IUS
INSTITUT
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DES SCIENCES

Faculté des Sciences et Technologie

(FST)

Niveau : L3-FST

Cours : Réseaux 2

Soumis au chargé de cours : Ismaël SAINT AMOUR

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Date : 18 Mai 2025

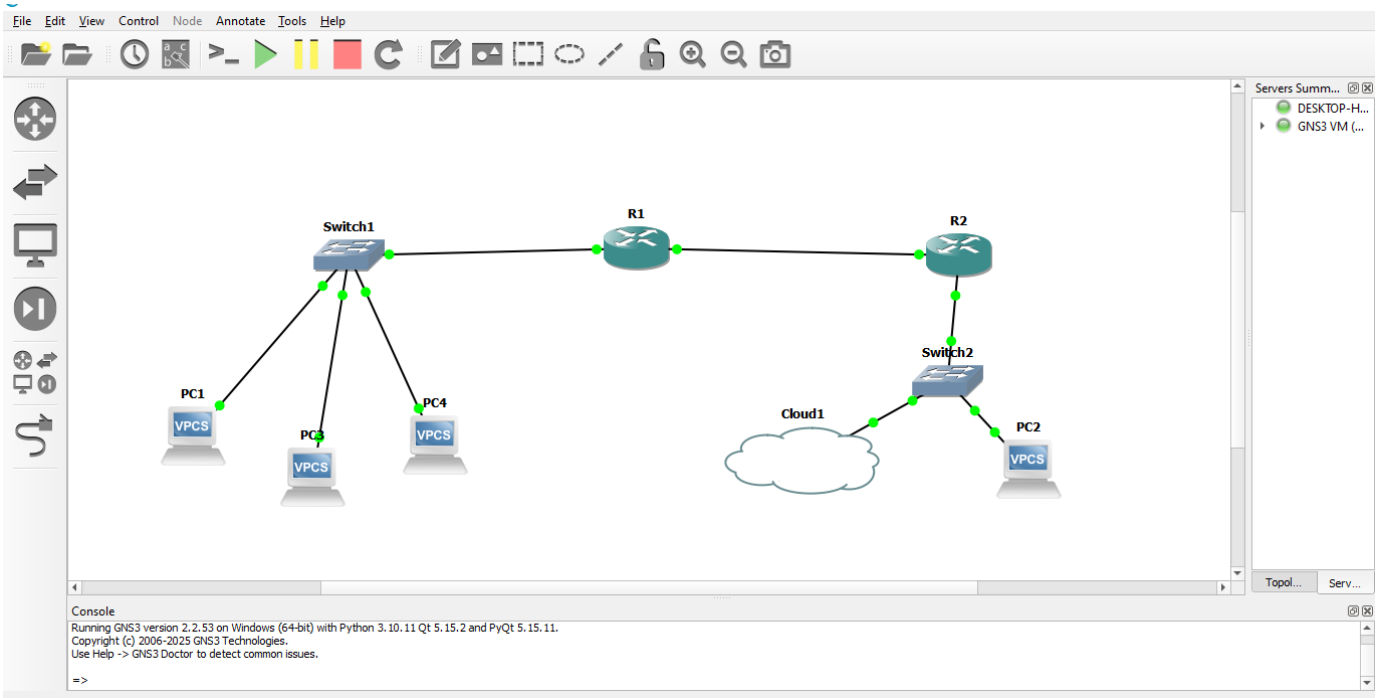
Configuration d’un VPN Site-à-Site avec GNS3 (IPSec) et VPN GRE over IPSec avec Routage Dynamique (OSPF)

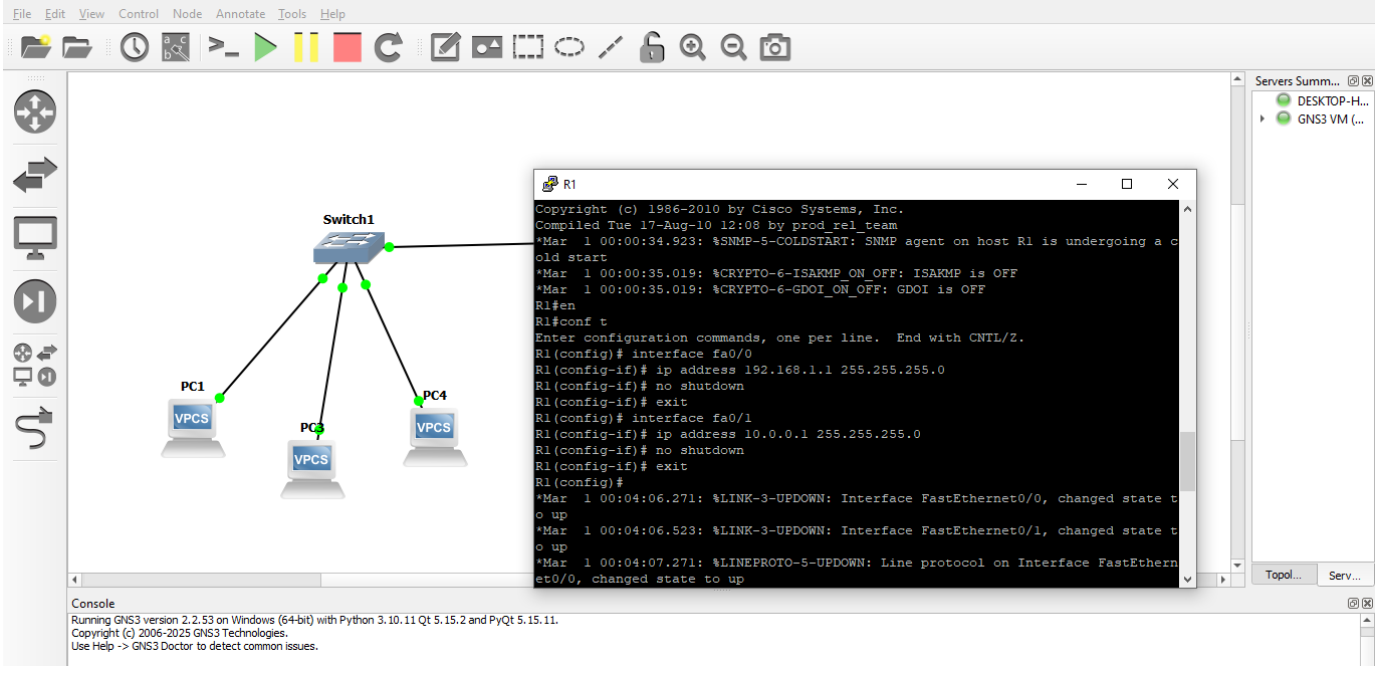
TD 6

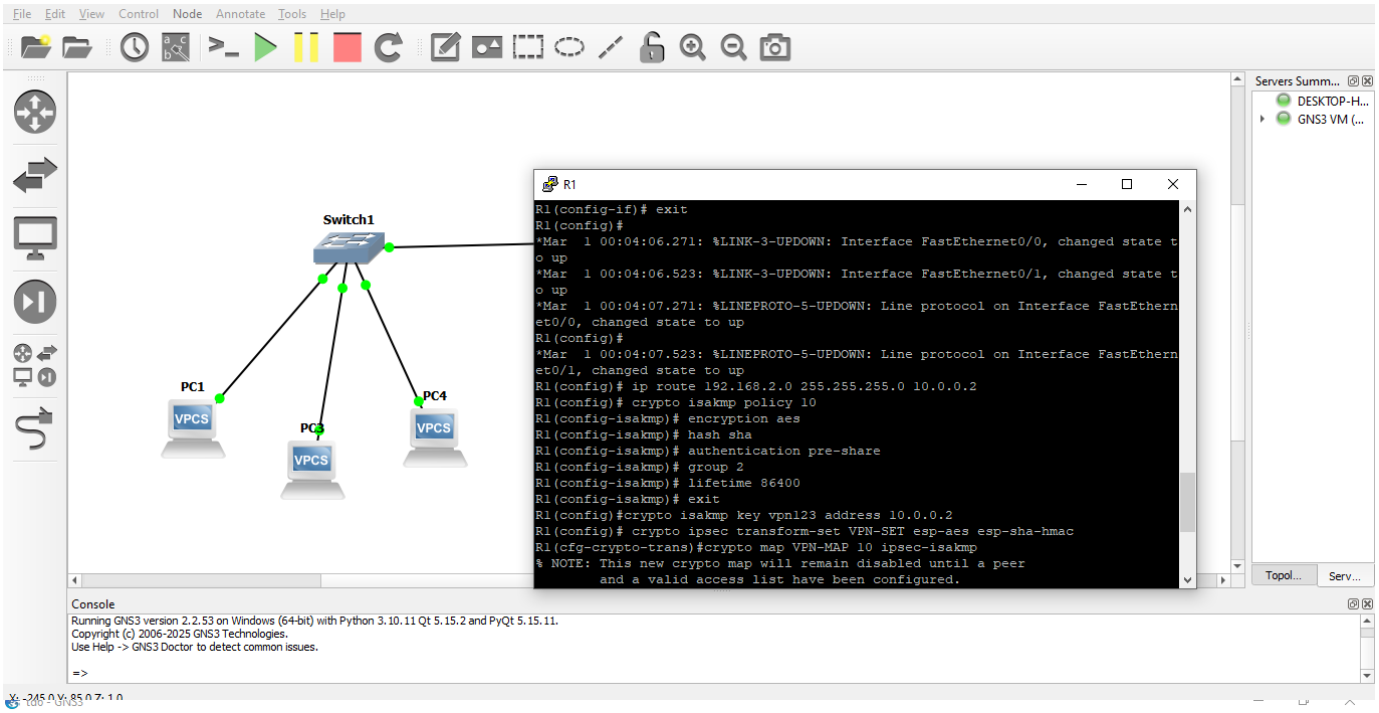
- ## Objectifs
  - Créer un VPN IPSec entre deux routeurs.
  - Assurer la confidentialité entre deux réseaux LAN.
  - Vérifier la connectivité et l’encapsulation des données.
  - Créer un tunnel GRE entre deux routeurs distants.
  - Sécuriser le tunnel avec **IPSec**.
  - Utiliser **OSPF** pour l’échange des routes à travers le tunnel.
  - Vérifier le chiffrement et la communication inter-sites.

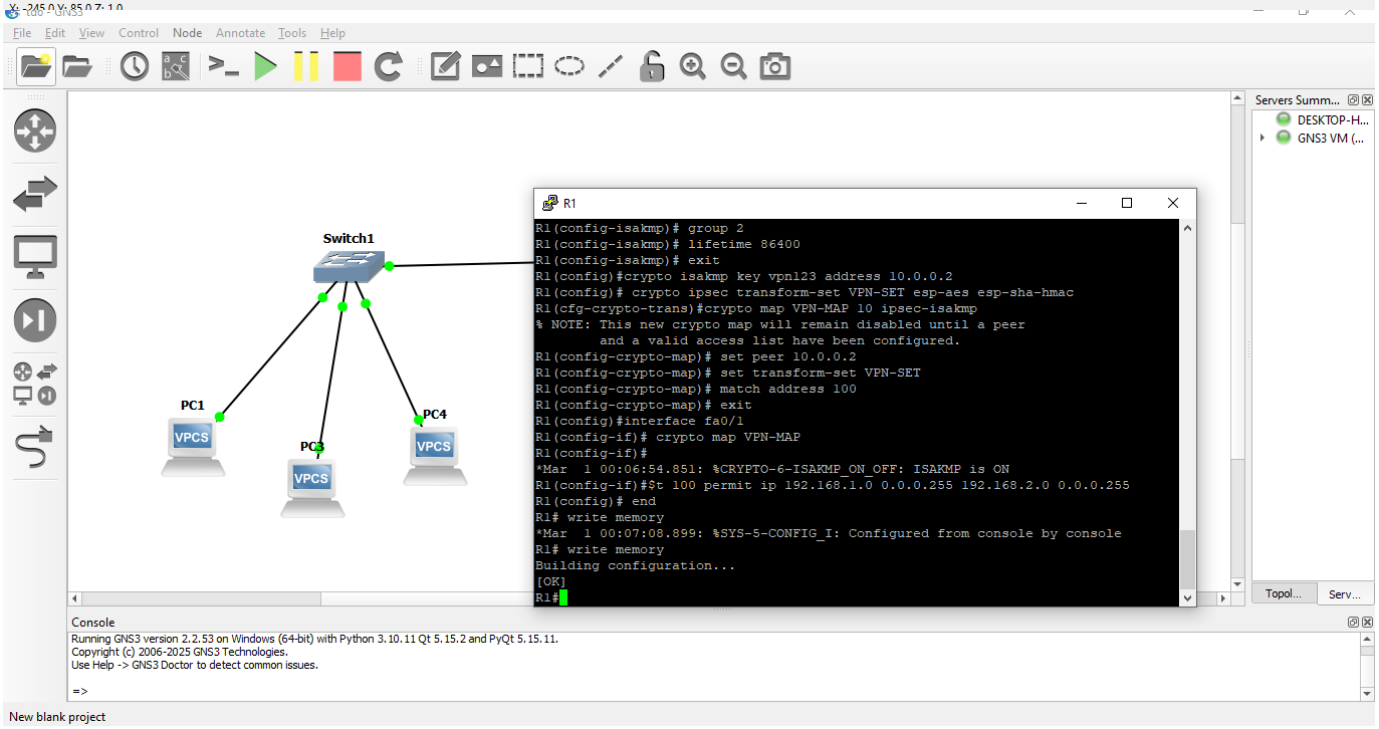
Travaux Dirigés

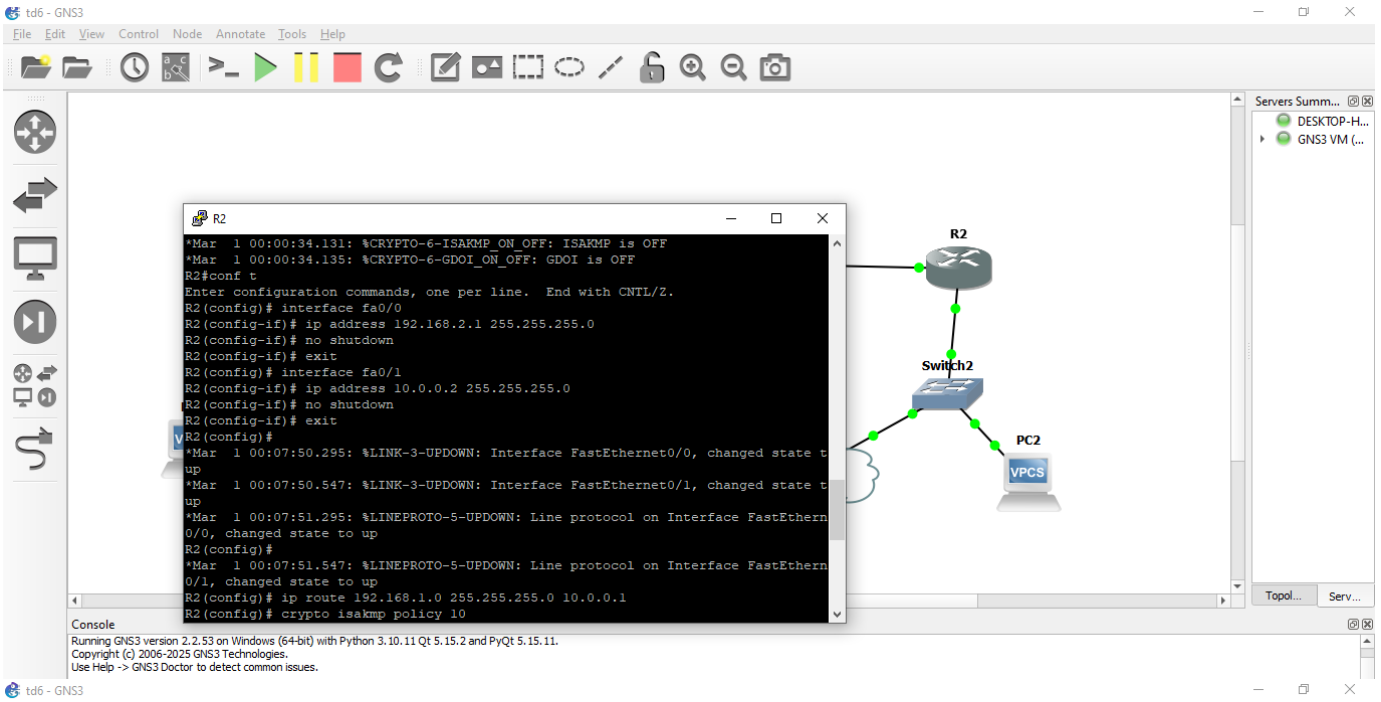
1. Reproduisez cette topologie en Configurant d'un VPN Site-à-Site

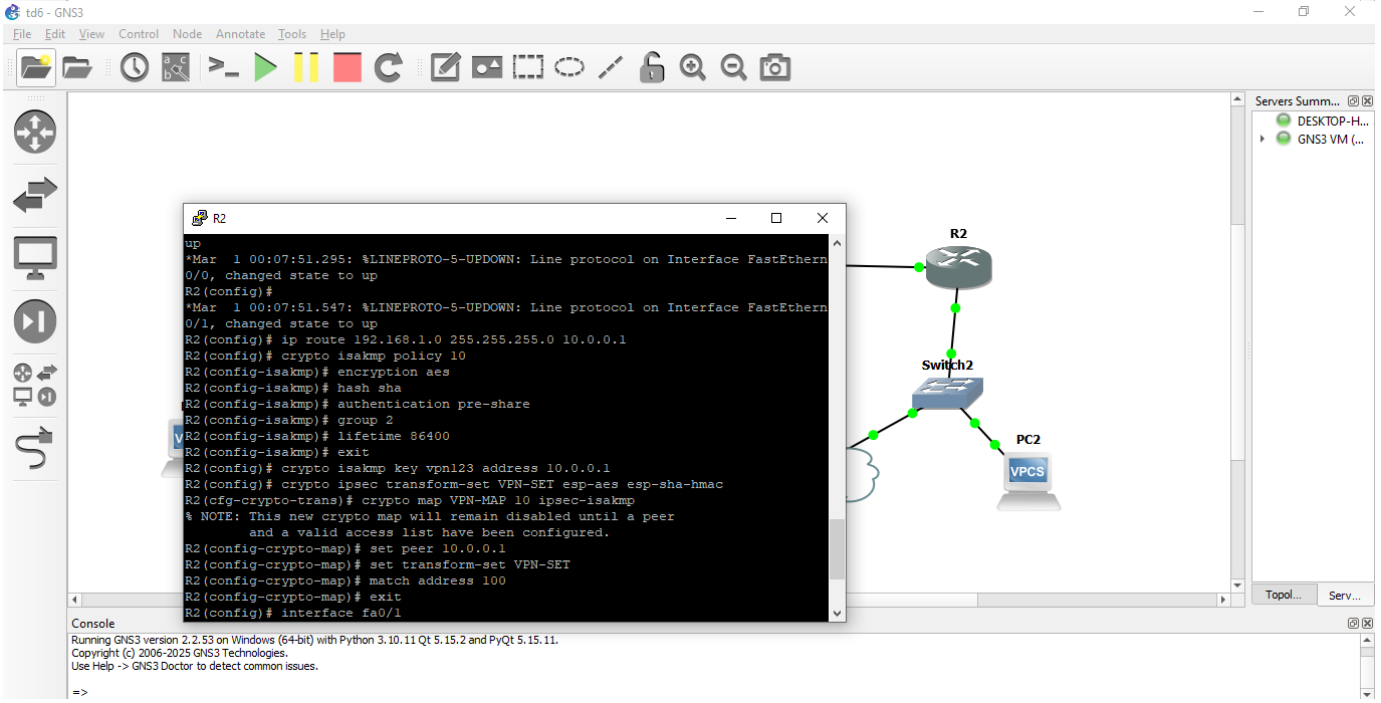


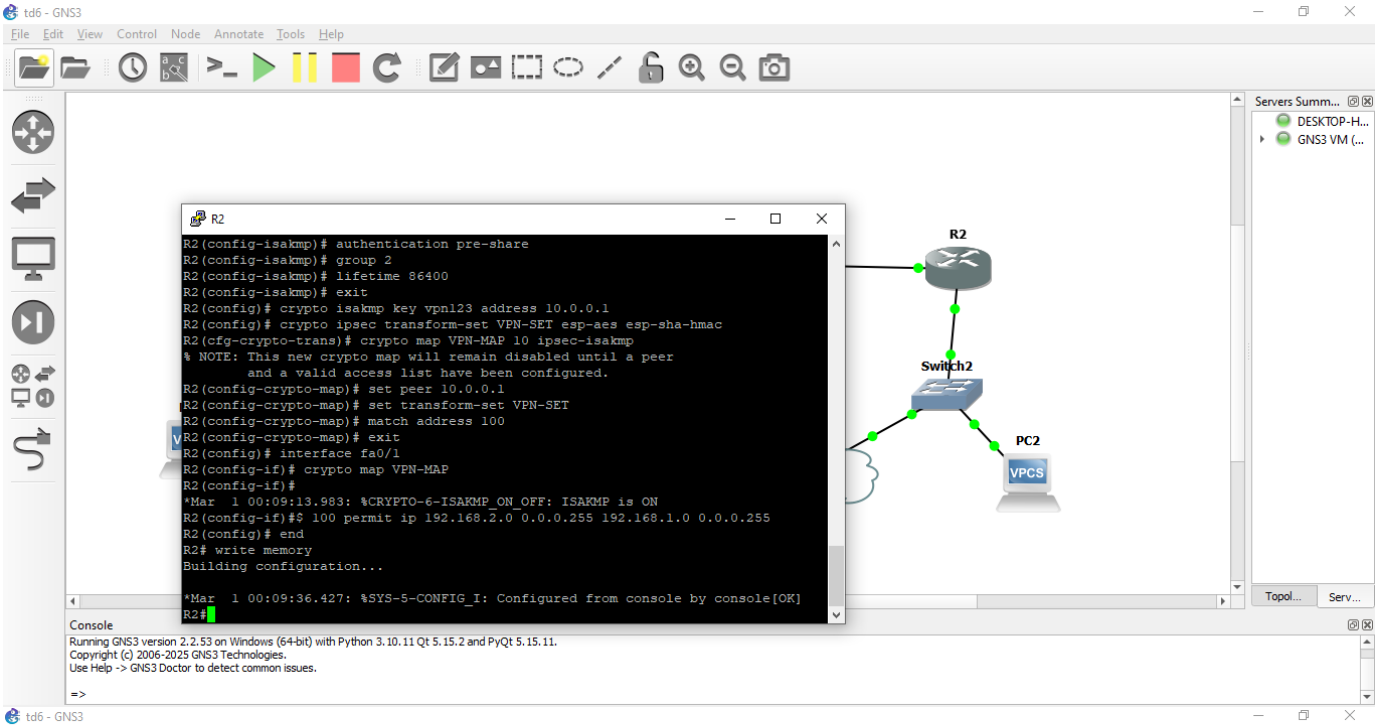


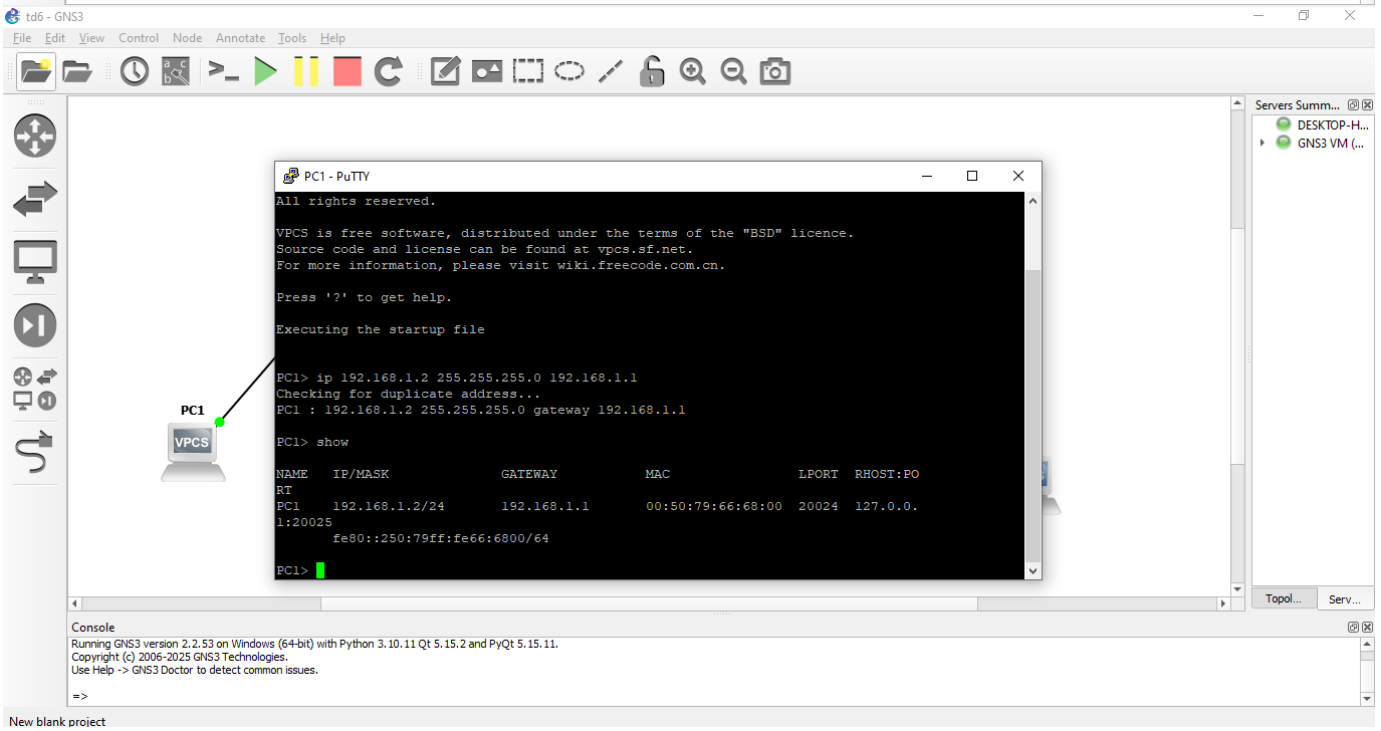

File Edit View Control Node Annotate Tools Help
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Switch1
PC1
PC3
PC4
VPCS
R1
R1(config-if)# exit
R1(config)#
*Mar 1 00:04:06.271: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
o up
*Mar 1 00:04:06.523: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state t
o up
*Mar 1 00:04:07.271: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et0/0, changed state to up
R1(config)#
*Mar 1 00:04:07.523: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
et0/1, changed state to up
R1(config)# ip route 192.168.2.0 255.255.255.0 10.0.0.2
R1(config)# crypto isakmp policy 10
R1(config-isakmp)# encryption aes
R1(config-isakmp)# hash sha
R1(config-isakmp)# authentication pre-share
R1(config-isakmp)# group 2
R1(config-isakmp)# lifetime 86400
R1(config-isakmp)# exit
R1(config)#crypto isakmp key vpn123 address 10.0.0.2
R1(config)# crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
R1(cfg-crypto-trans)#crypto map VPN-MAP 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

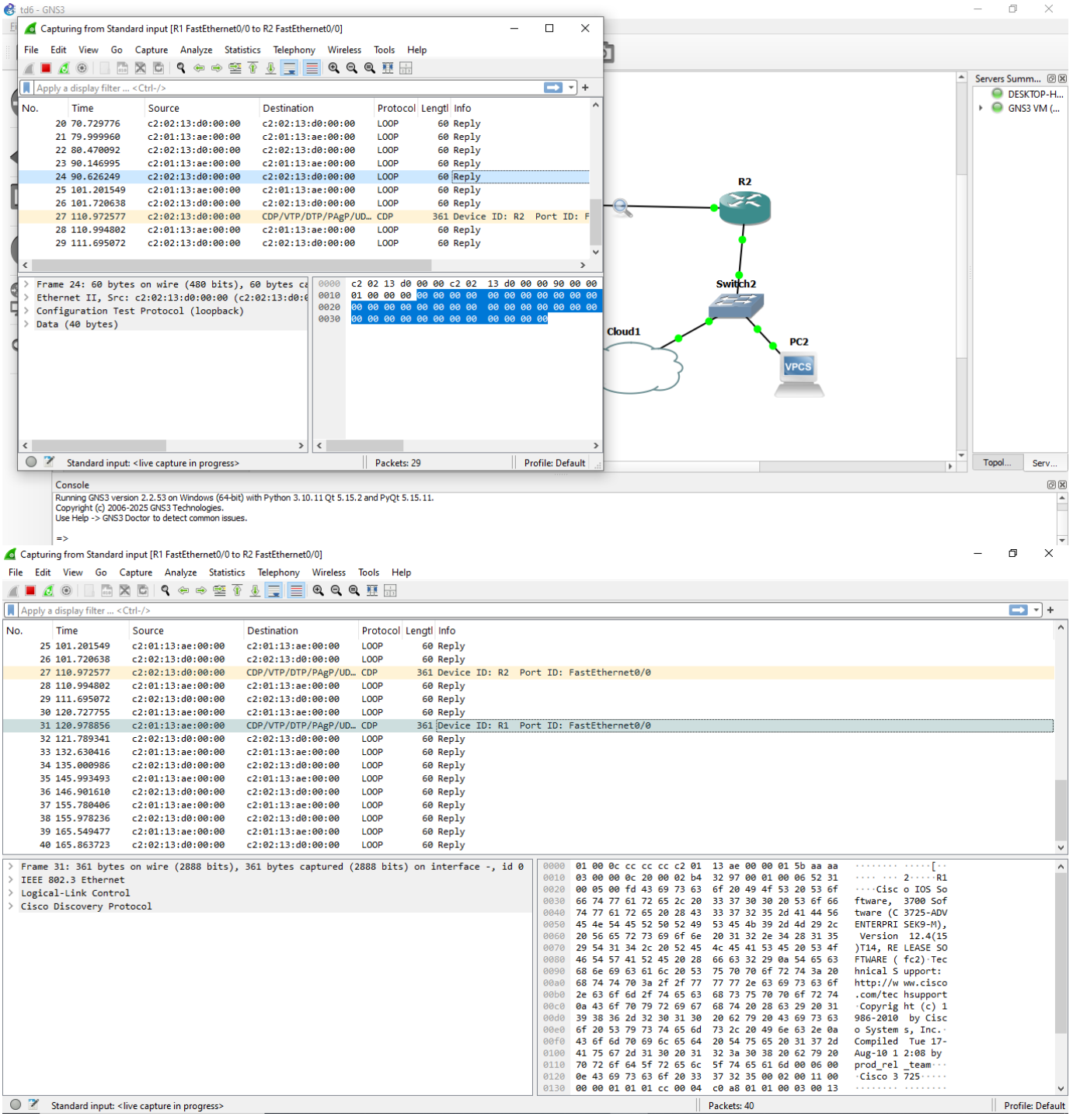

File Edit View Control Node Annotate Tools Help
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Switch1
PC1
PC3
PC4
VPCS
R1
R1(config-isakmp)# group 2
R1(config-isakmp)# lifetime 86400
R1(config-isakmp)# exit
R1(config)#crypto isakmp key vpn123 address 10.0.0.2
R1(config)# crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
R1(cfg-crypto-trans)#crypto map VPN-MAP 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
R1(config-crypto-map)# set peer 10.0.0.2
R1(config-crypto-map)# set transform-set VPN-SET
R1(config-crypto-map)# match address 100
R1(config-crypto-map)# exit
R1(config)#interface fa0/1
R1(config-if)# crypto map VPN-MAP
R1(config-if)#
*Mar 1 00:06:54.851: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
R1(config-if)#$t 100 permit ip 192.168.1.0 0.0.0.255 192.168.2.0 0.0.0.255
R1(config)# end
R1# write memory
*Mar 1 00:07:08.899: %SYS-5-CONFIG_I: Configured from console by console
R1# write memory
Building configuration...
[OK]
R1#
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>
New blank project


td6 - GNS3
File Edit View Control Node Annotate Tools Help
R2
*Mar 1 00:00:34.131: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is OFF
*Mar 1 00:00:34.135: %CRYPTO-6-GDOI_ON_OFF: GDOI is OFF
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)# interface fa0/0
R2(config-if)# ip address 192.168.2.1 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface fa0/1
R2(config-if)# ip address 10.0.0.2 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)#
*Mar 1 00:07:50.295: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
up
*Mar 1 00:07:50.547: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state t
up
*Mar 1 00:07:51.295: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/0, changed state to up
R2(config)#
*Mar 1 00:07:51.547: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/1, changed state to up
R2(config)# ip route 192.168.1.0 255.255.255.0 10.0.0.1
R2(config)# crypto isakmp policy 10
R2
Switch2
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.

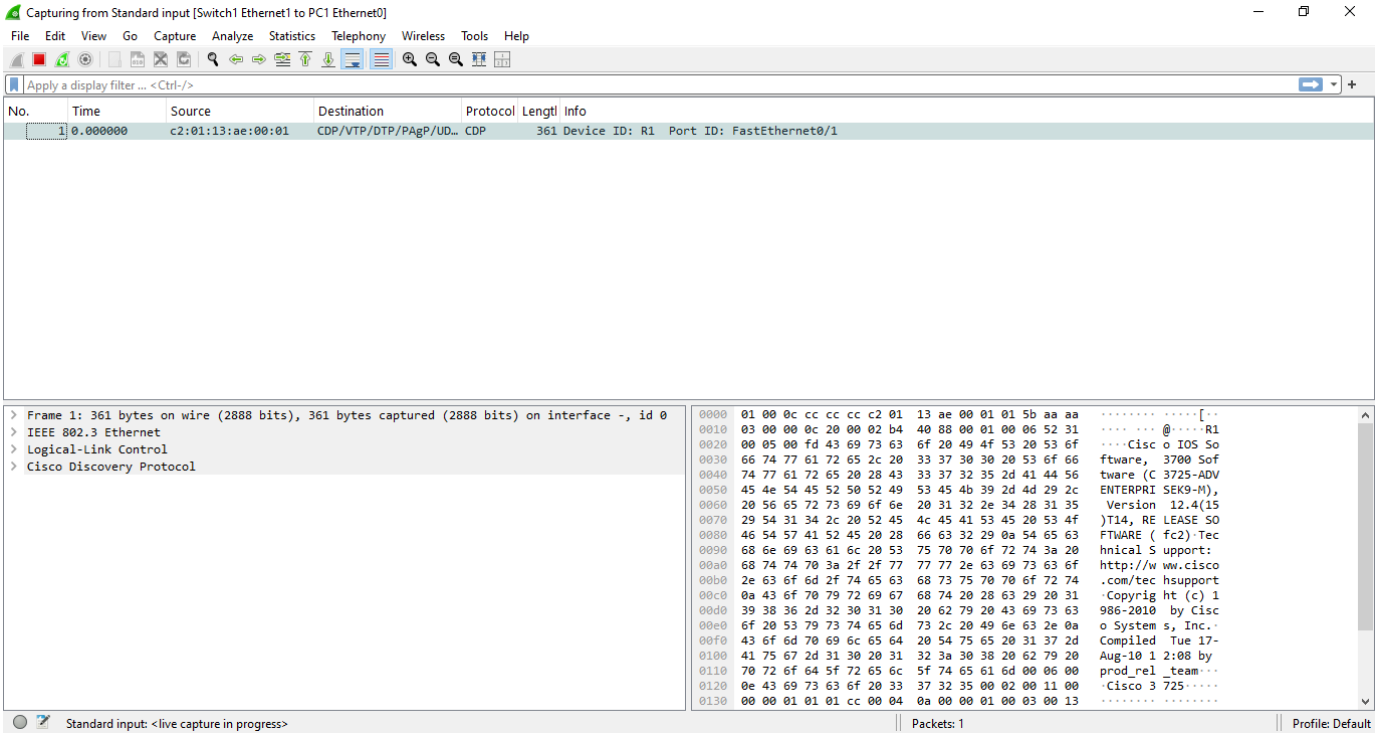

td6 - GNS3
File Edit View Control Node Annotate Tools Help
R2
up
*Mar 1 00:07:51.295: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/0, changed state to up
R2(config)#
*Mar 1 00:07:51.547: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/1, changed state to up
R2(config)# ip route 192.168.1.0 255.255.255.0 10.0.0.1
R2(config)# crypto isakmp policy 10
R2(config-isakmp)# encryption aes
R2(config-isakmp)# hash sha
R2(config-isakmp)# authentication pre-share
R2(config-isakmp)# group 2
R2(config-isakmp)# lifetime 86400
R2(config-isakmp)# exit
R2(config)# crypto isakmp key vpn123 address 10.0.0.1
R2(config)# crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
R2(cfg-crypto-trans)# crypto map VPN-MAP 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
R2(config-crypto-map)# set peer 10.0.0.1
R2(config-crypto-map)# set transform-set VPN-SET
R2(config-crypto-map)# match address 100
R2(config-crypto-map)# exit
R2(config)# interface fa0/1
R2
Switch2
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>


td6 - GNS3
File Edit View Control Node Annotate Tools Help
R2
R2(config-isakmp)# authentication pre-share
R2(config-isakmp)# group 2
R2(config-isakmp)# lifetime 86400
R2(config-isakmp)# exit
R2(config)# crypto isakmp key vpn123 address 10.0.0.1
R2(config)# crypto ipsec transform-set VPN-SET esp-aes esp-sha-hmac
R2(cfg-crypto-trans)# crypto map VPN-MAP 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
R2(config-crypto-map)# set peer 10.0.0.1
R2(config-crypto-map)# set transform-set VPN-SET
R2(config-crypto-map)# match address 100
R2(config-crypto-map)# exit
R2(config)# interface fa0/1
R2(config-if)# crypto map VPN-MAP
R2(config-if)#
*Mar 1 00:09:13.983: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
R2(config-if)#$ 100 permit ip 192.168.2.0 0.0.0.255 192.168.1.0 0.0.0.255
R2(config)# end
R2# write memory
Building configuration...
*Mar 1 00:09:36.427: %SYS-5-CONFIG_I: Configured from console by console[OK]
R2#
R2
Switch2
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

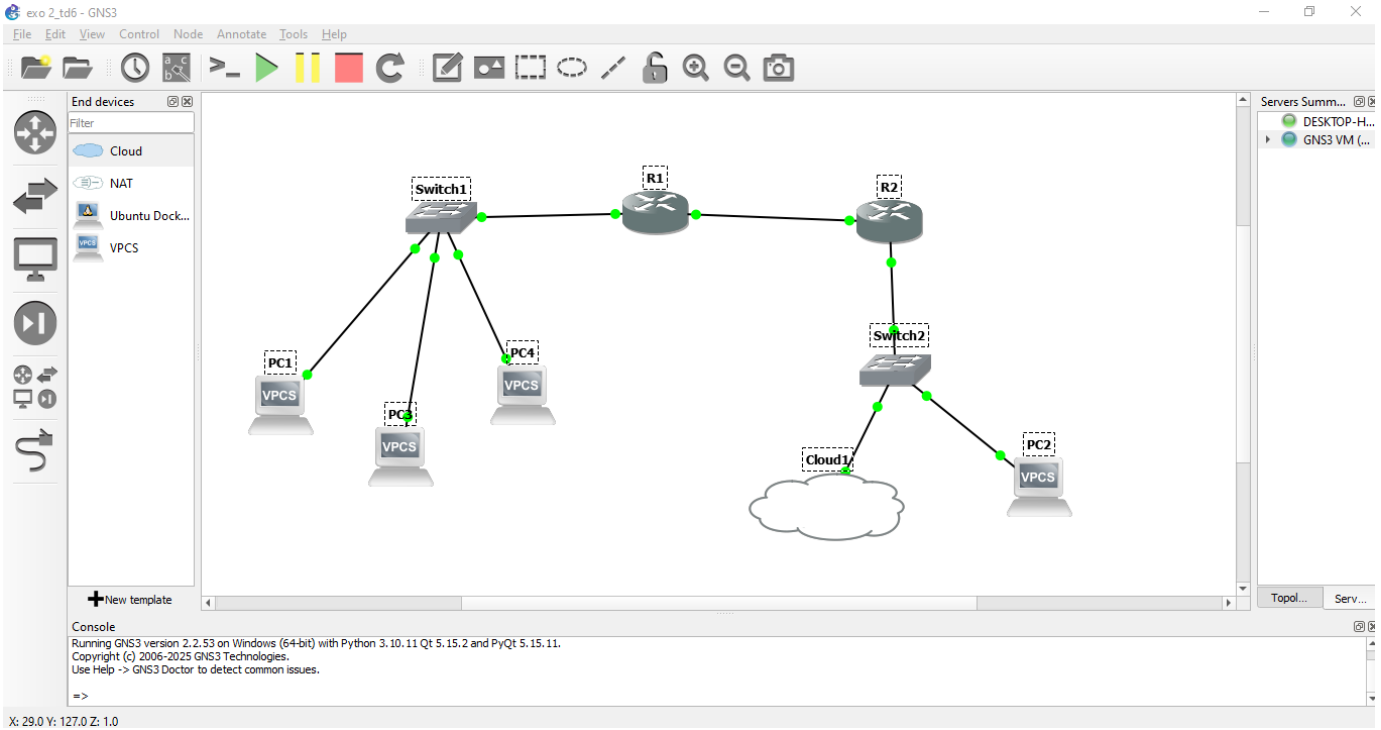

td6 - GNS3
File Edit View Control Node Annotate Tools Help
PC1 - PuTTY
All rights reserved.
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
PC1> ip 192.168.1.2 255.255.255.0 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.2 255.255.255.0 gateway 192.168.1.1
PC1> show
NAME IP/MASK GATEWAY MAC LPORT RHOST:PO
RT
PC1 192.168.1.2/24 192.168.1.1 00:50:79:66:68:00 20024 127.0.0.
1:20025
fe80::250:79ff:fe66:6800/64
PC1>
PC1
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>
New blank project

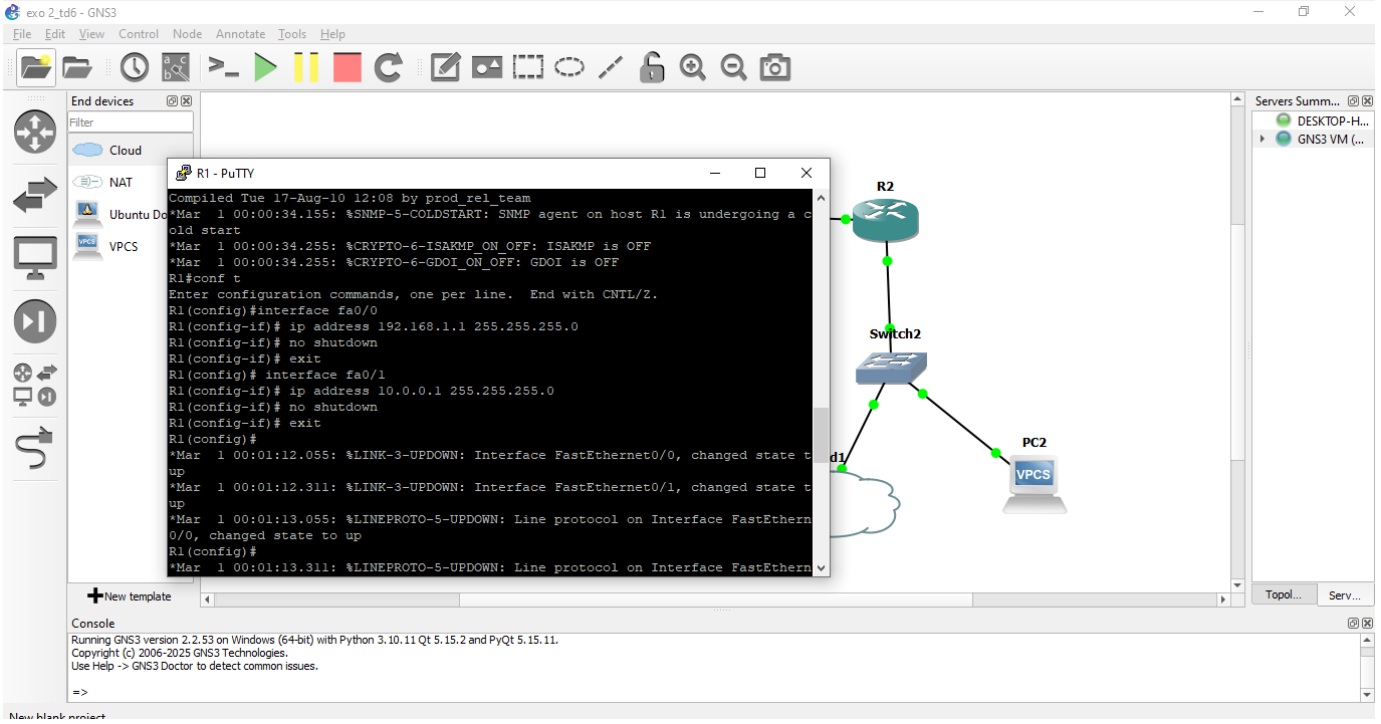

td6 - GNS3
Capturing from Standard input [R1 FastEthernet0/0 to R2 FastEthernet0/0]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
No. Time Source Destination Protocol Lengtl Info
20 70.729776 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
21 79.999960 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
22 80.470092 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
23 90.146995 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
24 90.626249 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
25 101.201549 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
26 101.720638 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
27 110.972577 c2:02:13:d0:00:00 CDP/VTP/DTP/PAgP/UD… CDP 361 Device ID: R2 Port ID: F
28 110.994802 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
29 111.695072 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
Frame 24: 60 bytes on wire (480 bits), 60 bytes ca
Ethernet II, Src: c2:02:13:d0:00:00 (c2:02:13:d0:0
Configuration Test Protocol (loopback)
Data (40 bytes)
0000 c2 02 13 d0 00 00 c2 02 13 d0 00 00 90 00 00
0010 01 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0020 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
0030 00 00 00 00 00 00 00 00 00 00 00 00
Standard input: <live capture in progress>
Packets: 29
Profile: Default
R2
Switch2
Cloud1
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

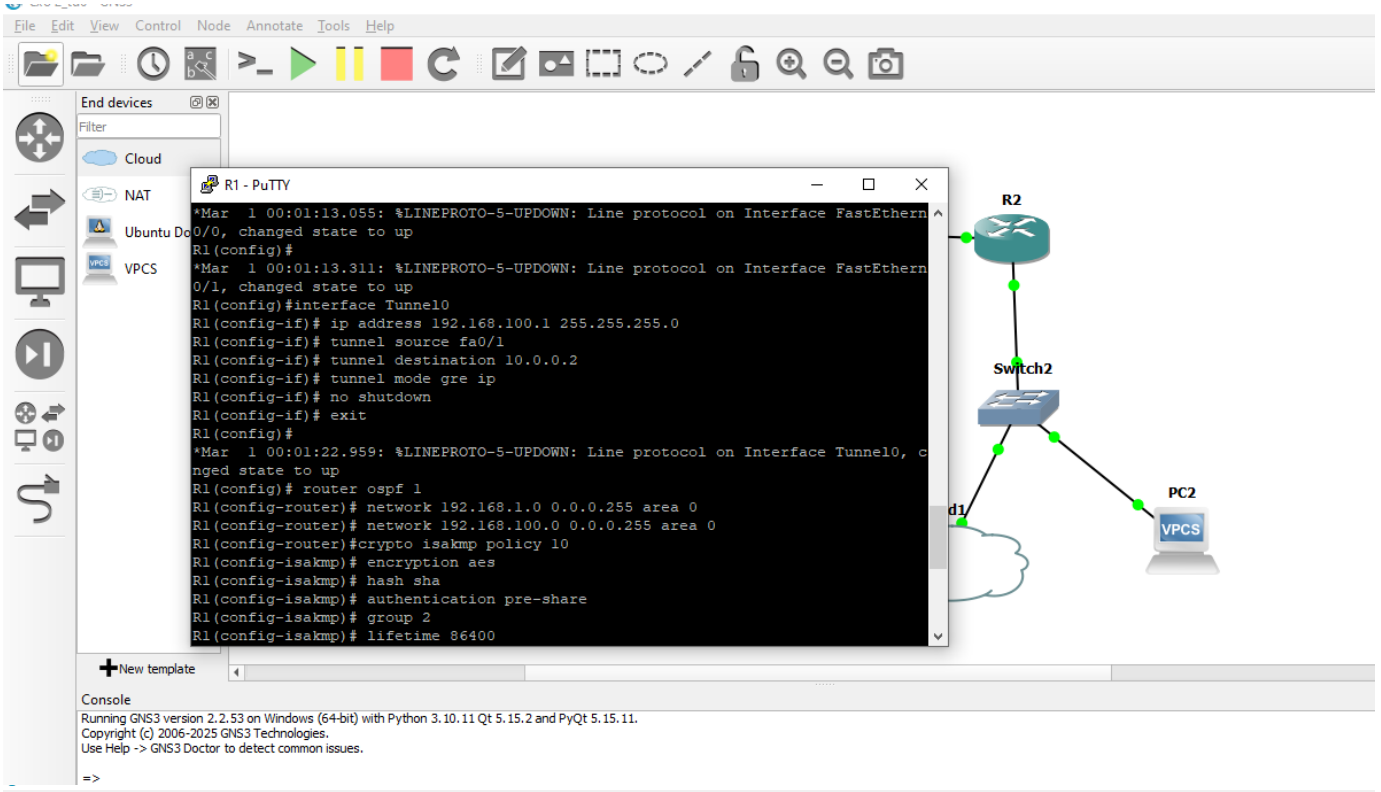
Capturing from Standard input [R1 FastEthernet0/0 to R2 FastEthernet0/0]
File Edit View Go Capture Analyze Statistics Telephony Wireless Tools Help
Apply a display filter ... <Ctrl-/>
No. Time Source Destination Protocol Lengtl Info
25 101.201549 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
26 101.720638 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
27 110.972577 c2:02:13:d0:00:00 CDP/VTP/DTP/PAgP/UD… CDP 361 Device ID: R2 Port ID: FastEthernet0/0
28 110.994802 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
29 111.695072 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
30 120.727755 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
31 120.978856 c2:01:13:ae:00:00 CDP/VTP/DTP/PAgP/UD… CDP 361 Device ID: R1 Port ID: FastEthernet0/0
32 121.789341 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
33 132.630416 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
34 135.000986 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
35 145.993493 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
36 146.901610 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
37 155.780406 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
38 155.978236 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
39 165.549477 c2:01:13:ae:00:00 c2:01:13:ae:00:00 LOOP 60 Reply
40 165.863723 c2:02:13:d0:00:00 c2:02:13:d0:00:00 LOOP 60 Reply
Frame 31: 361 bytes on wire (2888 bits), 361 bytes captured (2888 bits) on interface -, id 0
IEEE 802.3 Ethernet
Logical-Link Control
Cisco Discovery Protocol
0000 01 00 0c cc cc cc c2 01 13 ae 00 00 01 5b aa aa
0010 03 00 00 0c 20 00 02 b4 32 97 00 01 00 06 52 31
0020 00 05 00 fd 43 69 73 63 6f 20 49 4f 53 20 53 6f
0030 66 74 77 61 72 65 2c 20 33 37 30 30 20 53 6f 66
0040 74 77 61 72 65 20 28 43 33 37 32 35 2d 41 44 56
0050 45 4e 54 45 52 50 52 49 53 45 4b 39 2d 4d 29 2c
0060 20 56 65 72 73 69 6f 6e 20 31 32 2e 34 28 31 35
0070 29 54 31 34 2c 20 52 45 4c 45 41 53 45 20 53 4f
0080 46 54 57 41 52 45 20 28 66 63 32 29 0a 54 65 63
0090 68 6e 69 63 61 6c 20 53 75 70 70 6f 72 74 3a 20
00a0 68 74 74 70 3a 2f 2f 77 77 77 2e 63 69 73 63 6f
00b0 2e 63 6f 6d 2f 74 65 63 68 73 75 70 70 6f 72 74
00c0 0a 43 6f 70 79 72 69 67 68 74 20 28 63 29 20 31
00d0 39 38 36 2d 32 30 31 30 20 62 79 20 43 69 73 63
00e0 6f 20 53 79 73 74 65 6d 73 2c 20 49 6e 63 2e 0a
00f0 43 6f 6d 70 69 6c 65 64 20 54 75 65 20 31 37 2d
0100 41 75 67 2d 31 30 20 31 32 3a 30 38 20 62 79 20
0110 70 72 6f 64 5f 72 65 6c 5f 74 65 61 6d 00 06 00
0120 0e 43 69 73 63 6f 20 33 37 32 35 00 02 00 11 00
0130 00 00 01 01 01 cc 00 04 c0 a8 01 01 00 03 00 13
Standard input: <live capture in progress>
Packets: 40
Profile: Default

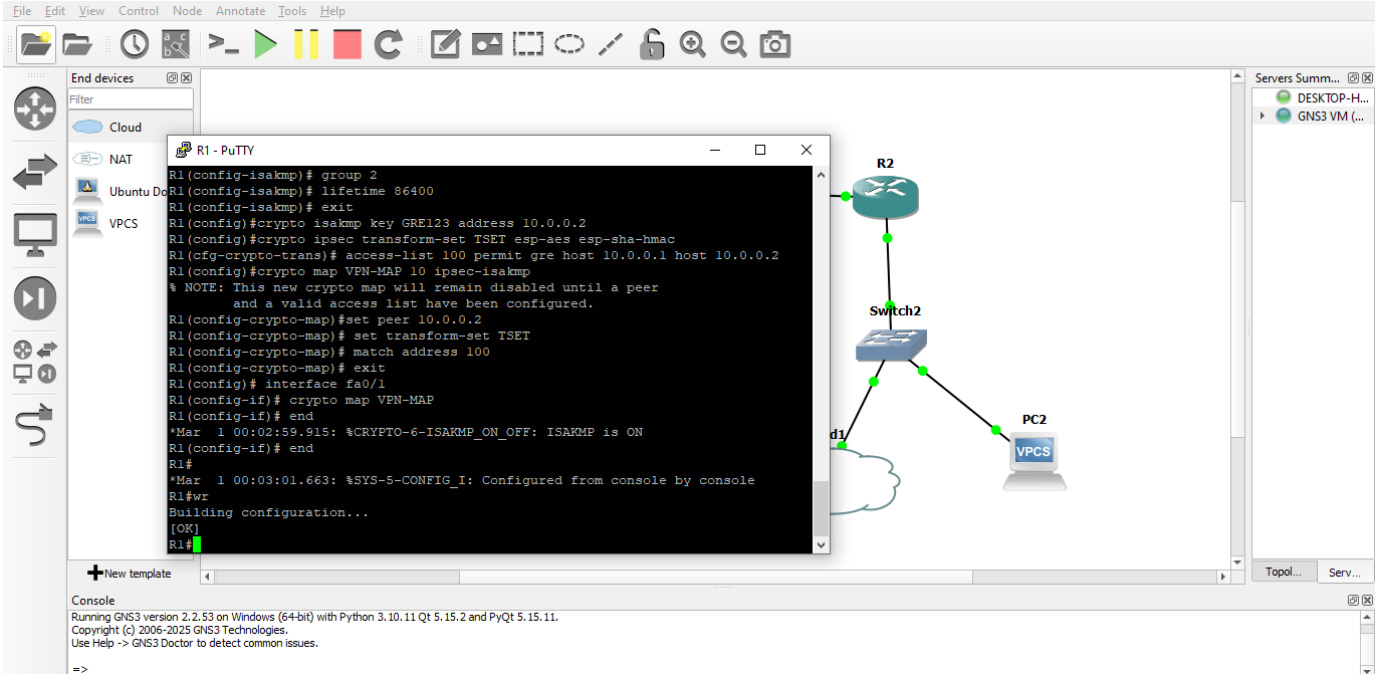


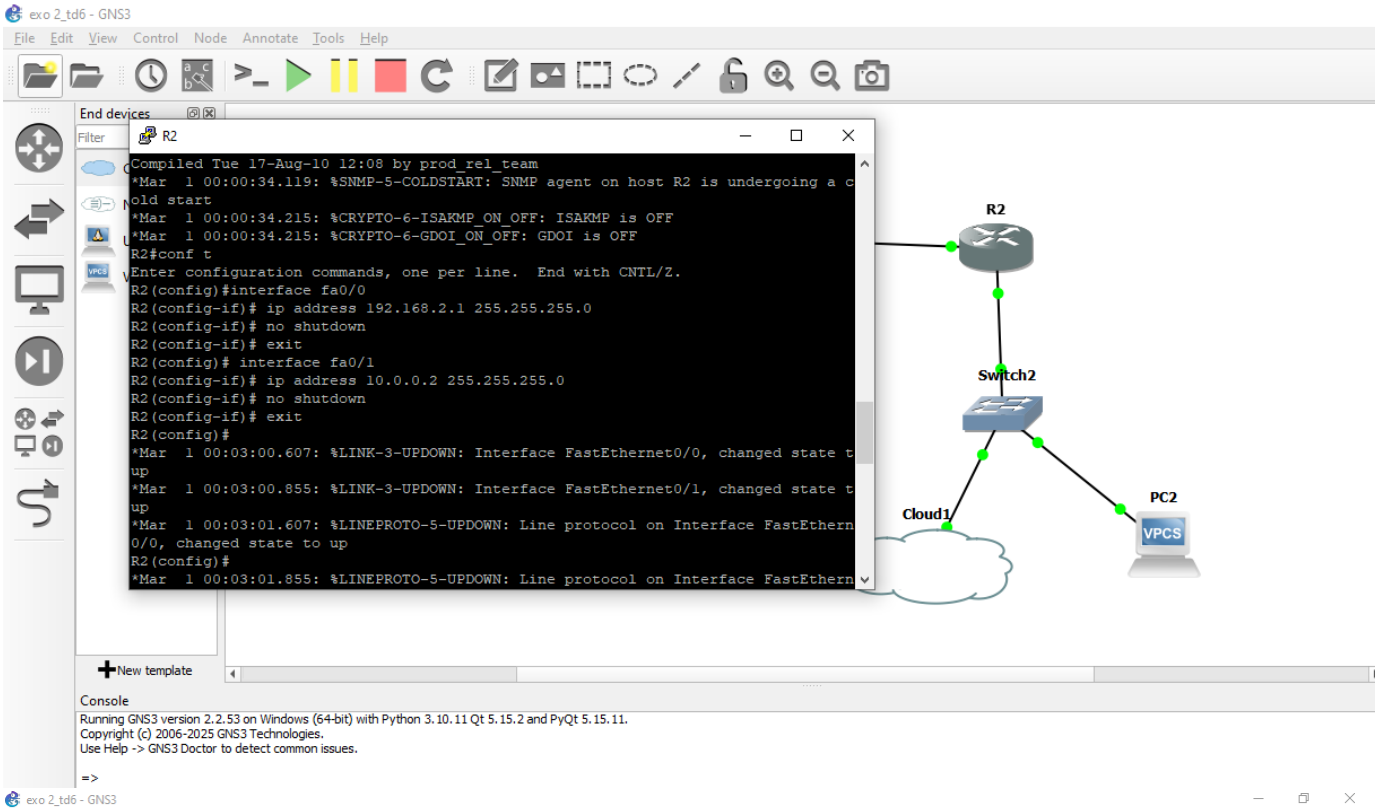
2-Reproduisez cette topologie en Configurant VPN GRE over IPSec avec Routage Dynamique (OSPF)

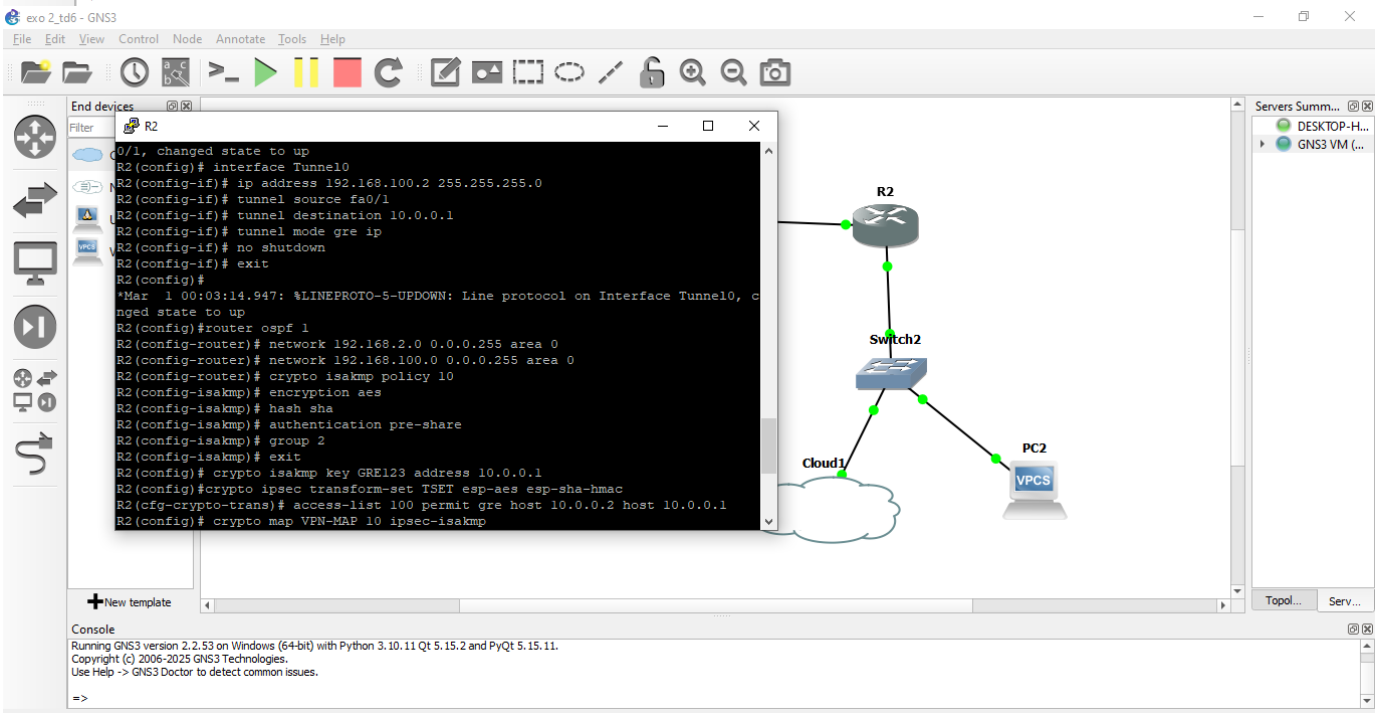

exo 2_td6 - GNS3
File Edit View Control Node Annotate Tools Help
End devices
Filter
Cloud
NAT
Ubuntu Dock...
VPCS
New template
Switch1
R1
R2
Switch2
PC1
PC2
PC3
PC4
Cloud1
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>
X: 29.0 Y: 127.0 Z: 1.0

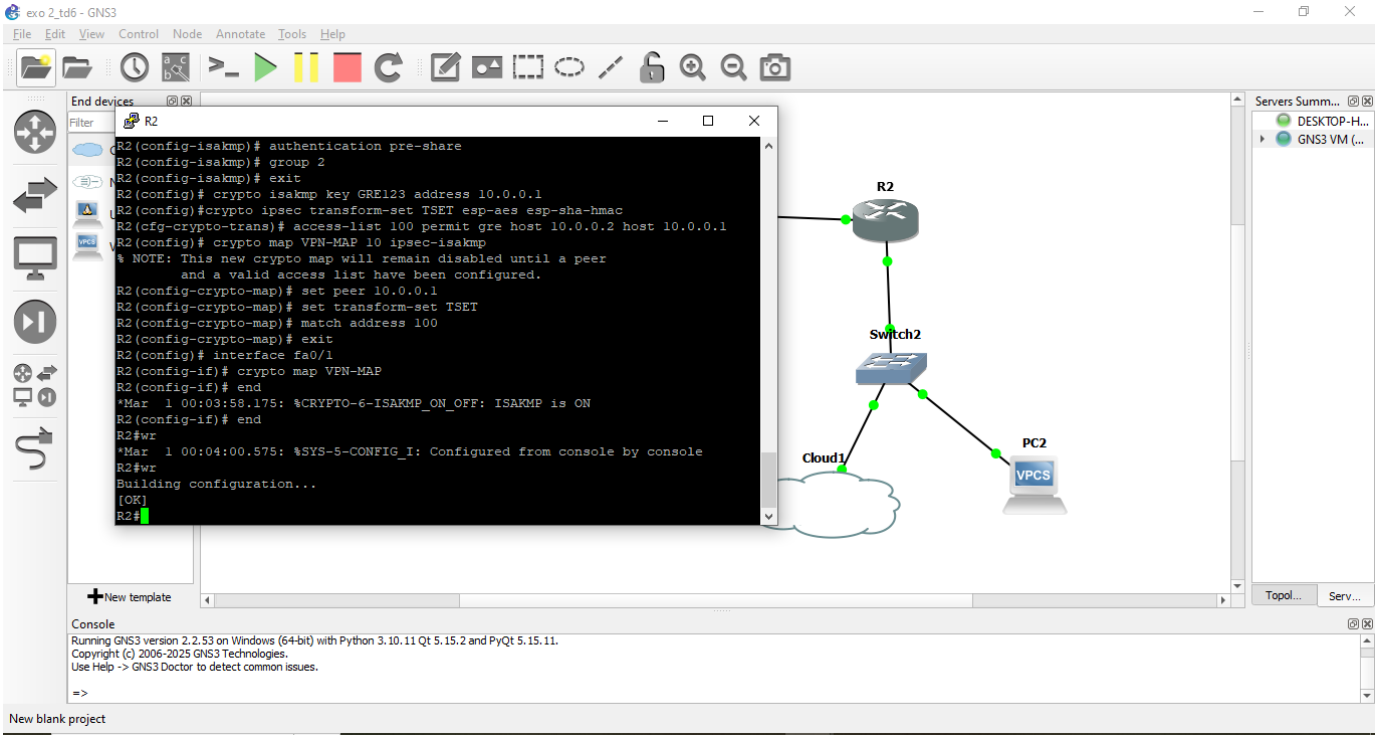

exo 2_td6 - GNS3
File Edit View Control Node Annotate Tools Help
End devices
Cloud
NAT
VPCS
New template
R1 - PuTTY
Compiled Tue 17-Aug-10 12:08 by prod_rel_team
*Mar 1 00:00:34.155: %SNMP-5-COLDSTART: SNMP agent on host R1 is undergoing a c
old start
*Mar 1 00:00:34.255: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is OFF
*Mar 1 00:00:34.255: %CRYPTO-6-GDOI_ON_OFF: GDOI is OFF
R1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface fa0/0
R1(config-if)# ip address 192.168.1.1 255.255.255.0
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)# interface fa0/1
R1(config-if)# ip address 10.0.0.1 255.255.255.0
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#
*Mar 1 00:01:12.055: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
up
*Mar 1 00:01:12.311: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state t
up
*Mar 1 00:01:13.055: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/0, changed state to up
R1(config)#
*Mar 1 00:01:13.311: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
R2
Switch2
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>
New blank project


File Edit View Control Node Annotate Tools Help
End devices
Filter
Cloud
NAT
Ubuntu Do
VPCS
R1 - PuTTY
*Mar 1 00:01:13.055: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/0, changed state to up
R1(config)#
*Mar 1 00:01:13.311: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/1, changed state to up
R1(config)#interface Tunnel0
R1(config-if)# ip address 192.168.100.1 255.255.255.0
R1(config-if)# tunnel source fa0/1
R1(config-if)# tunnel destination 10.0.0.2
R1(config-if)# tunnel mode gre ip
R1(config-if)# no shutdown
R1(config-if)# exit
R1(config)#
*Mar 1 00:01:22.959: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, c
nged state to up
R1(config)# router ospf 1
R1(config-router)# network 192.168.1.0 0.0.0.255 area 0
R1(config-router)# network 192.168.100.0 0.0.0.255 area 0
R1(config-router)#crypto isakmp policy 10
R1(config-isakmp)# encryption aes
R1(config-isakmp)# hash sha
R1(config-isakmp)# authentication pre-share
R1(config-isakmp)# group 2
R1(config-isakmp)# lifetime 86400
R2
Switch2
PC2
VPCS
New template
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

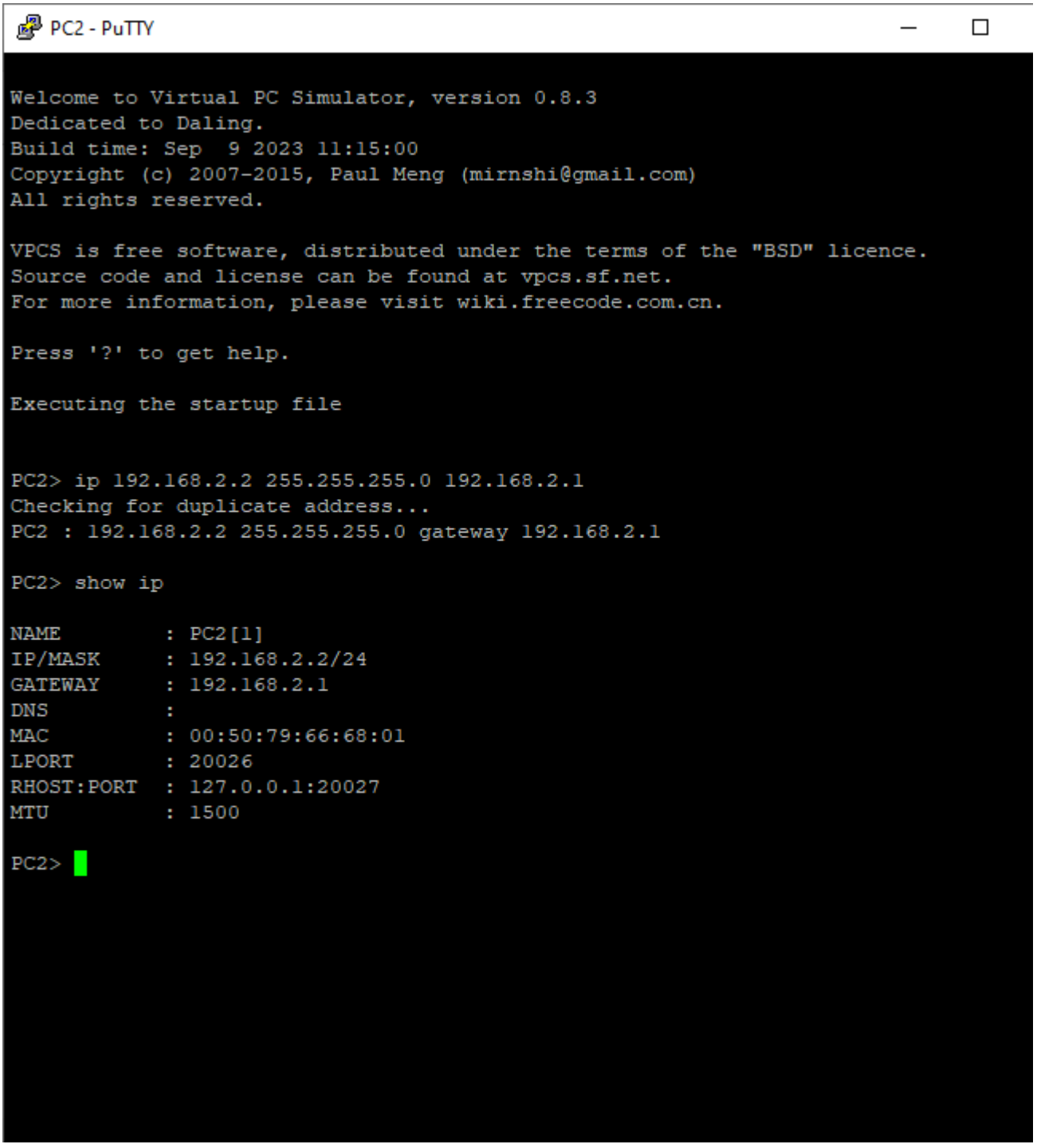

File Edit View Control Node Annotate Tools Help
End devices
Filter
Cloud
NAT
Ubuntu Do
VPCS
R1 - PuTTY
R1(config-isakmp)# group 2
R1(config-isakmp)# lifetime 86400
R1(config-isakmp)# exit
R1(config)#crypto isakmp key GRE123 address 10.0.0.2
R1(config)#crypto ipsec transform-set TSET esp-aes esp-sha-hmac
R1(cfg-crypto-trans)# access-list 100 permit gre host 10.0.0.1 host 10.0.0.2
R1(config)#crypto map VPN-MAP 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
R1(config-crypto-map)#set peer 10.0.0.2
R1(config-crypto-map)# set transform-set TSET
R1(config-crypto-map)# match address 100
R1(config-crypto-map)# exit
R1(config)# interface fa0/1
R1(config-if)# crypto map VPN-MAP
R1(config-if)# end
*Mar 1 00:02:59.915: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
R1(config-if)# end
R1#
*Mar 1 00:03:01.663: %SYS-5-CONFIG_I: Configured from console by console
R1#wr
Building configuration...
[OK]
R1#
R2
Switch2
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
New template
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

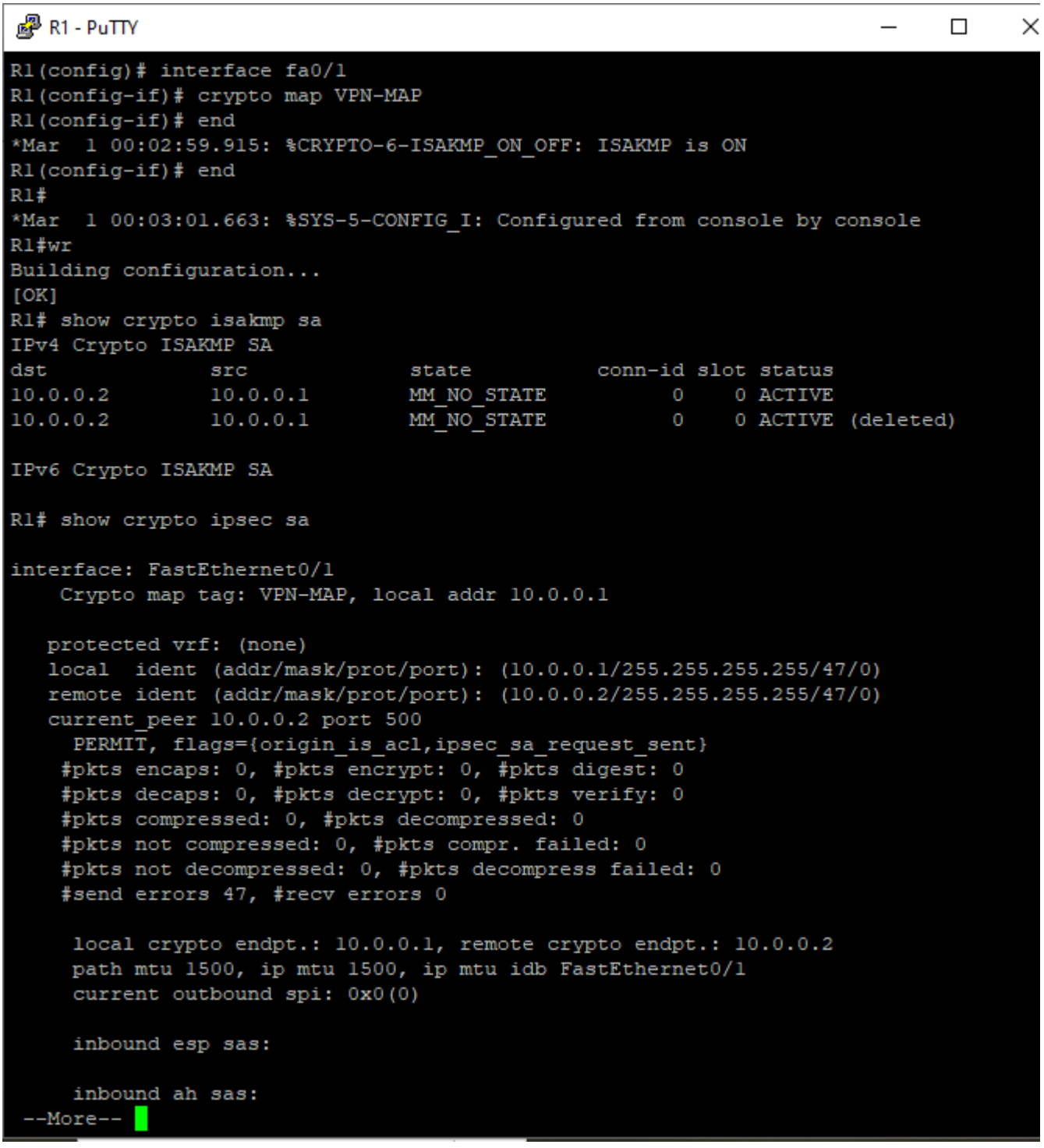

exo 2_td6 - GNS3
File Edit View Control Node Annotate Tools Help
End devices
Filter
R2
Compiled Tue 17-Aug-10 12:08 by prod_rel_team
*Mar 1 00:00:34.119: %SNMP-5-COLDSTART: SNMP agent on host R2 is undergoing a c
old start
*Mar 1 00:00:34.215: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is OFF
*Mar 1 00:00:34.215: %CRYPTO-6-GDOI_ON_OFF: GDOI is OFF
R2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R2(config)#interface fa0/0
R2(config-if)# ip address 192.168.2.1 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)# interface fa0/1
R2(config-if)# ip address 10.0.0.2 255.255.255.0
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)#
*Mar 1 00:03:00.607: %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state t
up
*Mar 1 00:03:00.855: %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state t
up
*Mar 1 00:03:01.607: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
0/0, changed state to up
R2(config)#
*Mar 1 00:03:01.855: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthern
R2
Switch2
Cloud1
PC2
VPCS
New template
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

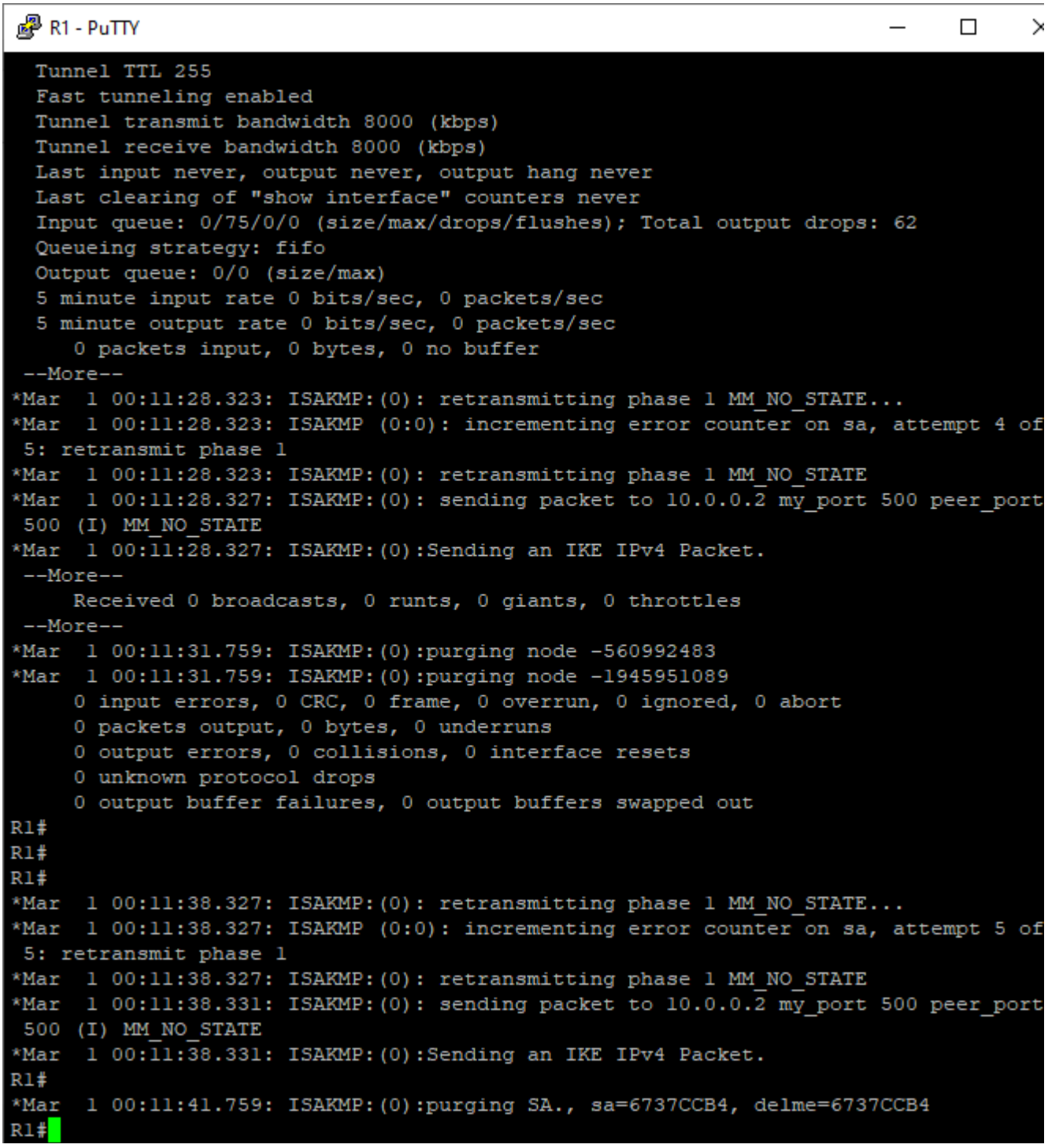

exo 2_td6 - GNS3
File Edit View Control Node Annotate Tools Help
End devices
Filter
R2
0/1, changed state to up
R2(config)# interface Tunnel0
R2(config-if)# ip address 192.168.100.2 255.255.255.0
R2(config-if)# tunnel source fa0/1
R2(config-if)# tunnel destination 10.0.0.1
R2(config-if)# tunnel mode gre ip
R2(config-if)# no shutdown
R2(config-if)# exit
R2(config)#
*Mar 1 00:03:14.947: %LINEPROTO-5-UPDOWN: Line protocol on Interface Tunnel0, c
nged state to up
R2(config)#router ospf 1
R2(config-router)# network 192.168.2.0 0.0.0.255 area 0
R2(config-router)# network 192.168.100.0 0.0.0.255 area 0
R2(config-router)# crypto isakmp policy 10
R2(config-isakmp)# encryption aes
R2(config-isakmp)# hash sha
R2(config-isakmp)# authentication pre-share
R2(config-isakmp)# group 2
R2(config-isakmp)# exit
R2(config)# crypto isakmp key GRE123 address 10.0.0.1
R2(config)#crypto ipsec transform-set TSET esp-aes esp-sha-hmac
R2(cfg-crypto-trans)# access-list 100 permit gre host 10.0.0.2 host 10.0.0.1
R2(config)# crypto map VPN-MAP 10 ipsec-isakmp
R2
Switch2
Cloud1
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
New template
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>

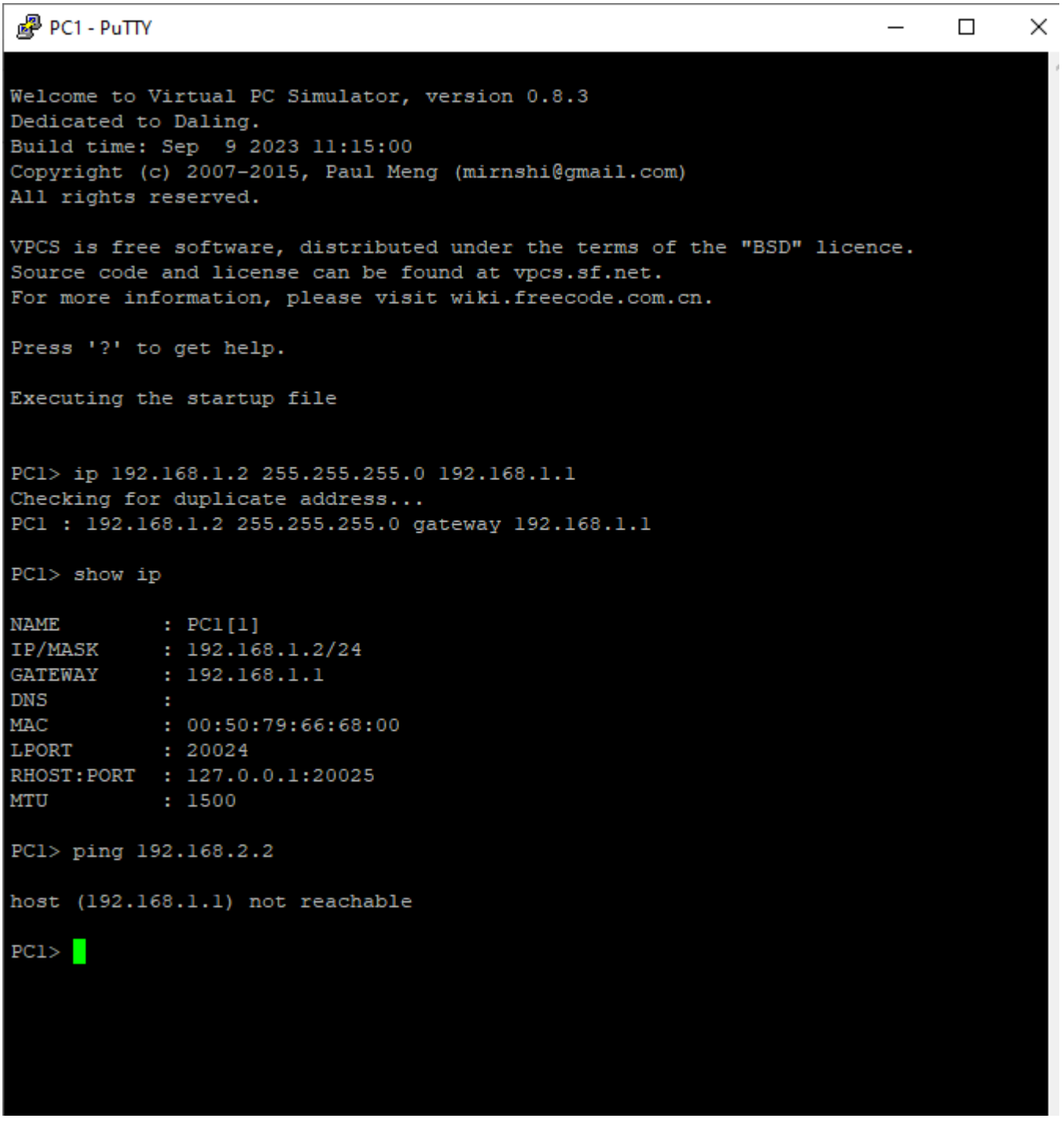

exo 2_td6 - GNS3
File Edit View Control Node Annotate Tools Help
End devices
Filter
R2
R2(config-isakmp)# authentication pre-share
R2(config-isakmp)# group 2
R2(config-isakmp)# exit
R2(config)# crypto isakmp key GRE123 address 10.0.0.1
R2(config)#crypto ipsec transform-set TSET esp-aes esp-sha-hmac
R2(cfg-crypto-trans)# access-list 100 permit gre host 10.0.0.2 host 10.0.0.1
R2(config)# crypto map VPN-MAP 10 ipsec-isakmp
% NOTE: This new crypto map will remain disabled until a peer
and a valid access list have been configured.
R2(config-crypto-map)# set peer 10.0.0.1
R2(config-crypto-map)# set transform-set TSET
R2(config-crypto-map)# match address 100
R2(config-crypto-map)# exit
R2(config)# interface fa0/1
R2(config-if)# crypto map VPN-MAP
R2(config-if)# end
*Mar 1 00:03:58.175: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
R2(config-if)# end
R2#wr
*Mar 1 00:04:00.575: %SYS-5-CONFIG_I: Configured from console by console
R2#wr
Building configuration...
[OK]
R2#
R2
Switch2
Cloud1
PC2
VPCS
Servers Summ...
DESKTOP-H...
GNS3 VM (...
New template
Topol...
Serv...
Console
Running GNS3 version 2.2.53 on Windows (64-bit) with Python 3.10.11 Qt 5.15.2 and PyQt 5.15.11.
Copyright (c) 2006-2025 GNS3 Technologies.
Use Help -> GNS3 Doctor to detect common issues.
=>
New blank project


PC1 - PuTTY
Welcome to Virtual PC Simulator, version 0.8.3
Dedicated to Daling.
Build time: Sep 9 2023 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
PC1> ip 192.168.1.2 255.255.255.0 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.2 255.255.255.0 gateway 192.168.1.1
PC1> show ip
NAME : PC1[1]
IP/MASK : 192.168.1.2/24
GATEWAY : 192.168.1.1
DNS :
MAC : 00:50:79:66:68:00
LPORT : 20024
RHOST:PORT : 127.0.0.1:20025
MTU : 1500
PC1>


PC2 - PuTTY
Welcome to Virtual PC Simulator, version 0.8.3
Dedicated to Daling.
Build time: Sep 9 2023 11:15:00
Copyright (c) 2007-2015, Paul Meng (mirnshi@gmail.com)
All rights reserved.
VPCS is free software, distributed under the terms of the "BSD" licence.
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
PC2> ip 192.168.2.2 255.255.255.0 192.168.2.1
Checking for duplicate address...
PC2 : 192.168.2.2 255.255.255.0 gateway 192.168.2.1
PC2> show ip
NAME : PC2[1]
IP/MASK : 192.168.2.2/24
GATEWAY : 192.168.2.1
DNS :
MAC : 00:50:79:66:68:01
LPORT : 20026
RHOST:PORT : 127.0.0.1:20027
MTU : 1500
PC2>


R1 - PuTTY
R1(config)# interface fa0/1
R1(config-if)# crypto map VPN-MAP
R1(config-if)# end
*Mar 1 00:02:59.915: %CRYPTO-6-ISAKMP_ON_OFF: ISAKMP is ON
R1(config-if)# end
R1#
*Mar 1 00:03:01.663: %SYS-5-CONFIG_I: Configured from console by console
R1#wr
Building configuration...
[OK]
R1# show crypto isakmp sa
IPv4 Crypto ISAKMP SA
dst   src   state   conn-id slot status
10.0.0.2   10.0.0.1   MM_NO_STATE   0   0 ACTIVE
10.0.0.2   10.0.0.1   MM_NO_STATE   0   0 ACTIVE (deleted)
IPv6 Crypto ISAKMP SA
R1# show crypto ipsec sa
interface: FastEthernet0/1
Crypto map tag: VPN-MAP, local addr 10.0.0.1
protected vrf: (none)
local ident (addr/mask/prot/port): (10.0.0.1/255.255.255.255/47/0)
remote ident (addr/mask/prot/port): (10.0.0.2/255.255.255.255/47/0)
current_peer 10.0.0.2 port 500
PERMIT, flags={origin_is_acl,ipsec_sa_request_sent}
#pkts encaps: 0, #pkts encrypt: 0, #pkts digest: 0
#pkts decaps: 0, #pkts decrypt: 0, #pkts verify: 0
#pkts compressed: 0, #pkts decompressed: 0
#pkts not compressed: 0, #pkts compr. failed: 0
#pkts not decompressed: 0, #pkts decompress failed: 0
#send errors 47, #recv errors 0
local crypto endpt.: 10.0.0.1, remote crypto endpt.: 10.0.0.2
path mtu 1500, ip mtu 1500, ip mtu idb FastEthernet0/1
current outbound spi: 0x0(0)
inbound esp sas:
inbound ah sas:
--More--


R1 - PuTTY
Tunnel TTL 255
Fast tunneling enabled
Tunnel transmit bandwidth 8000 (kbps)
Tunnel receive bandwidth 8000 (kbps)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 62
Queueing strategy: fifo
Output queue: 0/0 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
--More--
*Mar 1 00:11:28.323: ISAKMP:(0): retransmitting phase 1 MM_NO_STATE...
*Mar 1 00:11:28.323: ISAKMP (0:0): incrementing error counter on sa, attempt 4 of 5: retransmit phase 1
*Mar 1 00:11:28.323: ISAKMP:(0): retransmitting phase 1 MM_NO_STATE
*Mar 1 00:11:28.327: ISAKMP:(0): sending packet to 10.0.0.2 my_port 500 peer_port 500 (I) MM_NO_STATE
*Mar 1 00:11:28.327: ISAKMP:(0):Sending an IKE IPv4 Packet.
--More--
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
--More--
*Mar 1 00:11:31.759: ISAKMP:(0):purging node -560992483
*Mar 1 00:11:31.759: ISAKMP:(0):purging node -1945951089
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
0 unknown protocol drops
0 output buffer failures, 0 output buffers swapped out
R1#
R1#
R1#
*Mar 1 00:11:38.327: ISAKMP:(0): retransmitting phase 1 MM_NO_STATE...
*Mar 1 00:11:38.327: ISAKMP (0:0): incrementing error counter on sa, attempt 5 of 5: retransmit phase 1
*Mar 1 00:11:38.327: ISAKMP:(0): retransmitting phase 1 MM_NO_STATE
*Mar 1 00:11:38.331: ISAKMP:(0): sending packet to 10.0.0.2 my_port 500 peer_port 500 (I) MM_NO_STATE
*Mar 1 00:11:38.331: ISAKMP:(0):Sending an IKE IPv4 Packet.
R1#
*Mar 1 00:11:41.759: ISAKMP:(0):purging SA., sa=6737CCB4, delme=6737CCB4
R1#


PC1 - PuTTY
Welcome to Virtual PC Simulator, version 0.8.3
Dedicated to Daling.
Build time: Sep 9 2023 11:15:00
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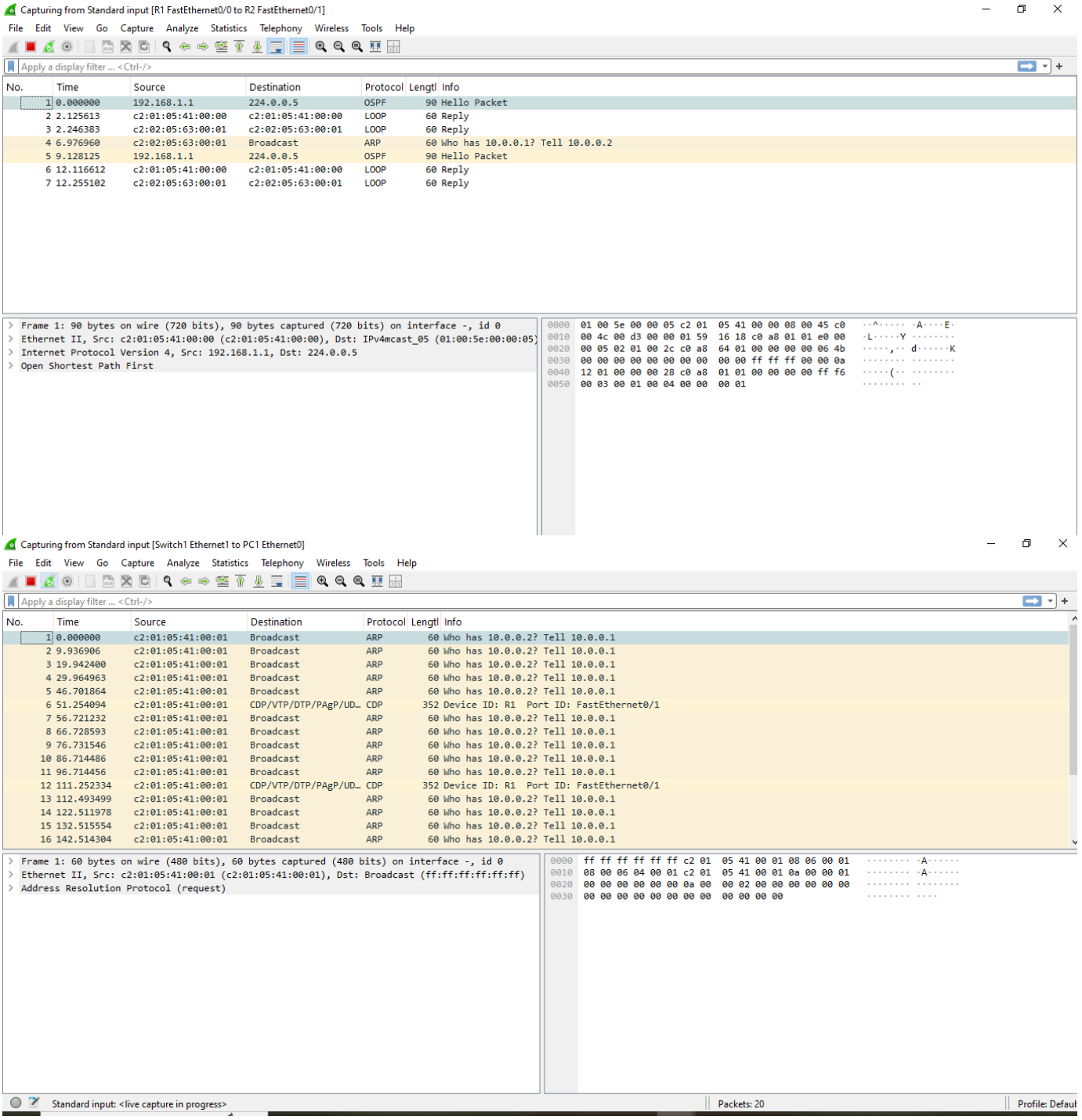
Source code and license can be found at vpcs.sf.net.
For more information, please visit wiki.freecode.com.cn.
Press '?' to get help.
Executing the startup file
PC1> ip 192.168.1.2 255.255.255.0 192.168.1.1
Checking for duplicate address...
PC1 : 192.168.1.2 255.255.255.0 gateway 192.168.1.1
PC1> show ip
NAME : PC1[1]
IP/MASK : 192.168.1.2/24
GATEWAY : 192.168.1.1
DNS :
MAC : 00:50:79:66:68:00
LPORT : 20024
RHOST:PORT : 127.0.0.1:20025
MTU : 1500
PC1> ping 192.168.2.2
host (192.168.1.1) not reachable
PC1>



Conclusion

Ce TD m'a permis de comprendre les différences entre un VPN IPSec classique et un tunnel GRE over IPSec, ainsi que leur utilité dans des scénarios réels. J'ai appris à sécuriser un réseau étendu (WAN) tout en permettant un routage dynamique via OSPF. Ces compétences sont essentielles pour concevoir des infrastructures réseau sécurisées, notamment dans les entreprises multi-sites ou le télétravail.