

Лабораторная работа №16

Настройка VPN

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Информация

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Получить навыки настройки VPN-туннеля через незащищённое Интернет-соединение.

1. Разместить в рабочей области проекта в соответствии с модельными предположениями оборудование для сети Университета г. Пиза.
2. В физической рабочей области проекта создать город Пиза, здание Университета г. Пиза. Переместить туда соответствующее оборудование.
3. Сделать первоначальную настройку и настройку интерфейсов оборудования сети Университета г. Пиза.
4. Настроить VPN на основе протокола GRE.
5. Проверить доступность узлов сети Университета г. Пиза с ноутбука администратора сети «Донская».

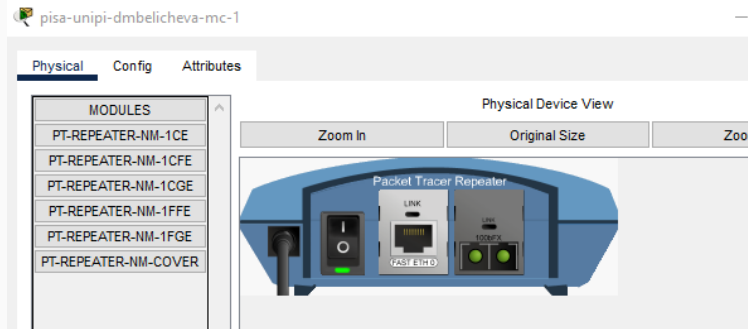


Рис. 1: Медиаконвертер с модулями PT-REPEATER-NM-1FFE и PT-REPEATER-NM-1CFE

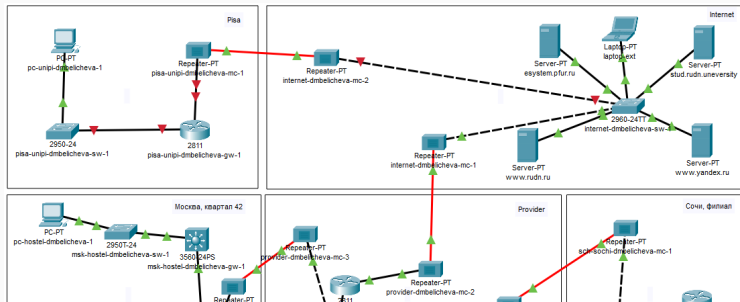


Рис. 2: Схема сети с дополнительными площадками

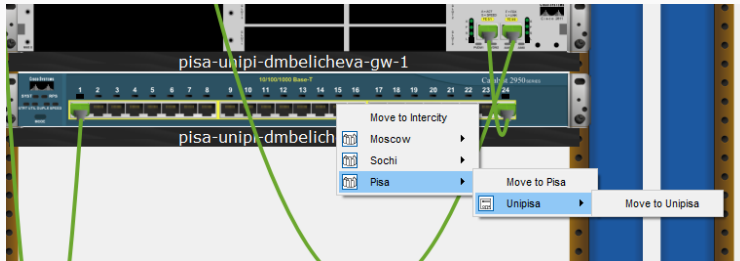


Рис. 3: Перемещение оборудования в г. Пиза

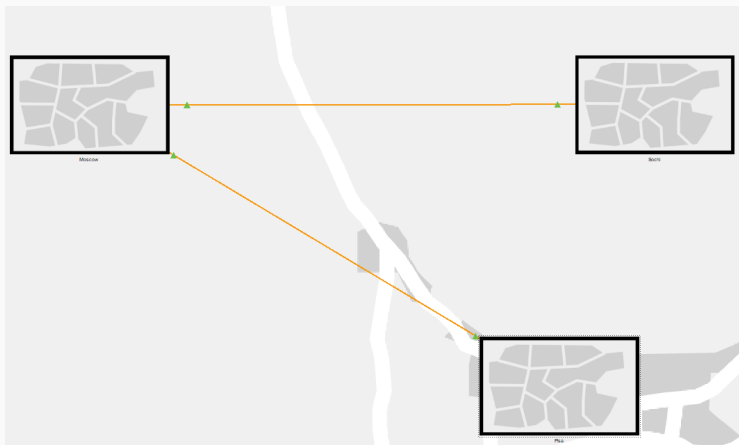


Рис. 4: Добавление г. Пиза

```
pisa-unipisa-dmbelicheva-gw-1(config)#line vty 0 4
pisa-unipisa-dmbelicheva-gw-1(config-line)#password cisco
pisa-unipisa-dmbelicheva-gw-1(config-line)#login
pisa-unipisa-dmbelicheva-gw-1(config-line)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#console 0
^
% Invalid input detected at '^' marker.

pisa-unipisa-dmbelicheva-gw-1(config)#line console 0
pisa-unipisa-dmbelicheva-gw-1(config-line)#password cisco
pisa-unipisa-dmbelicheva-gw-1(config-line)#login
pisa-unipisa-dmbelicheva-gw-1(config-line)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#enable secret cisco
pisa-unipisa-dmbelicheva-gw-1(config)#service password-encryption
pisa-unipisa-dmbelicheva-gw-1(config)#username admin privilege 1 secret cisco
pisa-unipisa-dmbelicheva-gw-1(config)#ip domain-name unipi.edu
pisa-unipisa-dmbelicheva-gw-1(config)#crypto key generate rsa
The name for the keys will be: pisa-unipisa-dmbelicheva-gw-1.unipi.edu
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.

How many bits in the modulus [512]: 2048
% Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

pisa-unipisa-dmbelicheva-gw-1(config)#line vty 0 4
*Mar 1 0:21:59.513: %SSH-5-ENABLED: SSH 1.99 has been enabled
pisa-unipisa-dmbelicheva-gw-1(config-line)#transport input ssh
pisa-unipisa-dmbelicheva-gw-1(config-line)#exit
```

Рис. 5: Первоначальная настройка маршрутизатора pisa-unipi-gw-1

```
Switch(config)#hostname pisa-unipi-dmbelicheva-sw-1
pisa-unipi-dmbelicheva-sw-1(config)#line vty 0 4
pisa-unipi-dmbelicheva-sw-1(config-line)#password cisco
pisa-unipi-dmbelicheva-sw-1(config-line)#login
pisa-unipi-dmbelicheva-sw-1(config-line)#exit
pisa-unipi-dmbelicheva-sw-1(config)#line console 0
pisa-unipi-dmbelicheva-sw-1(config-line)#password cisco
pisa-unipi-dmbelicheva-sw-1(config-line)#login
pisa-unipi-dmbelicheva-sw-1(config-line)#exit
pisa-unipi-dmbelicheva-sw-1(config)#enable secret cisco
pisa-unipi-dmbelicheva-sw-1(config)#service password-encryption
pisa-unipi-dmbelicheva-sw-1(config)#username admin privilege 1 secret cisco
pisa-unipi-dmbelicheva-sw-1(config)#ip domain-name unipi.edu
pisa-unipi-dmbelicheva-sw-1(config)#crypto key generate rsa
The name for the keys will be: pisa-unipi-dmbelicheva-sw-1.unipi.edu
Choose the size of the key modulus in the range of 360 to 2048 for your
  General Purpose Keys. Choosing a key modulus greater than 512 may take
  a few minutes.

How many bits in the modulus [512]: 2048
% Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

pisa-unipi-dmbelicheva-sw-1(config)#line vty 0 4
*Mar 1 0:24:13.970: %SSH-5-ENABLED: SSH 1.99 has been enabled
pisa-unipi-dmbelicheva-sw-1(config-line)#transport input ssh
pisa-unipi-dmbelicheva-sw-1(config-line)#^Z
```

Рис. 6: Первоначальная настройка коммутатора pisa-unipi-sw-1

```
pisa-unipisa-dmbelicheva-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
pisa-unipisa-dmbelicheva-gw-1(config)#int f0/0
pisa-unipisa-dmbelicheva-gw-1(config-if)#no shutdown

pisa-unipisa-dmbelicheva-gw-1(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

pisa-unipisa-dmbelicheva-gw-1(config-if)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#int f0/0.104
pisa-unipisa-dmbelicheva-gw-1(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.104, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.104, changed state to up

pisa-unipisa-dmbelicheva-gw-1(config-subif)#encapsulation dot1Q 401
pisa-unipisa-dmbelicheva-gw-1(config-subif)#ip address 10.131.0.1 255.255.255.0
pisa-unipisa-dmbelicheva-gw-1(config-subif)#description unipi-main
pisa-unipisa-dmbelicheva-gw-1(config-subif)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#int f0/1
pisa-unipisa-dmbelicheva-gw-1(config-if)#no shutdown

pisa-unipisa-dmbelicheva-gw-1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

pisa-unipisa-dmbelicheva-gw-1(config-if)#ip address 192.0.2.20 255.255.255.0
pisa-unipisa-dmbelicheva-gw-1(config-if)#description internet
pisa-unipisa-dmbelicheva-gw-1(config-if)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#ip route 0.0.0.0 0.0.0.0 192.0.2.1
pisa-unipisa-dmbelicheva-gw-1(config)#
```

Рис. 7: Настройка интерфейсов маршрутизатора pisa-unipi-gw-1

```
pisa-unipi-dmbelicheva-sw-1(config)#int f0/24
pisa-unipi-dmbelicheva-sw-1(config-if)#switchport mode trunk

pisa-unipi-dmbelicheva-sw-1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to up

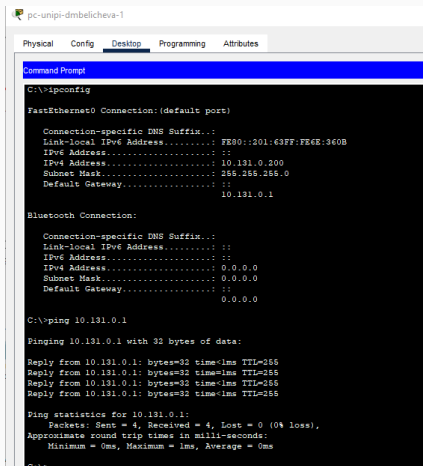
pisa-unipi-dmbelicheva-sw-1(config-if)#exit
pisa-unipi-dmbelicheva-sw-1(config)#int f0/1
pisa-unipi-dmbelicheva-sw-1(config-if)#switchport mode access
pisa-unipi-dmbelicheva-sw-1(config-if)#switchport access vlan 104
% Access VLAN does not exist. Creating vlan 104
pisa-unipi-dmbelicheva-sw-1(config-if)#exit
pisa-unipi-dmbelicheva-sw-1(config)#int f0/1
pisa-unipi-dmbelicheva-sw-1(config-if)#switchport mode access
pisa-unipi-dmbelicheva-sw-1(config-if)#no switchport access vlan 104
pisa-unipi-dmbelicheva-sw-1(config-if)#switchport access vlan 401
% Access VLAN does not exist. Creating vlan 401
pisa-unipi-dmbelicheva-sw-1(config-if)#exit
pisa-unipi-dmbelicheva-sw-1(config)#vlan 401
pisa-unipi-dmbelicheva-sw-1(config-vlan)#name unipi-main\
pisa-unipi-dmbelicheva-sw-1(config-vlan)#no name unipi-main\
pisa-unipi-dmbelicheva-sw-1(config-vlan)#name unipi-main
pisa-unipi-dmbelicheva-sw-1(config-vlan)#exit
pisa-unipi-dmbelicheva-sw-1(config)#int vlan401
pisa-unipi-dmbelicheva-sw-1(config-if)#
%LINK-5-CHANGED: Interface Vlan401, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan401, changed state to up

pisa-unipi-dmbelicheva-sw-1(config-if)#no shutdown
pisa-unipi-dmbelicheva-sw-1(config-if)#exit
pisa-unipi-dmbelicheva-sw-1(config)#^Z
```

Рис. 8: Настройка интерфейсов коммутатора pisa-unipi-sw-1

Выполнение лабораторной работы



```
pc-unipi-dmbelicheva-1
Physical Config Desktop Programming Attributes
Command Prompt
C:\>ipconfig

FastEthernet0 Connection: (default port)

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: FE80::201:63FF:FE6E:340B
    IPv6 Address . . . . .: ::
    IPv4 Address. . . . .: 10.131.0.200
    Subnet Mask . . . . .: 255.255.255.0
    Default Gateway . . . . .: ::
                                10.131.0.1

Bluetooth Connection:

    Connection-specific DNS Suffix...:
    Link-local IPv6 Address . . . . .: ::
    IPv6 Address . . . . .: ::
    IPv4 Address. . . . .: 0.0.0.0
    Subnet Mask . . . . .: 0.0.0.0
    Default Gateway . . . . .: ::
                                0.0.0.0

C:\>ping 10.131.0.1

Pinging 10.131.0.1 with 32 bytes of data:

Reply from 10.131.0.1: bytes=32 time<1ms TTL=255
Reply from 10.131.0.1: bytes=32 time<1ms TTL=255
Reply from 10.131.0.1: bytes=32 time<1ms TTL=255
Reply from 10.131.0.1: bytes=32 time<1ms TTL=255

Ping statistics for 10.131.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

Рис. 9: Проверка работоспособности соединения

Выполнение лабораторной работы

```
msh-donskaya-dmbelicheva-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
msh-donskaya-dmbelicheva-gw-1(config)#int Tunnel0

msh-donskaya-dmbelicheva-gw-1(config-if)#
%LINK-5-CHANGED: Interface Tunnel0, changed state to up

msh-donskaya-dmbelicheva-gw-1(config-if)#ip address 10.128.255.253 255.255.255.252
msh-donskaya-dmbelicheva-gw-1(config-if)#tunnel source f0/1.4
msh-donskaya-dmbelicheva-gw-1(config-if)#tunnel destination 192.0.2.20
msh-donskaya-dmbelicheva-gw-1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up

msh-donskaya-dmbelicheva-gw-1(config-if)#exit
msh-donskaya-dmbelicheva-gw-1(config)#interface loopback0

msh-donskaya-dmbelicheva-gw-1(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

msh-donskaya-dmbelicheva-gw-1(config-if)#ip address 10.128.254.1 255.255.255.255
msh-donskaya-dmbelicheva-gw-1(config-if)#exit
msh-donskaya-dmbelicheva-gw-1(config)#ip route 10.128.254.5 255.255.255.255 10.128.255.254
msh-donskaya-dmbelicheva-gw-1(config)#^Z
msh-donskaya-dmbelicheva-gw-1#
%SYS-5-CONFIG_I: Configured from console by console
```

Рис. 10: Настройка маршрутизатора msh-donskaya-gw-1

```
pisa-unipisa-dmbelicheva-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
pisa-unipisa-dmbelicheva-gw-1(config)#int Tunnel0

pisa-unipisa-dmbelicheva-gw-1(config-if)#
%LINK-5-CHANGED: Interface Tunnel0, changed state to up

pisa-unipisa-dmbelicheva-gw-1(config-if)#ip address 10.128.254.254 255.255.255.252
pisa-unipisa-dmbelicheva-gw-1(config-if)#tunnel source f0/1
pisa-unipisa-dmbelicheva-gw-1(config-if)#tunnel destination 198.51.100.2
pisa-unipisa-dmbelicheva-gw-1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up

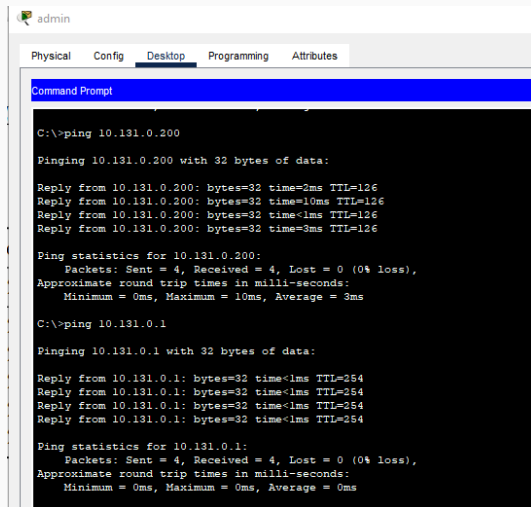
pisa-unipisa-dmbelicheva-gw-1(config-if)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#interface loopback0

pisa-unipisa-dmbelicheva-gw-1(config-if)#
%LINK-5-CHANGED: Interface Loopback0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

pisa-unipisa-dmbelicheva-gw-1(config-if)#ip address 10.128.254.5 255.255.255.255
pisa-unipisa-dmbelicheva-gw-1(config-if)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#ip route 10.128.254.1 255.255.255.255 10.128.255.253
pisa-unipisa-dmbelicheva-gw-1(config)#router ospf 1
pisa-unipisa-dmbelicheva-gw-1(config-router)#router-id 10.128.254.5
pisa-unipisa-dmbelicheva-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
pisa-unipisa-dmbelicheva-gw-1(config-router)#exit
pisa-unipisa-dmbelicheva-gw-1(config)#^Z
pisa-unipisa-dmbelicheva-gw-1#
%SYS-5-CONFIG I: Configured from console by console
```

Рис. 11: Настройка маршрутизатора pisa-unipi-gw-1



The screenshot shows a Windows desktop with a taskbar at the top containing icons for 'admin', 'Physical', 'Config', 'Desktop', 'Programming', and 'Attributes'. The 'Desktop' tab is active. A 'Command Prompt' window is open, displaying the results of two ping commands. The first command is 'ping 10.131.0.200', which shows four successful replies with varying times (2ms, 10ms, 1ms, 3ms) and a TTL of 126. The statistics show 4 packets sent, 4 received, and 0 lost. The second command is 'ping 10.131.0.1', which shows four successful replies with a time of less than 1ms and a TTL of 254. The statistics show 4 packets sent, 4 received, and 0 lost.

```
admin
Physical Config Desktop Programming Attributes

Command Prompt

C:\>ping 10.131.0.200

Pinging 10.131.0.200 with 32 bytes of data:

Reply from 10.131.0.200: bytes=32 time=2ms TTL=126
Reply from 10.131.0.200: bytes=32 time=10ms TTL=126
Reply from 10.131.0.200: bytes=32 time<1ms TTL=126
Reply from 10.131.0.200: bytes=32 time=3ms TTL=126

Ping statistics for 10.131.0.200:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>ping 10.131.0.1

Pinging 10.131.0.1 with 32 bytes of data:

Reply from 10.131.0.1: bytes=32 time<1ms TTL=254
Reply from 10.131.0.1: bytes=32 time<1ms TTL=254
Reply from 10.131.0.1: bytes=32 time<1ms TTL=254
Reply from 10.131.0.1: bytes=32 time<1ms TTL=254

Ping statistics for 10.131.0.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

Рис. 12: Проверка доступности соединения

В результате выполнения данной лабораторной работы я получила навыки настройки VPN-туннеля через незащищённое Интернет-соединение.