



UNICAM
UNIVERSITÀ DI CAMERINO

**Laurea
in
INFORMATICA**

INTERNET e RETI di CALCOLATORI A.A. 2022/2023
Capitolo 4 – Instradamento e Algoritmi di instradamento
Esercitazioni GNS3
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Reti di elaboratori

Virtualizzazione di una rete con GNS3



Virtualizzazione di una rete con GNS3

Routing protocol: RIP

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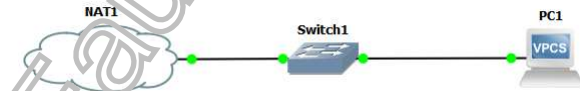
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Reti di elaboratori

Configure NAT Internet



```

PC1> ip dhcp
DDORA IP 192.168.122.205/24 GW 192.168.122.1
PC1>

PC1> show ip

NAME       : PC1 [1]
IP/MASK    : 192.168.122.205/24
GATEWAY    : 192.168.122.1
DNS        : 192.168.122.1
DHCP SERVER : 192.168.122.1
DHCP LEASE : 2912, 3600/1800/3150
MAC        : 00:50:79:66:68:00
LPORT      : 20004
RHOST:PORT : 127.0.0.1:20005
MTU        : 1500

PC1>

```

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Reti di elaboratori

Change ip NAT internet

```

root@gns3vm:~# root@gns3vm:~# cd /var/lib/libvirt/dnsmasq/
root@gns3vm:/var/lib/libvirt/dnsmasq# ls -al
total 16
drwxr-xr-x 2 root root 4096 Nov 22 11:32 .
drwxr-xr-x 7 root root 4096 Nov 22 10:29 ..
-rw-r--r-- 1 root root  0 Nov 22 11:21 default.addnhosts
-rw----- 1 root root 619 Nov 22 11:21 default.conf
-rw-r--r-- 1 root root  0 Nov 22 11:21 default.hostsfile
-rw-r--r-- 1 root root 183 Nov 22 11:32 virbr0.status
root@gns3vm:/var/lib/libvirt/dnsmasq#

root@gns3vm:/var/lib/libvirt/dnsmasq# cat default.conf
##WARNING: THIS IS AN AUTO-GENERATED FILE. CHANGES TO IT ARE LIKELY TO BE
##OVERWRITTEN AND LOST. Changes to this configuration should be made using:
## virsh net-edit default
## or other application using the libvirt API.
##
## dnsmasq conf file created by libvirt
strict-order
user=libvirt-dnsmasq
pid-file=/run/libvirt/network/default.pid
except-interface=lo
bind-dynamic
interface=virbr0
dhcp-range=192.168.122.2,192.168.122.254,255.255.255.0
dhcp-no-override
dhcp-authoritative
dhcp-lease-max=253
dhcp-hostsfile=/var/lib/libvirt/dnsmasq/default.hostsfile
addn-hosts=/var/lib/libvirt/dnsmasq/default.addnhosts
root@gns3vm:/var/lib/libvirt/dnsmasq#

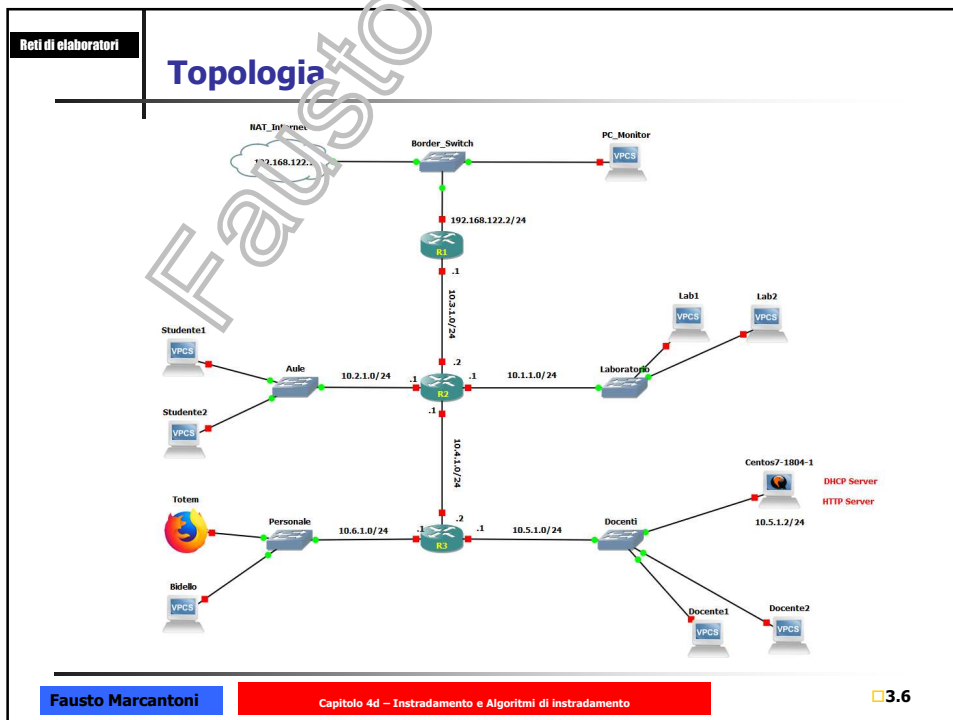
```

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Reti di elaboratori

Cisco 2600 Series Modular Access Router Family



https://www.cisco.com/c/dam/global/it_it/solutions/small-business/pdf/net_found/2600_ds.pdf

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Reti di elaboratori

Config slots R1 - R2 - R3

R1 configuration

General Memories and disks **Slots** Advanced Usage

Adapters

slot 0: C2600-MB-1E

slot 1: NM-1E



R2 configuration

General Memories and disks **Slots** Advanced Usage

Adapters

slot 0: C2600-MB-1E

slot 1: NM-4E



R3 configuration

General Memories and disks **Slots** Advanced Usage

Adapters

slot 0: C2600-MB-1E

slot 1: NM-4E

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Reti di elaboratori

basic command

```
R1# show running-config / sh run

R1# conf t
R1(config)# interface eth 0/0
R1(config-int)# ip address 192.168.x.y 255.255.255.0
R1(config-int)# no shutdown
R1(config-int)#exit
R1(config)#exit
R1#

R1# show ip interface brief / sh ip int bri

R1# write memory / wr mem
Overwrite the previous NVRAM configuration? [confirm] Y/N
R1#
```

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Reti di elaboratori

configure interface R1 - eth0/0 dhcp client

```
interface Ethernet0/0
 ip address dhcp
 ip nat outside
 ip virtual-reassembly
 half-duplex
!
interface Ethernet1/0
 ip address 10.3.1.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
 half-duplex
```

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Reti di elaboratori

configure interface R1 - eth0/0 static IP

```

interface Ethernet0/0
 ip address 192.168.122.2 255.255.255.0
 ip nat outside
 ip virtual-reassembly
 half-duplex
!
interface Ethernet1/0
 ip address 10.3.1.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
 half-duplex

```

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Reti di elaboratori

configure interface R1 - dhcp / static

```

interface Ethernet0/0
 ip address dhcp
 ip nat outside
 ip virtual-reassembly
 half-duplex
!
interface Ethernet1/0
 ip address 10.3.1.1 255.255.255.0
 ip nat inside
 ip virtual-reassembly
 half-duplex

```

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Reti di elaboratori	<h2>enable nat inside/outside</h2>	
<pre> interface Ethernet0/0 ip address dhcp ip nat outside ip virtual-reassembly half-duplex ! interface Ethernet1/0 ip address 10.3.1.1 255.255.255.0 ip nat inside ip virtual-reassembly half-duplex </pre>		
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Reti di elaboratori	<h2>enable nat inside/outside</h2>	
<pre> ip nat inside source list 1 interface Ethernet0/0 overload ! access-list 1 permit any </pre>		
<pre> ip nat pool Net192 192.168.122.100 192.168.122.200 prefix-length 24 ! definisce il NAT pool chiamato prova-pool con un range di indirizzi pubblici da utilizzare x internet </pre>		
<pre> ip nat inside source list 1 pool Net192 [overload] ! indica che ogni pacchetto ricevuto sulla inside interface e ammesso dalla acl-1 avrà una corrispondenza tra l'indirizzo privato "source" e un indirizzo pubblico "out" del NAT pool "Net192". La keyword "overload" abilita il NAT ad associare più indirizzi privati su un singolo ip pubblico del pool, in questo caso il router mantiene una ulteriore informazione dai protocolli di livello superiore (per esempio, i numeri di porta TCP o UDP) per tradurre dall'indirizzo globale il corretto indirizzo locale. </pre>		
<pre> show ip nat translations </pre>		
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Reti di elaboratori

verify ip configuration

```
show interface
show interface 0/0
show ip interface
```

```
R1#show ip interface brief
Interface                IP-Address      OK? Method Status
Protocol
Ethernet0/0              192.168.122.35 YES DHCP    up
Ethernet1/0              10.3.1.1        YES NVRAM   up
NVI0                     unassigned      YES unset  administratively down
R1#
```

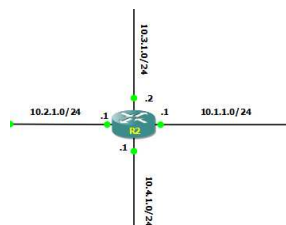
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Reti di elaboratori

configure interface R2

```
interface Ethernet0/0
 ip address 10.3.1.2 255.255.255.0
 half-duplex
 !
interface Ethernet1/0
 ip address 10.2.1.1 255.255.255.0
 half-duplex
 !
interface Ethernet1/1
 ip address 10.1.1.1 255.255.255.0
 half-duplex
 !
interface Ethernet1/2
 ip address 10.4.1.1 255.255.255.0
 half-duplex
```



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Reti di elaboratori

configure DHCP Server R2 (1/2)

```

ip dhcp pool Aule
  network 10.2.1.0 255.255.255.0
  default-router 10.2.1.1
  dns-server 8.8.8.8
  lease 30
  class Aule
    address range 10.2.1.100 10.2.1.200
!
ip dhcp pool Laboratorio
  network 10.1.1.0 255.255.255.0
  default-router 10.1.1.1
  dns-server 8.8.8.8
  lease 30
  class Laboratorio
    address range 10.1.1.150 10.1.1.250

```

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Reti di elaboratori

configure DHCP Server R2 (1/2)

```

ip dhcp class Aule
!
ip dhcp class Laboratorio

```

```

show ip dhcp binding
show ip dhcp server statistics

```

```

ip dhcp
ip dhcp -x
ip dhcp -r

```

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Reti di elaboratori

configure interface R3

```

interface Ethernet0/0
 ip address 10.4.1.2 255.255.255.0
 half-duplex
!
interface Ethernet1/0
 ip address 10.5.1.1 255.255.255.0
 half-duplex
!
interface Ethernet1/1
 ip address 10.6.1.1 255.255.255.0
 ip helper-address 10.5.1.2
 half-duplex

```

10.6.1.1/24 R3 10.5.1.0/24

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Reti di elaboratori

configure dhcp relay interface R3

```

interface Ethernet1/1
 ip address 10.5.1.1 255.255.255.0
 ip helper-address 10.5.1.2
 half-duplex

```

Command	Description
ip helper-address a.b.c.d	This command is executed in interface configuration mode to enable a Layer 3 interface to receive BOOTP DHCP Request and forward them to a specified DHCP server.

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Reti di elaboratori

Install dhcp server e http server

```

sudo yum install httpd
sudo yum install dhcpd

sudo systemctl enable dhcpd
sudo systemctl enable httpd

sudo systemctl start httpd
sudo systemctl stop httpd
sudo systemctl status httpd

sudo systemctl start dhcpd
sudo systemctl stop dhcpd
sudo systemctl status dhcpd

```

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Reti di elaboratori

configure DHCPD server on Centos 7

configure DHCPD server on Centos 7

```

subnet 10.5.1.0 netmask 255.255.255.0 {
    range 10.5.1.100 10.5.1.200;
    option subnet-mask 255.255.255.0;
    option broadcast-address 10.5.1.255;
    option routers 10.5.1.1;
    option domain-name-servers 8.8.8.8, 8.8.4.4;
    default-lease-time 600;
    max-lease-time 7200;
}

subnet 10.6.1.0 netmask 255.255.255.0 {
    range 10.6.1.100 10.6.1.200;
    option subnet-mask 255.255.255.0;
    option broadcast-address 10.6.1.255;
    option routers 10.6.1.1;
    option domain-name-servers 8.8.8.8, 8.8.4.4;
    default-lease-time 600;
    max-lease-time 7200;
}

```

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Reti di elaboratori

enable routing RIP on R1

```

router rip
  version 2
  network 10.0.0.0
  network 192.168.122.0
  default-information originate
  !
ip forward-protocol nd
ip route 0.0.0.0 0.0.0.0 192.168.122.1
!
```

```
ip default-gateway 192.168.122.1
```

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Reti di elaboratori

enable routing RIP on R1

```

router rip
  version 2
  network 10.0.0.0
  network 192.168.122.0
  default-information originate
  !
ip forward-protocol nd
ip route 0.0.0.0 0.0.0.0 192.168.122.1
!
```

Per propagare una default route, l'edge router deve essere configurato con:

- Una default static route utilizzando il comando `ip route 0.0.0.0 0.0.0.0 {ip-address | exit-intf}`
- Il comando `default-information originate` nella modalità di configurazione del router. Ciò indica all'edge router di essere la fonte delle informazioni sulla default route e di diffondere la default static route negli updates del routing

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Reti di elaboratori

enable routing RIP on R2 - R3

```
router rip
version 2
network 10.0.0.0
```

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Reti di elaboratori

verify routing on R1

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is 192.168.122.1 to network 0.0.0.0

C    192.168.122.0/24 is directly connected, Ethernet0/0
    10.0.0.0/24 is subnetted, 6 subnets
C    10.3.1.0 is directly connected, Ethernet1/0
R    10.2.1.0 [120/1] via 10.3.1.2, 00:00:20, Ethernet1/0
R    10.1.1.0 [120/1] via 10.3.1.2, 00:00:20, Ethernet1/0
R    10.6.1.0 [120/2] via 10.3.1.2, 00:00:20, Ethernet1/0
R    10.5.1.0 [120/2] via 10.3.1.2, 00:00:20, Ethernet1/0
R    10.4.1.0 [120/1] via 10.3.1.2, 00:00:20, Ethernet1/0
S*   0.0.0.0/0 [1/0] via 192.168.122.1
R1#
```

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Reti di elaboratori	<h2 style="margin: 0;">verify routing on R2</h2>	
<pre> R2#sh ip route Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, * - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route Gateway of last resort is 10.3.1.1 to network 0.0.0.0 R 192.168.122.0/24 [120/1] via 10.3.1.1, 00:00:03, Ethernet0/0 10.0.0.0/24 is subnetted, 6 subnets C 10.3.1.0 is directly connected, Ethernet0/0 C 10.2.1.0 is directly connected, Ethernet1/0 C 10.1.1.0 is directly connected, Ethernet1/1 R 10.6.1.0 [120/1] via 10.4.1.2, 00:00:00, Ethernet1/2 R 10.5.1.0 [120/1] via 10.4.1.2, 00:00:00, Ethernet1/2 C 10.4.1.0 is directly connected, Ethernet1/2 R* 0.0.0.0/0 [120/1] via 10.3.1.1, 00:00:03, Ethernet0/0 R2# </pre>		
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Reti di elaboratori	<h2 style="margin: 0;">verify routing on R3</h2>	
<pre> R3#sh ip route Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2 E1 - OSPF external type 1, E2 - OSPF external type 2 i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2 ia - IS-IS inter area, * - candidate default, U - per-user static route o - ODR, P - periodic downloaded static route Gateway of last resort is 10.4.1.1 to network 0.0.0.0 R 192.168.122.0/24 [120/2] via 10.4.1.1, 00:00:17, Ethernet0/0 10.0.0.0/24 is subnetted, 6 subnets R 10.3.1.0 [120/1] via 10.4.1.1, 00:00:17, Ethernet0/0 R 10.2.1.0 [120/1] via 10.4.1.1, 00:00:17, Ethernet0/0 R 10.1.1.0 [120/1] via 10.4.1.1, 00:00:17, Ethernet0/0 C 10.6.1.0 is directly connected, Ethernet1/1 C 10.5.1.0 is directly connected, Ethernet1/0 C 10.4.1.0 is directly connected, Ethernet0/0 R* 0.0.0.0/0 [120/2] via 10.4.1.1, 00:00:19, Ethernet0/0 R3# </pre>		
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Reti di elaboratori

troubleshooting

troubleshooting

Etimologia: ← voce ingl.; propr. 'caccia (*shooting*) ai guasti (*trouble*)'.

(inform.) analisi sistematica del funzionamento di un sistema hardware o software, alla ricerca di eventuali guasti o errori

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Reti di elaboratori

Cisco Discovery Protocol (CDP)

Cisco Discovery Protocol (CDP) is a Link-Layer Cisco proprietary protocol that allows Cisco devices to communicate regardless of IP connectivity. It is used primarily to communicate protocol addresses and device capabilities. CDP sends frames that contain Type Length Values (TLVs), which are different properties of the port and/or connection.

```
show cdp neighbors
```

```
R2#sh cdp nei
R2#sh cdp neighbors
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge
                  S - Switch, H - Host, I - IGMP, r - Repeater

Device ID      Local Intrfce  Holdtme  Capability  Platform  Port ID
R3             Eth 1/2       156      R S I       2610      Eth 0/0
R1             Eth 0/0       151      R S I       2610      Eth 1/0
R2#
```

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Reti di elaboratori

Configurazioni



R1_i1_startup-config.cfg



R2_i2_startup-config.cfg



R3_i3_startup-config.cfg

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