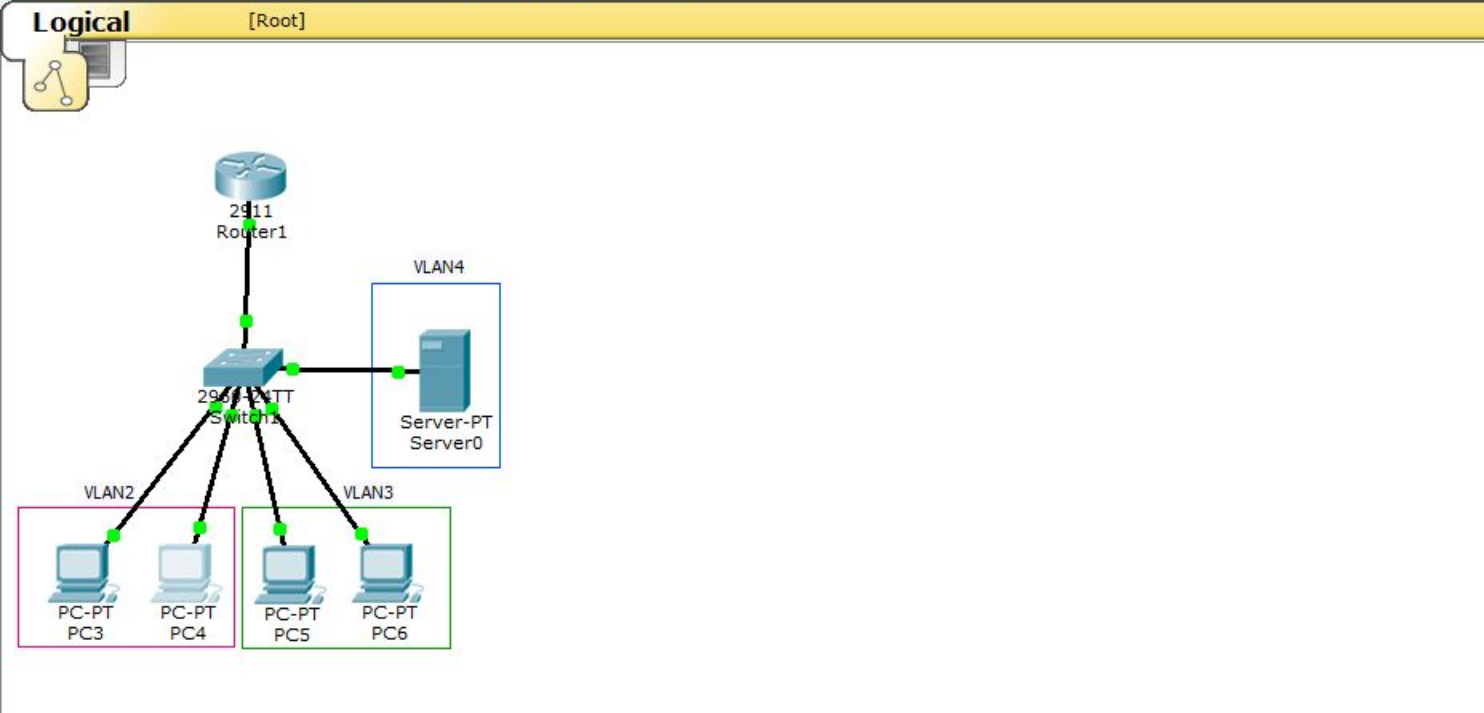
Connections

Scenario 0

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------

New Delete

Toggle PDU List Window



### IP Configuration

IP Configuration

DHCP     Static    DHCP request successful.

IP Address: 192.168.2.3

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.2.1

DNS Server: 8.8.8.8

---

IPv6 Configuration

DHCP     Auto Config     Static

IPv6 Address: /

Link Local Address: FE80::2D0:BCFF:FEA0:7AE3

IPv6 Gateway:

IPv6 DNS Server:

http:

Web Browser

Cisco IP Communicator

Пробуем получить DNS-адрес, для компьютера PC4. Видим, что ip-адрес есть.

Connections

Automatically Choose Connection Type

Scenario 0

New    Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete



### IP Configuration

IP Configuration

DHCP  Static DHCP request successful.

IP Address: 192.168.3.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.3.1

DNS Server: 8.8.8.8

IPv6 Configuration

DHCP  Auto Config  Static

IPv6 Address: /

Link Local Address: FE80::201:C7FF:FEC9:720C

IPv6 Gateway:

IPv6 DNS Server:

Web Browser

Cisco IP Communicator

Пробуем получить DNS-адрес, для компьютера PC5. Видим, что ip-адрес есть.

Connections

Automatically Choose Connection Type

Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------





### IP Configuration

IP Configuration

DHCP     Static    DHCP request successful.

IP Address: 192.168.3.3

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.3.1

DNS Server: 8.8.8.8

---

IPv6 Configuration

DHCP     Auto Config     Static

IPv6 Address: /

Link Local Address: FE80::260:5CFF:FE81:233E

IPv6 Gateway:

IPv6 DNS Server:

http:

**Web Browser**

**Cisco IP Communicator**

Пробуем получить DNS-адрес, для компьютера PC6. Видим, что ip-адрес есть.

Connections

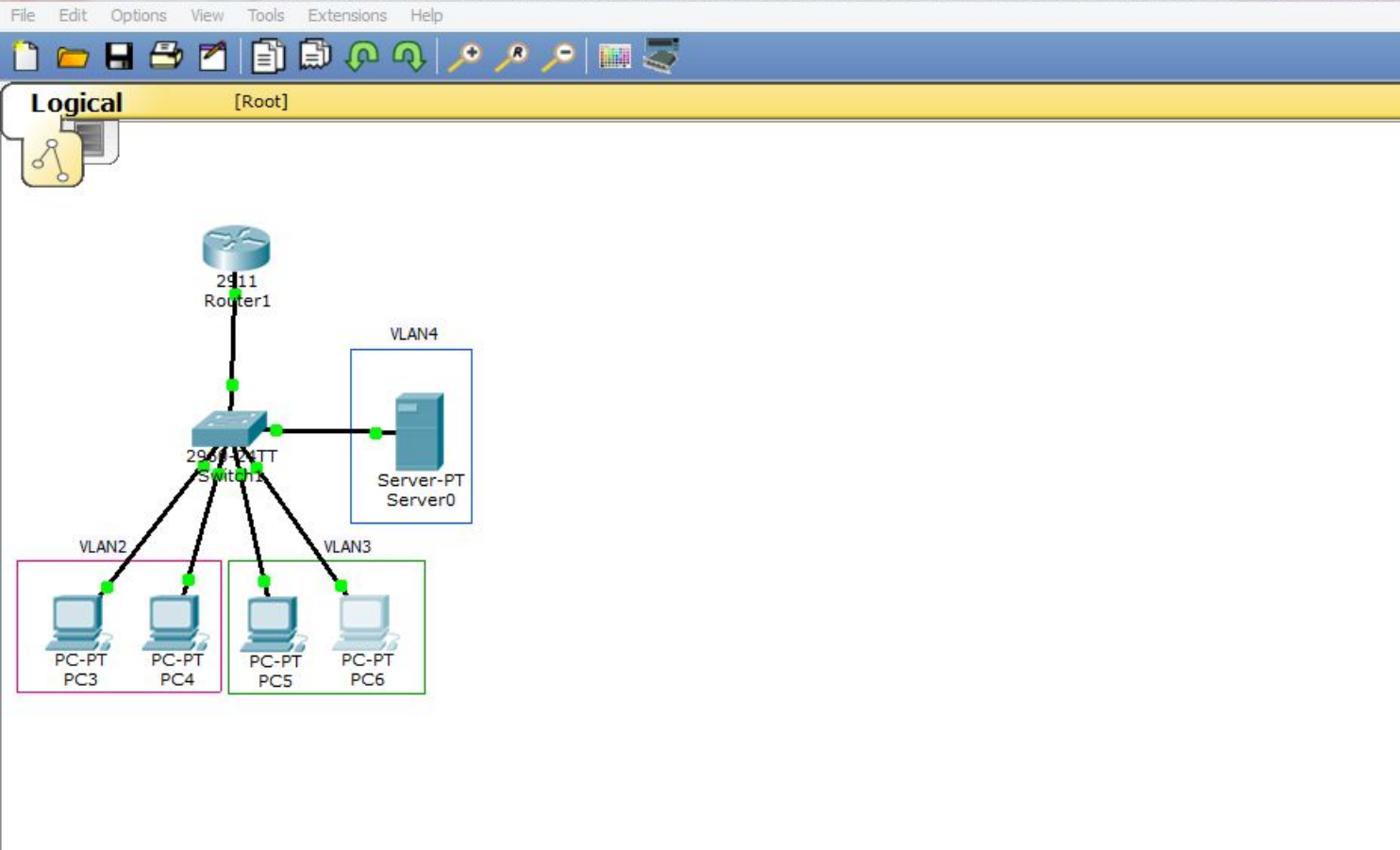
Automatically Choose Connection Type

Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete



PC6

Physical Config Desktop Custom Interface

**Command Prompt**

```

Packet Tracer PC Command Line 1.0
PC>ping 192.168.3.1

Pinging 192.168.3.1 with 32 bytes of data:

Reply from 192.168.3.1: bytes=32 time=1ms TTL=255
Reply from 192.168.3.1: bytes=32 time=0ms TTL=255
Reply from 192.168.3.1: bytes=32 time=0ms TTL=255
Reply from 192.168.3.1: bytes=32 time=0ms TTL=255

Ping statistics for 192.168.3.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>ping 192.168.2.2

Pinging 192.168.2.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.2.2: bytes=32 time=0ms TTL=127
Reply from 192.168.2.2: bytes=32 time=0ms TTL=127
Reply from 192.168.2.2: bytes=32 time=0ms TTL=127

Ping statistics for 192.168.2.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>
  
```

Проверим связь PC6 со шлюзом, связь есть.

Проверим связь PC6 с другими PC, связь есть.

Time: 04:20:28

Power Cycle Devices Fast Forward Time

Realtime

Connections

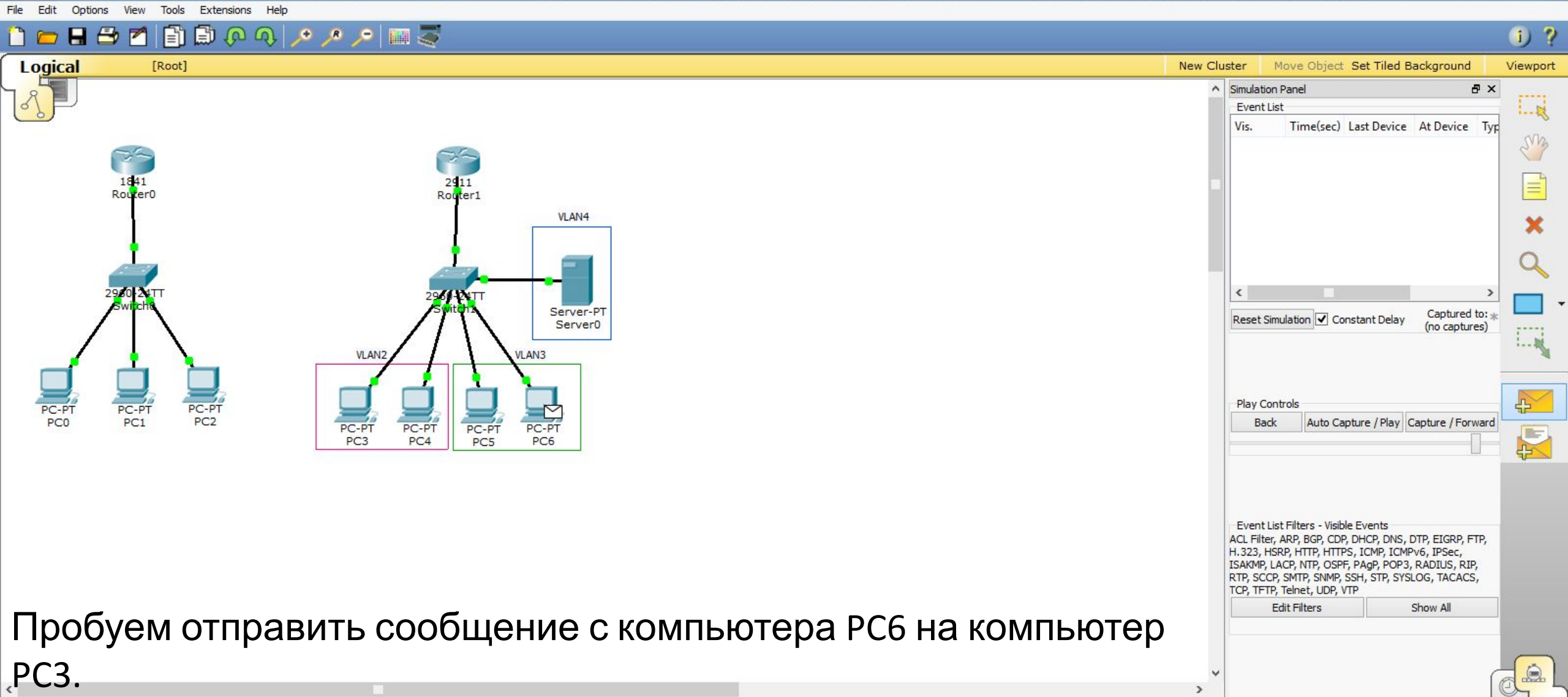
Automatically Choose Connection Type

Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete



Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
------	-----------	-------------	-----------	------

Reset Simulation  Constant Delay Captured to: \* (no captures)

Play Controls

Back Auto Capture / Play Capture / Forward

Event List Filters - Visible Events

ACL Filter, ARP, BGP, CDP, DHCP, DNS, DTP, EIGRP, FTP, H.323, HSRP, HTTP, HTTPS, ICMP, ICMPv6, IPsec, ISAKMP, LACP, NTP, OSPF, PAP, POP3, RADIUS, RIP, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, VTP

Edit Filters Show All

Пробуем отправить сообщение с компьютера PC6 на компьютер PC3.

Time: 04:44:41.869 Power Cycle Devices PLAY CONTROLS: Back Auto Capture / Play Capture / Forward

Connections

Automatically Choose Connection Type

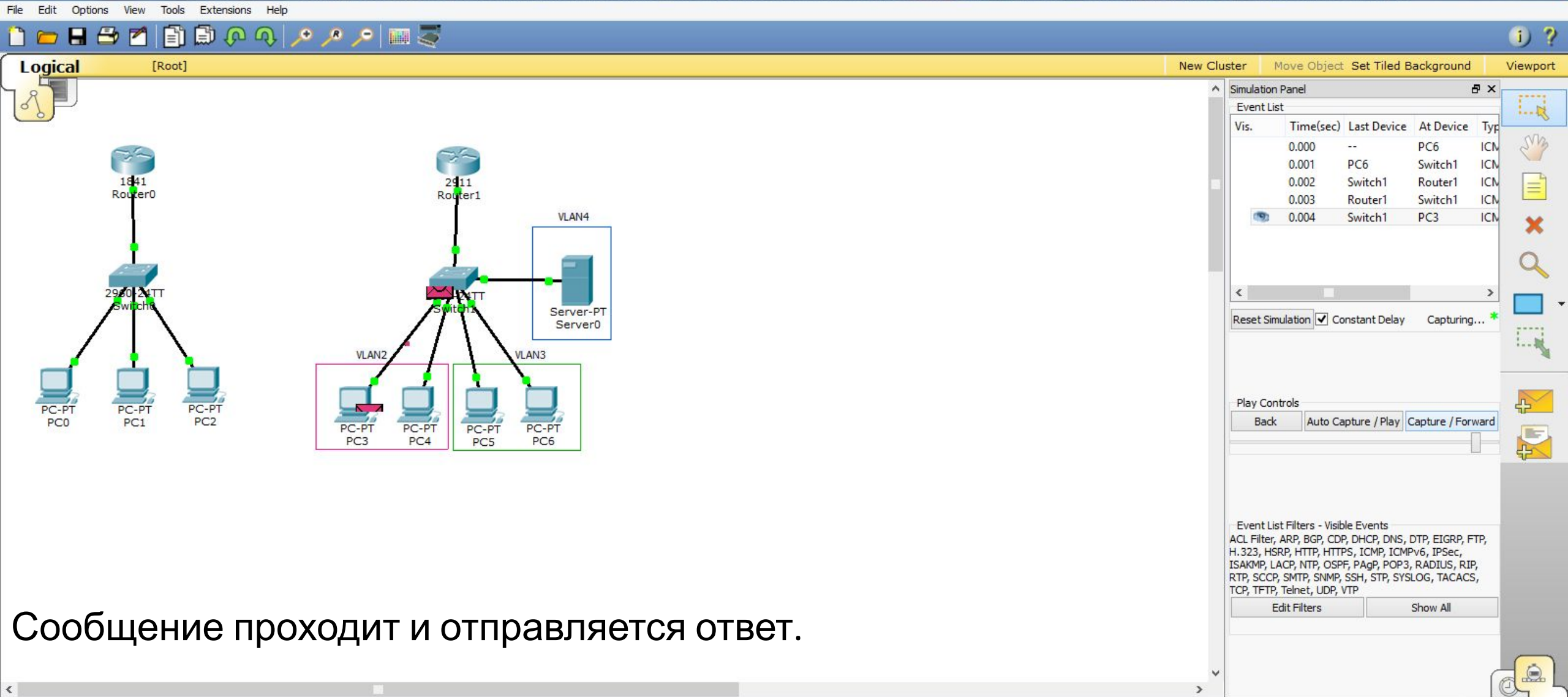
Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
------	-------------	--------	-------------	------	-------	------------	----------	-----	------	--------





Simulation Panel

Event List

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC6	ICMP
	0.001	PC6	Switch1	ICMP
	0.002	Switch1	Router1	ICMP
	0.003	Router1	Switch1	ICMP
<input checked="" type="checkbox"/>	0.004	Switch1	PC3	ICMP

Reset Simulation  Constant Delay Capturing...

Play Controls

Back Auto Capture / Play Capture / Forward

Event List Filters - Visible Events

ACL Filter, ARP, BGP, CDP, DHCP, DNS, DTP, EIGRP, FTP, H.323, HSRP, HTTP, HTTPS, ICMP, ICMPv6, IPSec, ISAKMP, LACP, NTP, OSPF, PAP, POP3, RADIUS, RIP, RTP, SCCP, SMTP, SNMP, SSH, STP, SYSLOG, TACACS, TCP, TFTP, Telnet, UDP, VTP

Edit Filters Show All

Сообщение проходит и отправляется ответ.

Time: 04:44:41.872 Power Cycle Devices PLAY CONTROLS: Back Auto Capture / Play Capture / Forward

Connections

Scenario 0

New Delete

Toggle PDU List Window

Fire	Last Status	Source	Destination	Type	Color	Time (sec)	Periodic	Num	Edit	Delete
<input checked="" type="checkbox"/>	In Progress	PC6	PC3	ICMP	Red	0.000	N	0	(edit)	(delete)

Automatically Choose Connection Type



Маска подсети	Маска в двоичной системе	Префикс	Количество адресов	Обратная маска
255.255.255.255	11111111.11111111.11111111.11111111	/32	1	0.0.0.0
255.255.255.254	11111111.11111111.11111111.11111110	/31	2	0.0.0.1
255.255.255.252	11111111.11111111.11111111.11111100	/30	4	0.0.0.3
255.255.255.248	11111111.11111111.11111111.11111000	/29	8	0.0.0.7
255.255.255.240	11111111.11111111.11111111.11110000	/28	16	0.0.0.15
255.255.255.224	11111111.11111111.11111111.11100000	/27	32	0.0.0.31
255.255.255.192	11111111.11111111.11111111.11000000	/26	64	0.0.0.63
255.255.255.128	11111111.11111111.11111111.10000000	/25	128	0.0.0.127
255.255.255.0	11111111.11111111.11111111.00000000	/24	256	0.0.0.255
255.255.254.0	11111111.11111111.11111110.00000000	/23	512	0.0.1.255
255.255.252.0	11111111.11111111.11111100.00000000	/22	1024	0.0.3.255
255.255.248.0	11111111.11111111.11111000.00000000	/21	2048	0.0.7.255
255.255.240.0	11111111.11111111.11110000.00000000	/20	4096	0.0.15.255
255.255.224.0	11111111.11111111.11100000.00000000	/19	8192	0.0.31.255
255.255.192.0	11111111.11111111.11000000.00000000	/18	16384	0.0.63.255
255.255.128.0	11111111.11111111.10000000.00000000	/17	32768	0.0.127.255
255.255.0.0	11111111.11111111.00000000.00000000	/16	65536	0.0.255.255
255.254.0.0	11111111.11111110.00000000.00000000	/15	131072	0.1.255.255
255.252.0.0	11111111.11111100.00000000.00000000	/14	262144	0.3.255.255
255.248.0.0	11111111.11111000.00000000.00000000	/13	524288	0.7.255.255
255.240.0.0	11111111.11110000.00000000.00000000	/12	1048576	0.15.255.255

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# Спасибо за внимание!

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