

# Защита лабораторной работы №16

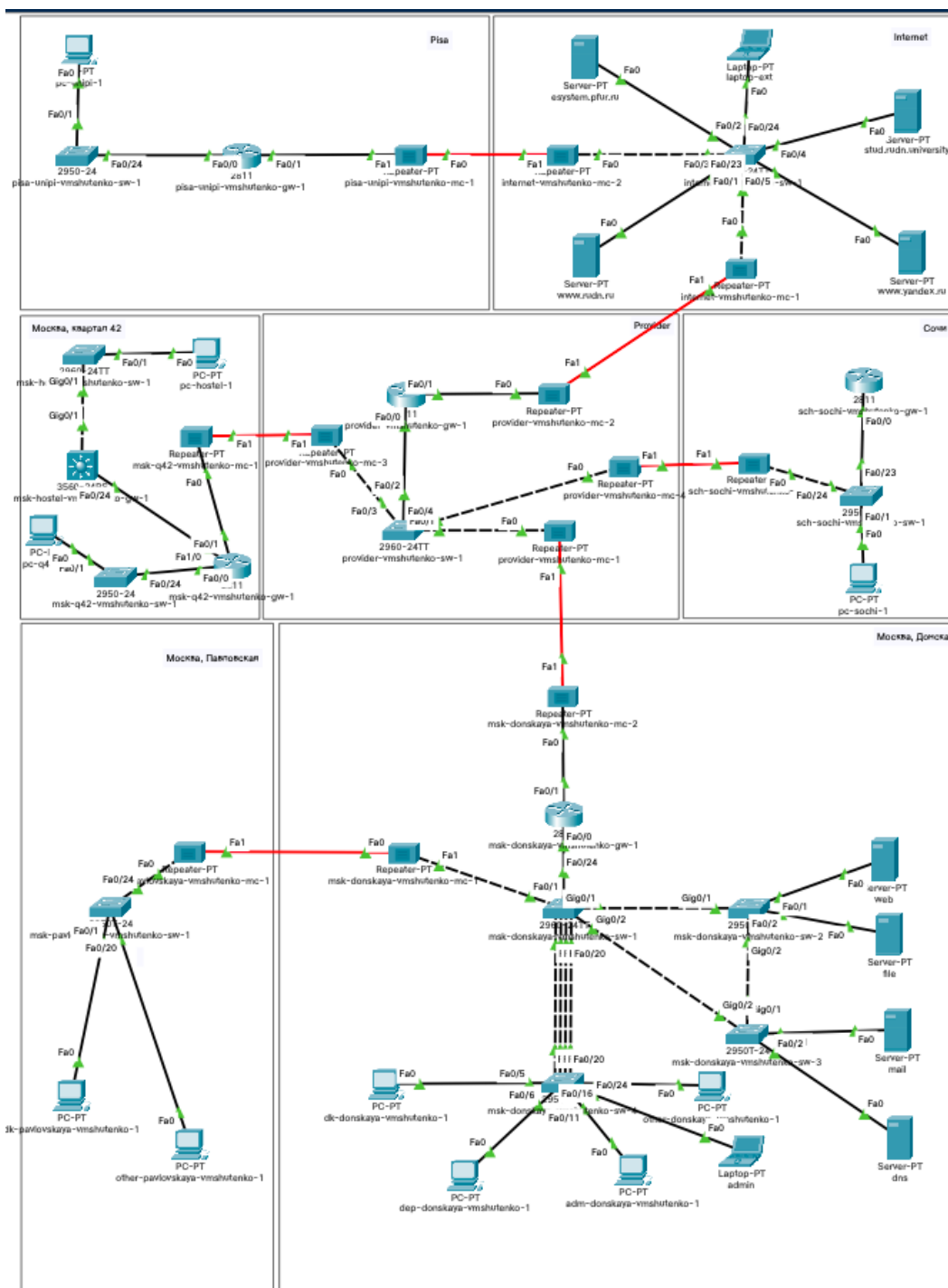
# Цель лабораторной работы

- Получение навыков настройки VPN-туннеля через незащищённое Интернет-соединение.

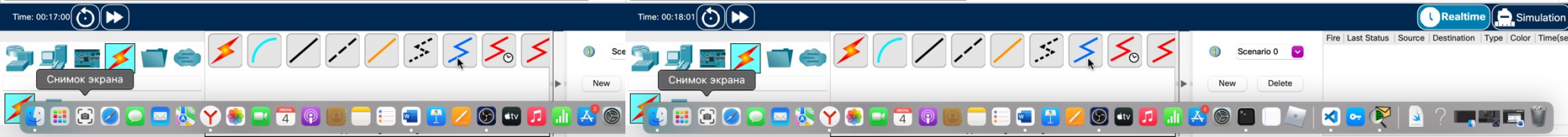
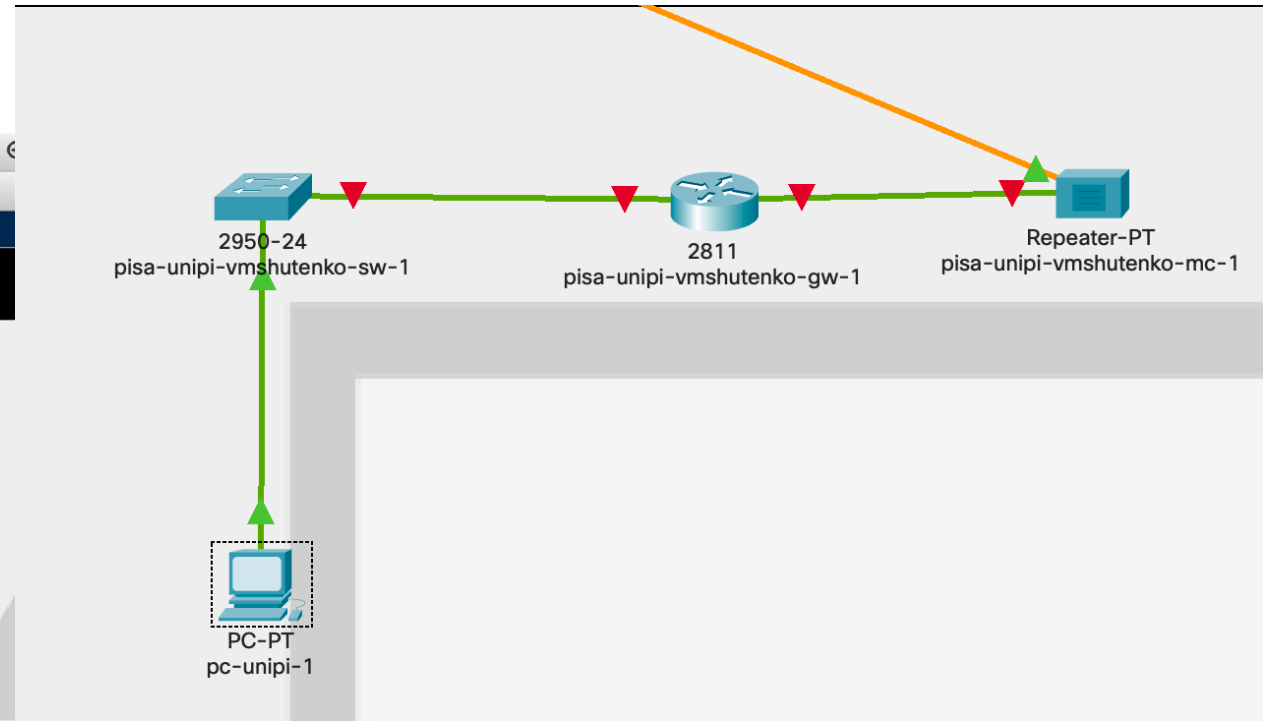
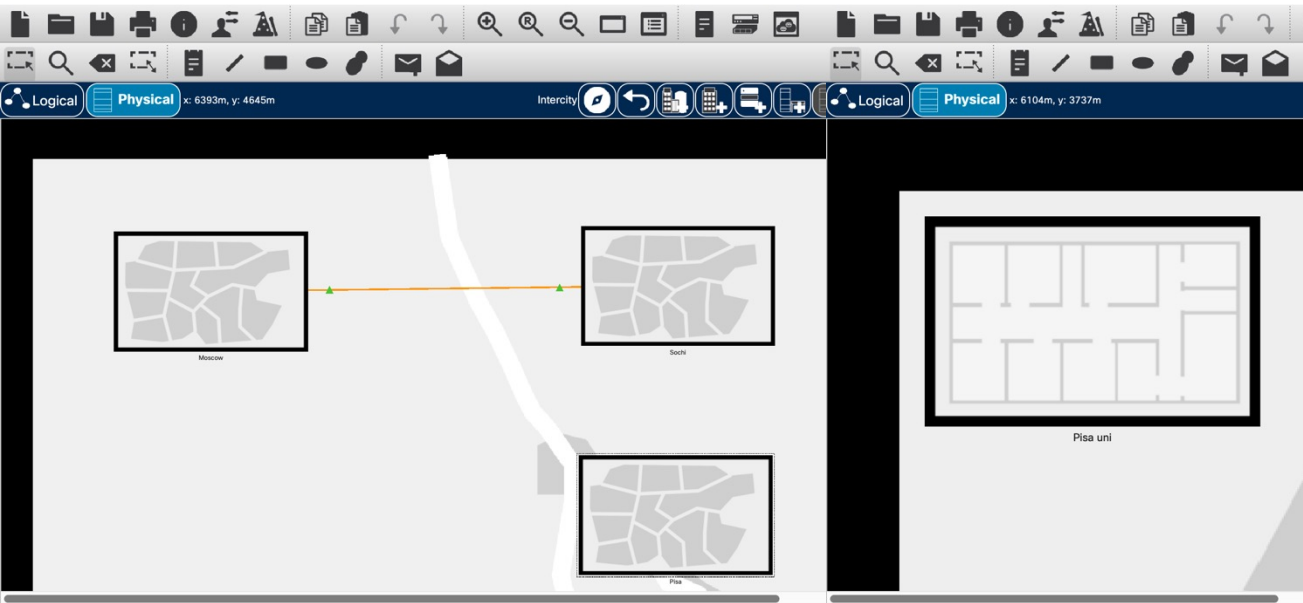
# Задание лабораторной работы

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 (см. раздел 16.5.1).
4. Настроить VPN на основе протокола GRE [1] (см. раздел 16.5.2).
5. Проверить доступность узлов сети Университета г. Пиза с ноутбука администратора сети «Донская».

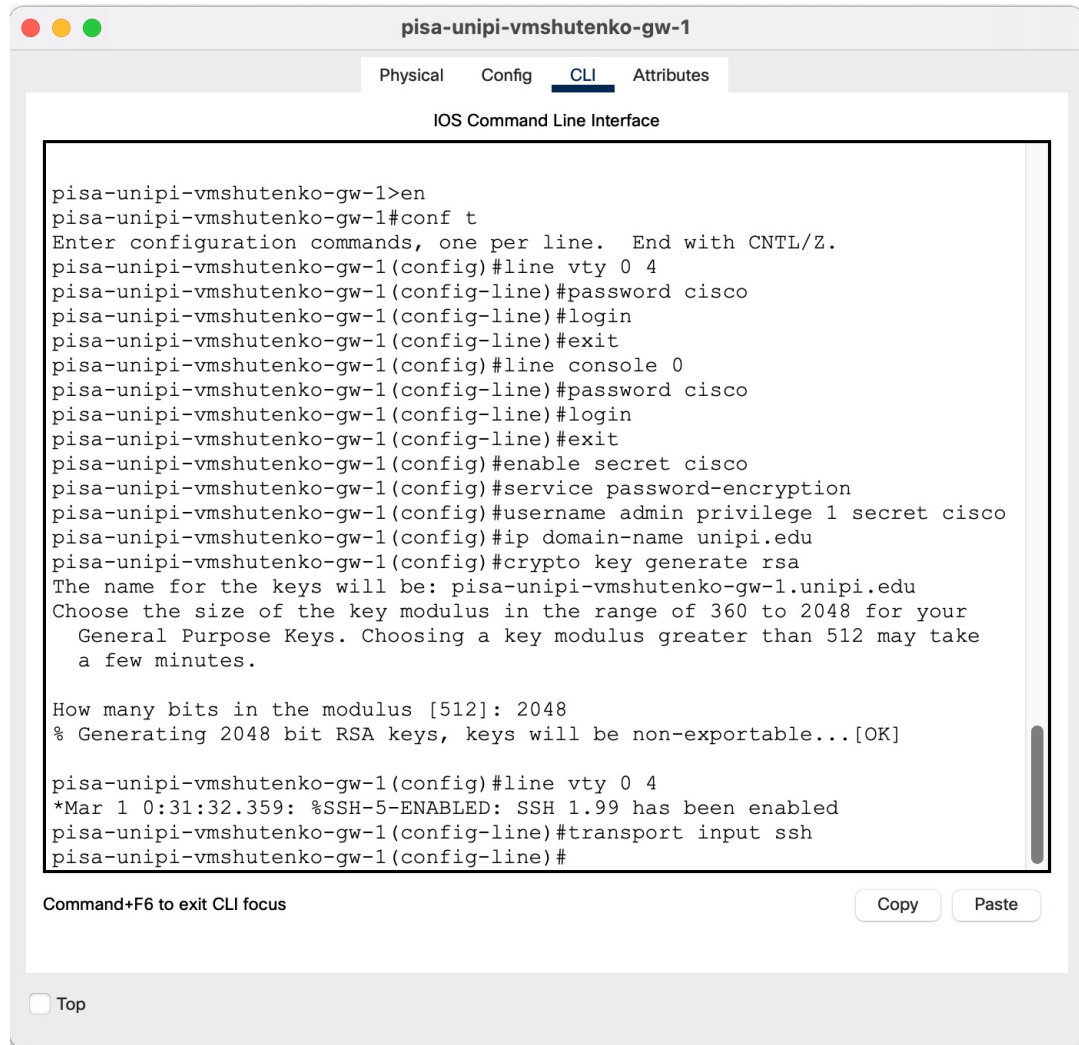
# Схема сети



# Перенос оборудования с Донской в город Пиза



# Настройка маршрутизатора pisa-unipi-gw-1



The screenshot shows the CLI interface of the pisa-unipi-vmshutenko-gw-1 router. The 'CLI' tab is selected. The user enters 'en' to enter configuration mode, then 'conf t' to enter global configuration mode. They configure the console line with 'line vty 0 4', 'password cisco', and 'login'. They also configure the console line with 'line console 0', 'password cisco', and 'login'. They enable secret encryption with 'enable secret cisco' and 'service password-encryption'. They set the username 'admin' with privilege level 1 and the domain name 'unipi.edu'. They generate RSA keys with 'crypto key generate rsa' and choose a modulus of 2048. They enable SSH with 'ssh 1.99' and configure the transport input as 'ssh'. Finally, they configure the vty lines with 'line vty 0 4' and 'transport input ssh'.

```
pisa-unipi-vmshutenko-gw-1>en
pisa-unipi-vmshutenko-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
pisa-unipi-vmshutenko-gw-1(config)#line vty 0 4
pisa-unipi-vmshutenko-gw-1(config-line)#password cisco
pisa-unipi-vmshutenko-gw-1(config-line)#login
pisa-unipi-vmshutenko-gw-1(config-line)#exit
pisa-unipi-vmshutenko-gw-1(config)#line console 0
pisa-unipi-vmshutenko-gw-1(config-line)#password cisco
pisa-unipi-vmshutenko-gw-1(config-line)#login
pisa-unipi-vmshutenko-gw-1(config-line)#exit
pisa-unipi-vmshutenko-gw-1(config)#enable secret cisco
pisa-unipi-vmshutenko-gw-1(config)#service password-encryption
pisa-unipi-vmshutenko-gw-1(config)#username admin privilege 1 secret cisco
pisa-unipi-vmshutenko-gw-1(config)#ip domain-name unipi.edu
pisa-unipi-vmshutenko-gw-1(config)#crypto key generate rsa
The name for the keys will be: pisa-unipi-vmshutenko-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.

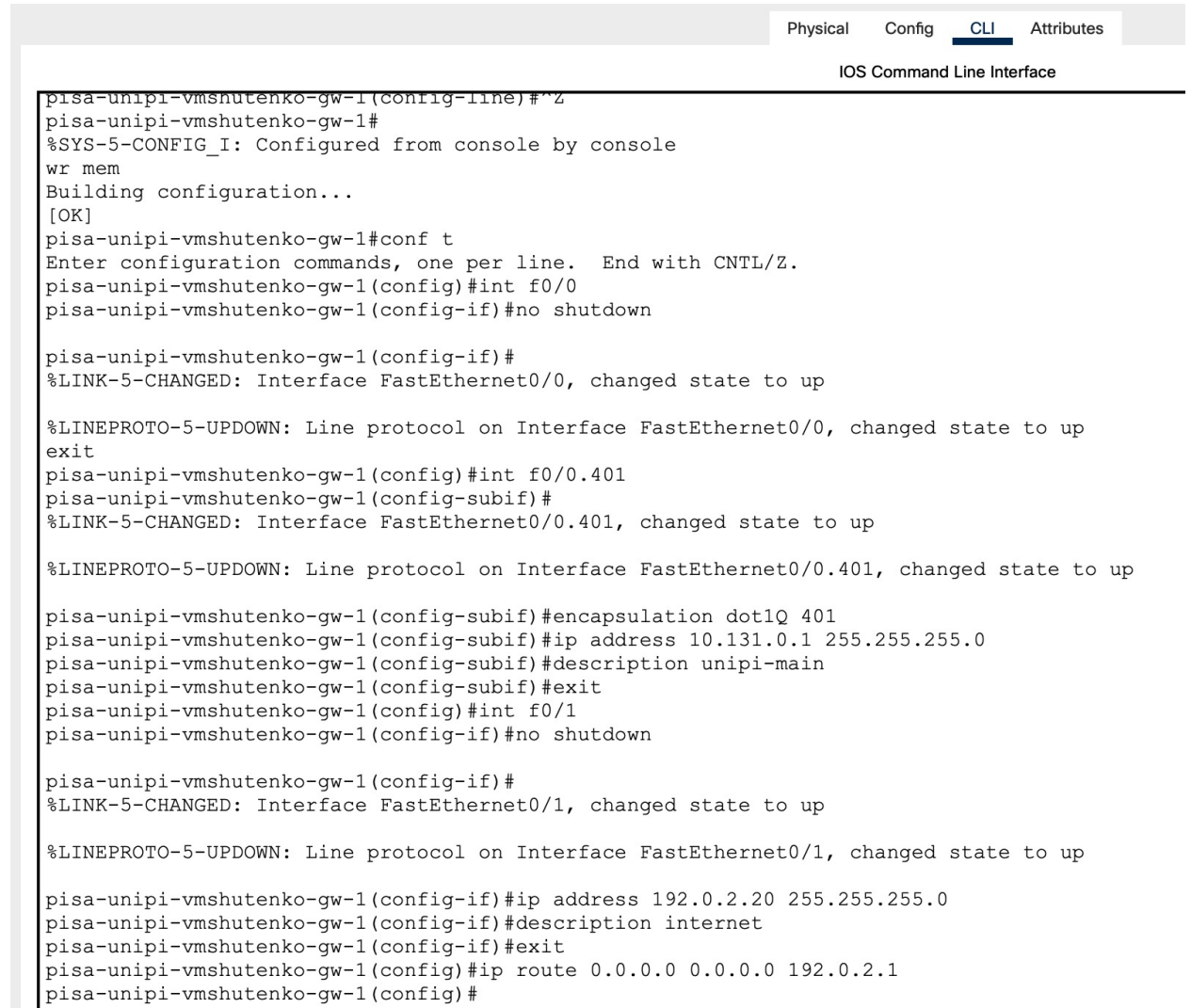
How many bits in the modulus [512]: 2048
% Generating 2048 bit RSA keys, keys will be non-exportable...[OK]

pisa-unipi-vmshutenko-gw-1(config)#line vty 0 4
*Mar 1 0:31:32.359: %SSH-5-ENABLED: SSH 1.99 has been enabled
pisa-unipi-vmshutenko-gw-1(config-line)#transport input ssh
pisa-unipi-vmshutenko-gw-1(config-line)#
```

Command+F6 to exit CLI focus

Copy Paste

Top



The screenshot shows the CLI interface of the pisa-unipi-vmshutenko-gw-1 router. The 'CLI' tab is selected. The user enters 'en' to enter configuration mode, then 'conf t' to enter global configuration mode. They configure the console line with 'line vty 0 4', 'password cisco', and 'login'. They also configure the console line with 'line console 0', 'password cisco', and 'login'. They enable secret encryption with 'enable secret cisco' and 'service password-encryption'. They set the username 'admin' with privilege level 1 and the domain name 'unipi.edu'. They generate RSA keys with 'crypto key generate rsa' and choose a modulus of 2048. They enable SSH with 'ssh 1.99' and configure the transport input as 'ssh'. Finally, they configure the vty lines with 'line vty 0 4' and 'transport input ssh'.

```
pisa-unipi-vmshutenko-gw-1(config-line)#^Z
pisa-unipi-vmshutenko-gw-1#
%SYS-5-CONFIG_I: Configured from console by console
wr mem
Building configuration...
[OK]
pisa-unipi-vmshutenko-gw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
pisa-unipi-vmshutenko-gw-1(config)#int f0/0
pisa-unipi-vmshutenko-gw-1(config-if)#no shutdown

pisa-unipi-vmshutenko-gw-1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

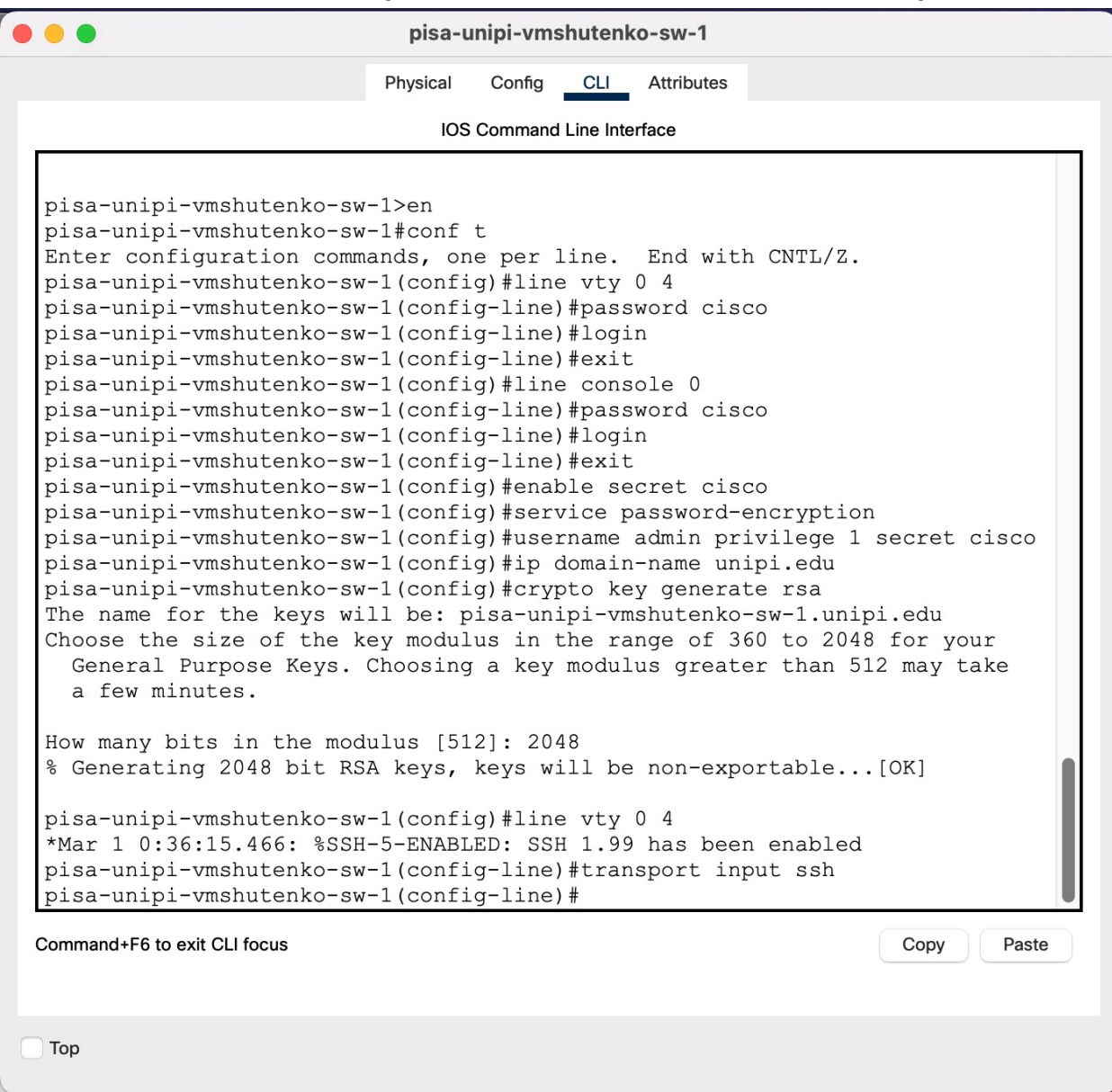
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
exit
pisa-unipi-vmshutenko-gw-1(config)#int f0/0.401
pisa-unipi-vmshutenko-gw-1(config-subif)#
%LINK-5-CHANGED: Interface FastEthernet0/0.401, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0.401, changed state to up
pisa-unipi-vmshutenko-gw-1(config-subif)#encapsulation dot1Q 401
pisa-unipi-vmshutenko-gw-1(config-subif)#ip address 10.131.0.1 255.255.255.0
pisa-unipi-vmshutenko-gw-1(config-subif)#description unipi-main
pisa-unipi-vmshutenko-gw-1(config-subif)#exit
pisa-unipi-vmshutenko-gw-1(config)#int f0/1
pisa-unipi-vmshutenko-gw-1(config-if)#no shutdown

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

# Настройка коммутатора pisa-unipi-sw-1



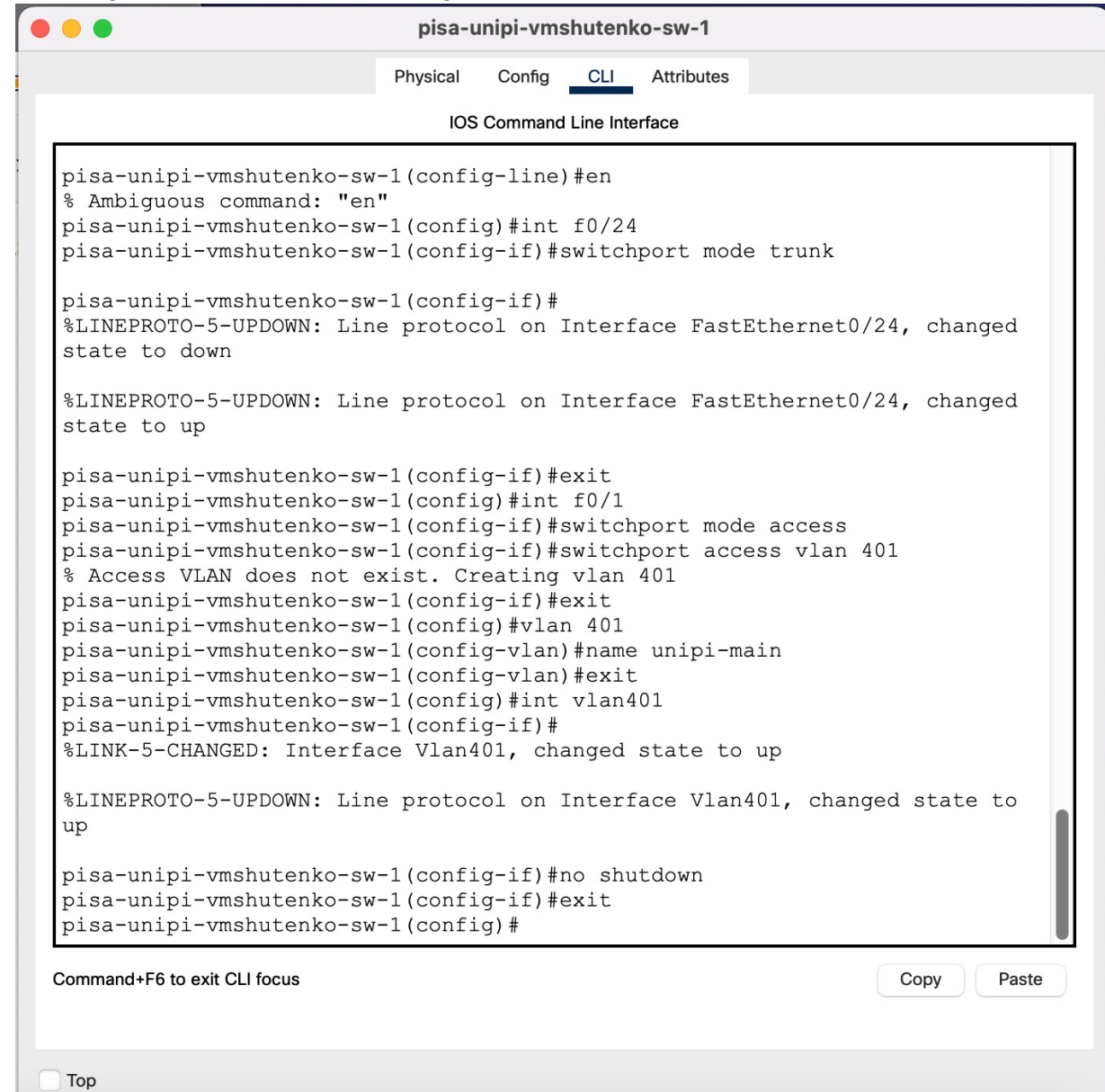
The screenshot shows the CLI interface of a switch named 'pisa-unipi-vmshutenko-sw-1'. The 'CLI' tab is selected. The interface displays the following commands and their outputs:

```
pisa-unipi-vmshutenko-sw-1>en
pisa-unipi-vmshutenko-sw-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
pisa-unipi-vmshutenko-sw-1(config)#line vty 0 4
pisa-unipi-vmshutenko-sw-1(config-line)#password cisco
pisa-unipi-vmshutenko-sw-1(config-line)#login
pisa-unipi-vmshutenko-sw-1(config-line)#exit
pisa-unipi-vmshutenko-sw-1(config)#line console 0
pisa-unipi-vmshutenko-sw-1(config-line)#password cisco
pisa-unipi-vmshutenko-sw-1(config-line)#login
pisa-unipi-vmshutenko-sw-1(config-line)#exit
pisa-unipi-vmshutenko-sw-1(config)#enable secret cisco
pisa-unipi-vmshutenko-sw-1(config)#service password-encryption
pisa-unipi-vmshutenko-sw-1(config)#username admin privilege 1 secret cisco
pisa-unipi-vmshutenko-sw-1(config)#ip domain-name unipi.edu
pisa-unipi-vmshutenko-sw-1(config)#crypto key generate rsa
The name for the keys will be: pisa-unipi-vmshutenko-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-vmshutenko-sw-1(config)#line vty 0 4
*Mar 1 0:36:15.466: %SSH-5-ENABLED: SSH 1.99 has been enabled
pisa-unipi-vmshutenko-sw-1(config-line)#transport input ssh
pisa-unipi-vmshutenko-sw-1(config-line)#
```

At the bottom, there are buttons for 'Copy' and 'Paste', and a 'Top' link.



The screenshot shows the CLI interface of a switch named 'pisa-unipi-vmshutenko-sw-1'. The 'CLI' tab is selected. The interface displays the following commands and their outputs:

```
pisa-unipi-vmshutenko-sw-1(config-line)#en
% Ambiguous command: "en"
pisa-unipi-vmshutenko-sw-1(config)#int f0/24
pisa-unipi-vmshutenko-sw-1(config-if)#switchport mode trunk

pisa-unipi-vmshutenko-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-vmshutenko-sw-1(config-if)#exit
pisa-unipi-vmshutenko-sw-1(config)#int f0/1
pisa-unipi-vmshutenko-sw-1(config-if)#switchport mode access
pisa-unipi-vmshutenko-sw-1(config-if)#switchport access vlan 401
% Access VLAN does not exist. Creating vlan 401
pisa-unipi-vmshutenko-sw-1(config-if)#exit
pisa-unipi-vmshutenko-sw-1(config)#vlan 401
pisa-unipi-vmshutenko-sw-1(config-vlan)#name unipi-main
pisa-unipi-vmshutenko-sw-1(config-vlan)#exit
pisa-unipi-vmshutenko-sw-1(config)#int vlan401
pisa-unipi-vmshutenko-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

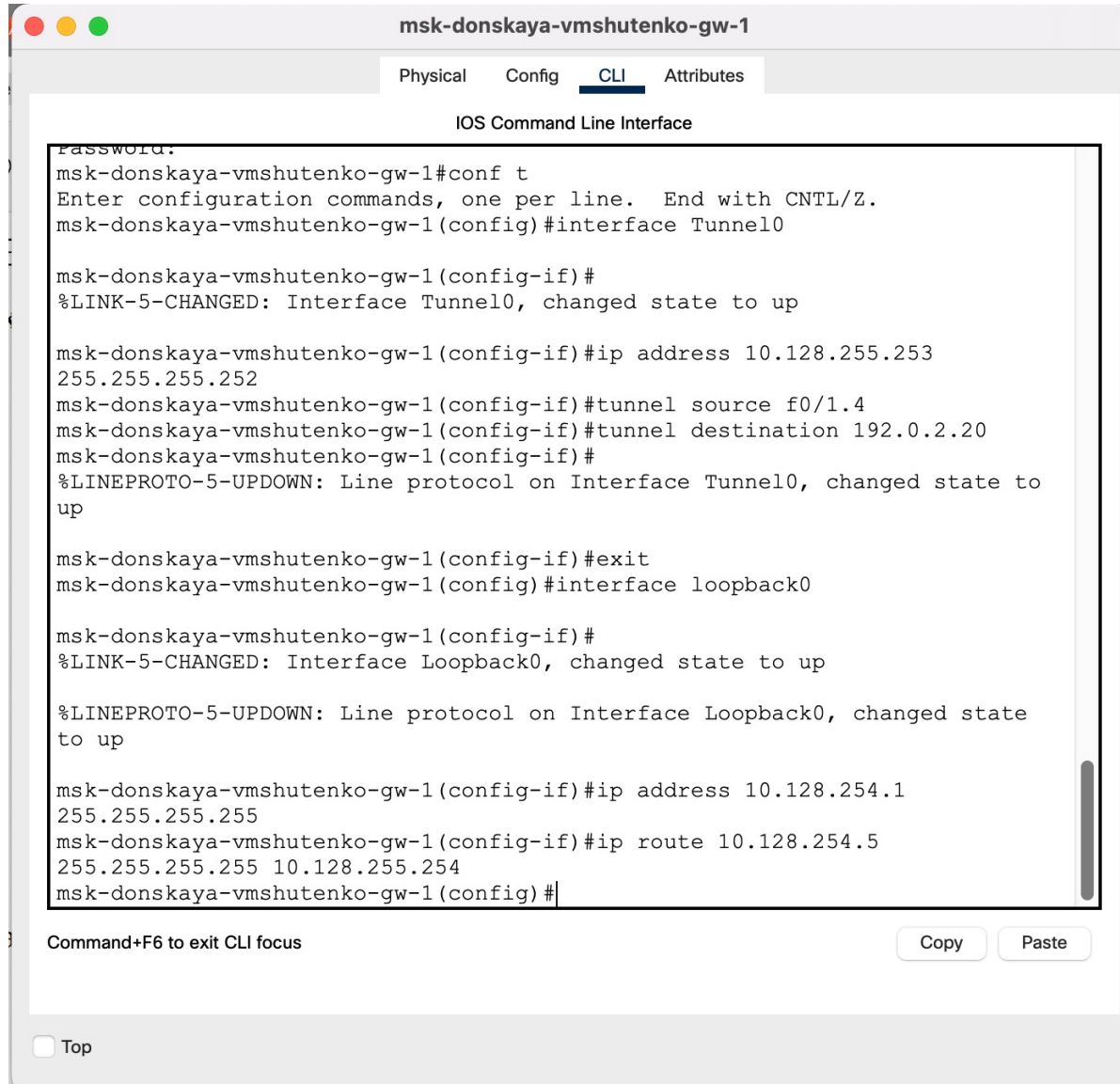
pisa-unipi-vmshutenko-sw-1(config-if)#no shutdown
pisa-unipi-vmshutenko-sw-1(config-if)#exit
pisa-unipi-vmshutenko-sw-1(config)#
```

At the bottom, there are buttons for 'Copy' and 'Paste', and a 'Top' link.



# Настроила VPN на основе протокола GRE.

## Настройка маршрутизатора msk-donskaya-gw-1



The screenshot shows a web-based configuration interface for a network device named 'msk-donskaya-vmshutenko-gw-1'. The 'CLI' tab is selected, displaying the 'IOS Command Line Interface'. The interface shows a series of commands being entered and executed, with status messages indicating the state of the interfaces and protocols.

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

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

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

msk-donskaya-vmshutenko-gw-1(config-if)#exit
msk-donskaya-vmshutenko-gw-1(config)#interface loopback0

msk-donskaya-vmshutenko-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

msk-donskaya-vmshutenko-gw-1(config-if)#ip address 10.128.254.1
255.255.255.255
msk-donskaya-vmshutenko-gw-1(config-if)#ip route 10.128.254.5
255.255.255.255 10.128.255.254
msk-donskaya-vmshutenko-gw-1(config)#
```

At the bottom of the CLI window, there is a message: 'Command+F6 to exit CLI focus'. To the right of the CLI window are 'Copy' and 'Paste' buttons. Below the CLI window is a 'Top' button with a checkbox.



# Настройка маршрутизатора pisa-unipi-gw-1

```
Physical  Config  CLI  Attributes
IOS Command Line Interface

Password:
pisa-unipi-vmshutenko-gw-1>en
Password:
pisa-unipi-vmshutenko-gw-1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
pisa-unipi-vmshutenko-gw-1(config)#interface Tunnel0

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

pisa-unipi-vmshutenko-gw-1(config-if)#ip address 10.128.255.254 255.255.255.252
pisa-unipi-vmshutenko-gw-1(config-if)#tunnel source f0/1
pisa-unipi-vmshutenko-gw-1(config-if)#tunnel destination 198.51.100.2
pisa-unipi-vmshutenko-gw-1(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, changed state to up

pisa-unipi-vmshutenko-gw-1(config-if)#exit
pisa-unipi-vmshutenko-gw-1(config)#interface loopback0

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

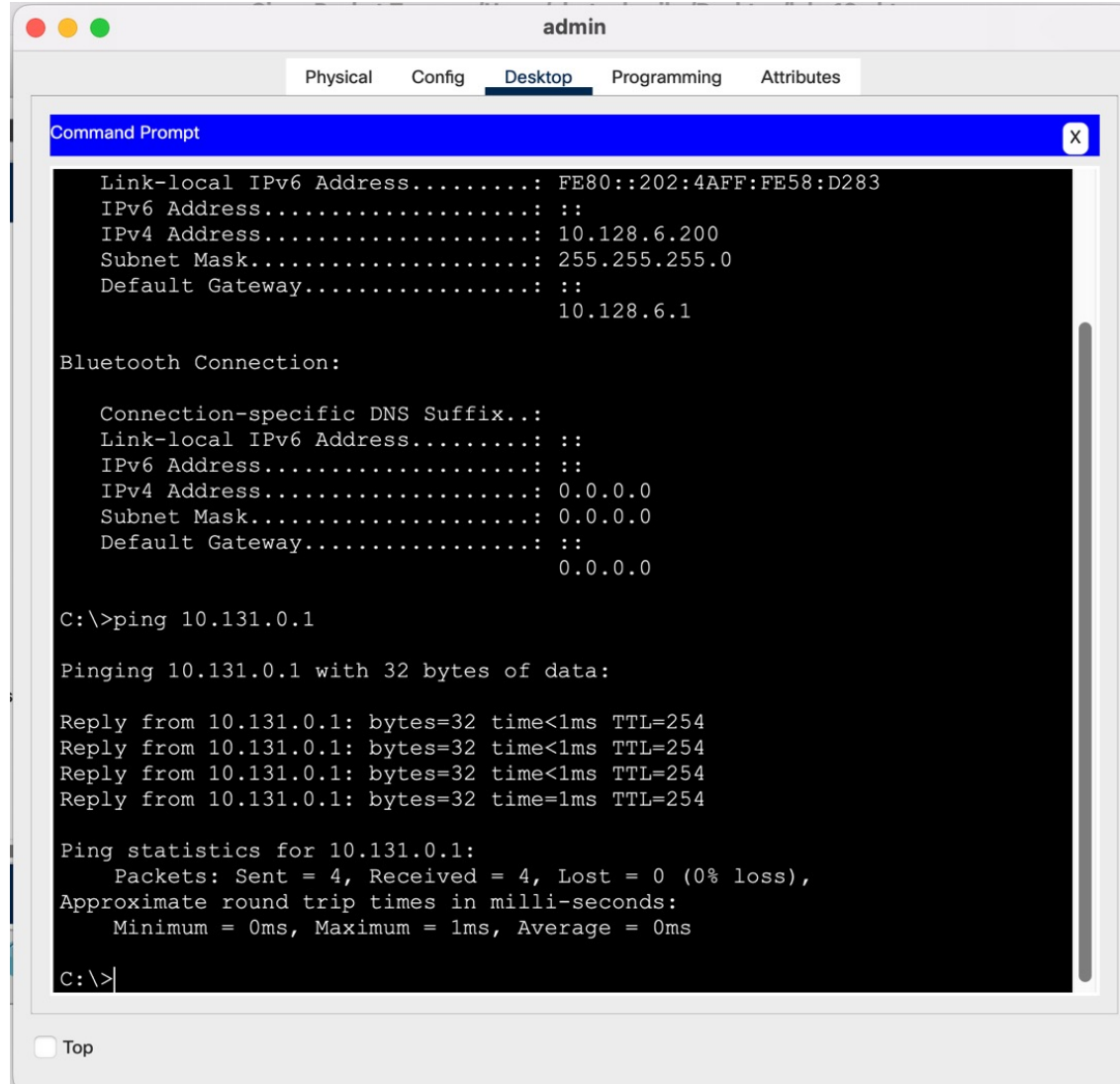
%LINEPROTO-5-UPDOWN: Line protocol on Interface Loopback0, changed state to up

pisa-unipi-vmshutenko-gw-1(config-if)#ip address 10.128.254.5 255.255.255.255
pisa-unipi-vmshutenko-gw-1(config-if)#exit
pisa-unipi-vmshutenko-gw-1(config)#ip route 10.128.254.1 255.255.255.255 10.128.255.253
pisa-unipi-vmshutenko-gw-1(config)#router ospf 1
pisa-unipi-vmshutenko-gw-1(config-router)#routerid 10.128.254.5
^
% Invalid input detected at '^' marker.

pisa-unipi-vmshutenko-gw-1(config-router)#router-id 10.128.254.5
pisa-unipi-vmshutenko-gw-1(config-router)#network 10.0.0.0 0.255.255.255 area 0
pisa-unipi-vmshutenko-gw-1(config-router)#exit
pisa-unipi-vmshutenko-gw-1(config)#
00:30:35: %OSPF-5-ADJCHG: Process 1, Nbr 10.128.254.1 on Tunnel0 from LOADING to FULL, Loading Done
|
```

Command-EF to exit CLI focus

# Запуск пинга на компьютере администратора.



```
admin
Physical Config Desktop Programming Attributes

Command Prompt

Link-local IPv6 Address.....: FE80::202:4AFF:FE58:D283
IPv6 Address.....: ::
IPv4 Address.....: 10.128.6.200
Subnet Mask.....: 255.255.255.0
Default Gateway.....: ::
                        10.128.6.1

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

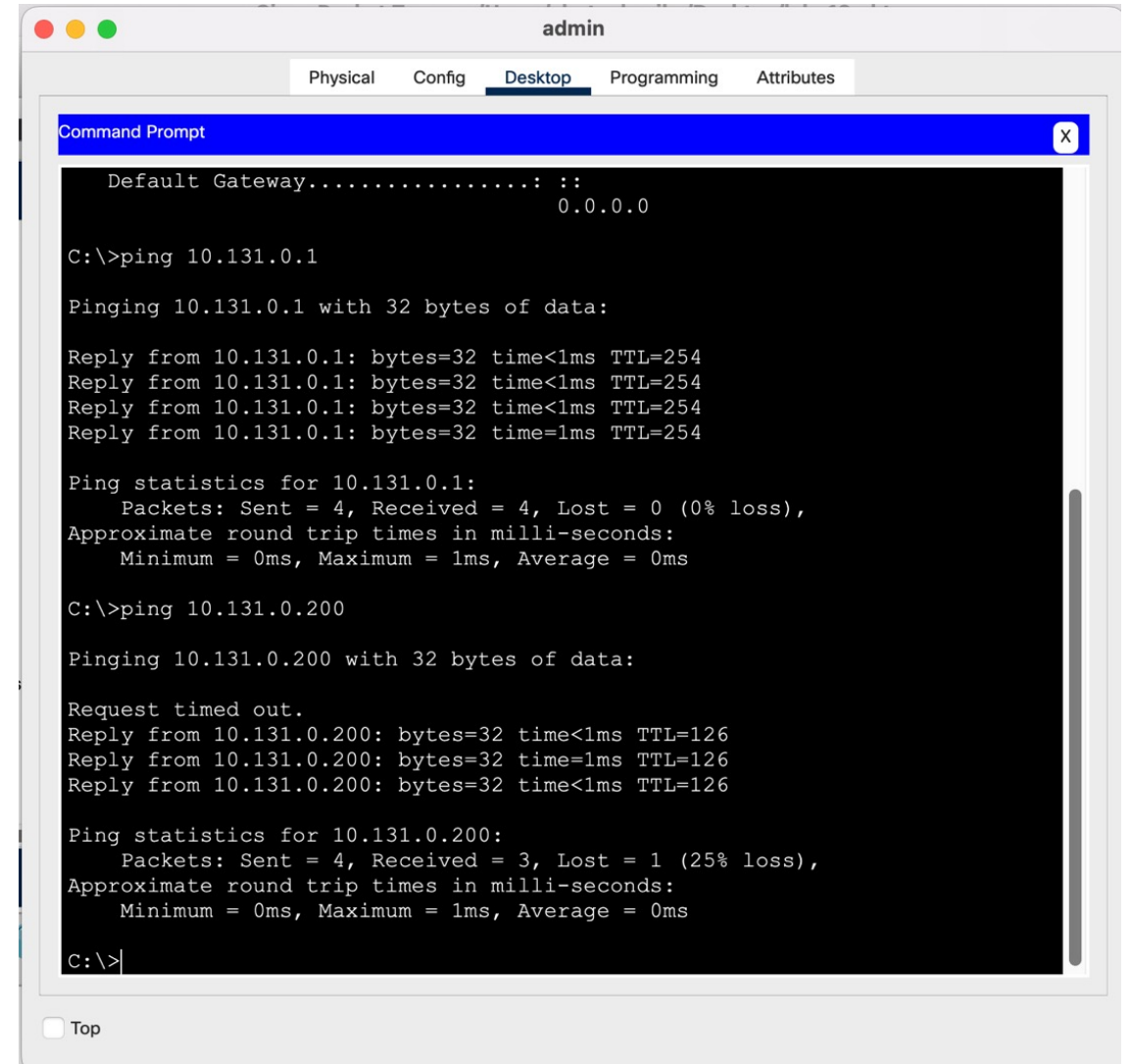
C:\>ping 10.131.0.1

Pinging 10.131.0.1 with 32 bytes of data:

Reply from 10.131.0.1: bytes=32 time<1ms TTL=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 = 1ms, Average = 0ms

C:\>
```



```
admin
Physical Config Desktop Programming Attributes

Command Prompt

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=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 = 1ms, Average = 0ms

C:\>ping 10.131.0.200

Pinging 10.131.0.200 with 32 bytes of data:

Request timed out.
Reply from 10.131.0.200: bytes=32 time<1ms TTL=126
Reply from 10.131.0.200: bytes=32 time=1ms TTL=126
Reply from 10.131.0.200: bytes=32 time<1ms TTL=126

Ping statistics for 10.131.0.200:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

# Итоги выполнения работы

1. В рабочей области размещен проект в соответствии с модельными предположениями оборудование для сети Университета г. Пиза.
2. В физической рабочей области проекта создан город Пиза, здание Университета г. Пиза. Туда перемещено соответствующее оборудование.
3. Сделана первоначальная настройка и настройка интерфейсов оборудования сети Университета г. Пиза.
4. Настроен VPN на основе протокола GRE.
5. Проверена доступность узлов сети Университета г. Пиза с ноутбука администратора сети «Донская».

# Вывод

- Я настроила получила навыки настройки VPN-туннеля через незащищённое Интернет-соединение.