Progetto Laboratorio Reti

Programmazione e gestione dei sistemi informatici
Dipartimento di Matematica e Informatica

Realizzato da:

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L'azienda PharmaNova ci ha richiesto la realizzazione di una struttura di rete che interconnetta in modo sicuro i suoi quattro grandi uffici situati al piano terra di quattro edifici diversi, ciascuno distanziato di 50 metri dagli altri.

Nello specifico ci ha indicato il bisogno di installare e configurare:

- Un server di posta elettronica
- Un server web
- Un server proxy
- Due server DNS

Inoltre ci hanno indicato come andrà gestito il traffico e in quali edifici preferiscono allestire le due sale server.
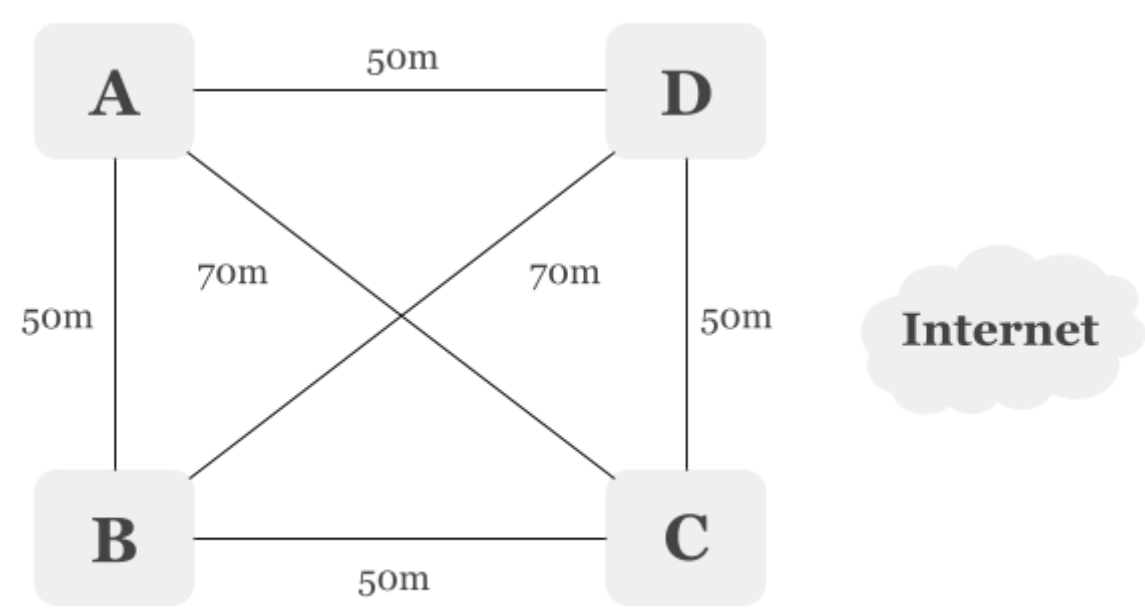
Edificio	Num. Utenti	Num. Server	Copertura Wi-fi
A	50	0	No
B	50	1	No
C	50	4	Si
D	50	0	No

Il Collegamento fisico della rete avverrà tramite le seguenti due tipologie di cavi:

- **UTP (Unshielded Twisted Pair)** sarà impiegato per il collegamento delle workstation agli switch di ogni piano (utilizzo stimato 600 metri)
- **STP (Shielded Twisted Pair)** verrà utilizzato per i restanti collegamenti (come quelli tra i router (RA - RB) o tra router e switch (RA - SWITCH A) (utilizzo stimato 500 metri)

Quella che segue è la suddivisione logica in sottoreti:

Edificio	Sottorete
A	192.168.1.0/24
B	192.168.2.0/24
C	192.168.3.0/24
D	192.168.4.0/24
DMZ	192.168.5.0/24

Queste sono le sottoreti che abbiamo utilizzato per collegare gli edifici

Edificio	Sottorete
A - B	192.168.6.0/24
B - C	192.168.7.0/24
C - D	192.168.8.0/24
D - A	192.168.9.0/24
A - C	192.168.10.0/24
B - D	192.168.11.0/24
C - Firewall	192.168.12.0/24

Struttura Logica/Fisica
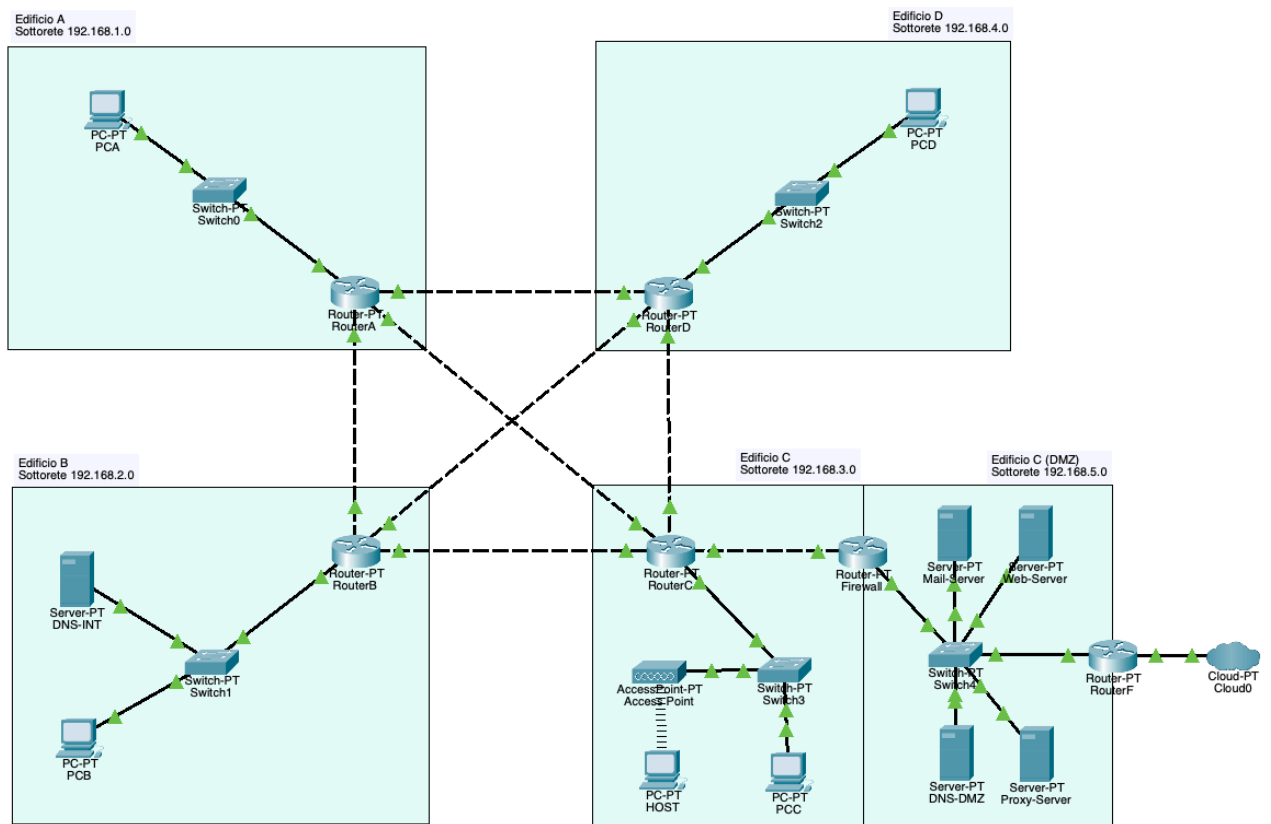
Configurazione Router A

```
hostname RouterA
interface FastEthernet0/0
  ip address 192.168.1.2
255.255.255.0
  no shutdown
interface FastEthernet1/0
  ip address 192.168.6.1
255.255.255.0
  no shutdown
interface FastEthernet2/0
  ip address 192.168.9.1
255.255.255.0
  no shutdown
interface FastEthernet3/0
  ip address 192.168.10.1
255.255.255.0
  no shutdown
ip dhcp excluded-address 192.168.1.1
192.168.1.10
ip dhcp pool RETEA
  network 192.168.1.0 255.255.255.0
  default-router 192.168.1.2
  dns-server 192.168.2.10
router rip
version 2
  network 192.168.1.2
  network 192.168.6.1
  network 192.168.9.1
  network 192.168.10.1
ip domain-lookup
ip nameserver 192.168.2.10
```

Configurazione Router B

```
hostname RouterB
interface FastEthernet0/0
  ip address 192.168.2.2
255.255.255.0
  no shutdown
interface FastEthernet1/0
  ip address 192.168.6.2
255.255.255.0
  no shutdown
interface FastEthernet2/0
  ip address 192.168.7.1
255.255.255.0
  no shutdown
interface FastEthernet3/0
  ip address 192.168.11.1
255.255.255.0
  no shutdown
ip dhcp excluded-address 192.168.2.1
192.168.2.10
ip dhcp pool RETEB
  network 192.168.2.0 255.255.255.0
  default-router 192.168.2.2
  dns-server 192.168.2.10
router rip
version 2
  network 192.168.2.0
  network 192.168.6.0
  network 192.168.7.0
  network 192.168.11.0
ip domain-lookup
ip nameserver 192.168.2.10
```

Configurazione Router C

```
hostname RouterC
interface FastEthernet0/0
  ip address 192.168.3.2
255.255.255.0
  no shutdown
interface FastEthernet1/0
  ip address 192.168.7.2
255.255.255.0
  no shutdown
interface FastEthernet2/0
  ip address 192.168.8.1
255.255.255.0
  no shutdown
interface FastEthernet3/0
  ip address 192.168.10.2
255.255.255.0
  no shutdown
interface FastEthernet4/0
  ip address 192.168.12.1
255.255.255.0
  no shutdown
ip dhcp excluded-address 192.168.3.1
192.168.3.10
ip dhcp pool RETEC
  network 192.168.3.0 255.255.255.0
  default-router 192.168.3.2
  dns-server 192.168.2.10
router rip
version 2
  network 192.168.3.0
  network 192.168.7.0
  network 192.168.8.0
  network 192.168.10.0
  network 192.168.12.0
ip domain-lookup
ip nameserver 192.168.2.10
```

Configurazione Router D

```
hostname RouterD
interface FastEthernet0/0
  ip address 192.168.4.2
255.255.255.0
  no shutdown
interface FastEthernet1/0
  ip address 192.168.8.2
255.255.255.0
  no shutdown
interface FastEthernet2/0
  ip address 192.168.9.2
255.255.255.0
  no shutdown
interface FastEthernet3/0
  ip address 192.168.11.2
255.255.255.0
  no shutdown
ip dhcp excluded-address 192.168.4.1
192.168.4.10
ip dhcp pool RETED
  network 192.168.4.0 255.255.255.0
  default-router 192.168.4.2
  dns-server 192.168.2.10
router rip
version 2
  network 192.168.4.0
  network 192.168.8.0
  network 192.168.9.0
  network 192.168.11.0
ip domain-lookup
ip nameserver 192.168.2.10
```

Configurazione Firewall

```
hostname Firewall
interface FastEthernet0/0
  ip address 192.168.12.2
255.255.255.0
  no shutdown
interface FastEthernet1/0
  ip address 192.168.5.1
255.255.255.0
  no shutdown
router rip
version 2
  network 192.168.5.0
  network 192.168.12.0
ip domain-lookup
ip nameserver 192.168.2.10
```

Configurazione Router F

```
hostname RouterF
interface FastEthernet0/0
 ip address 192.168.5.2
255.255.255.0
no shutdown
interface FastEthernet0/0
 ip address dhcp
no shutdown
router rip
version 2
 network 192.168.5.0
ip domain-lookup
ip nameserver 192.168.2.10
```

Configurazione PCA

```
set pcname PCA
ip dhcp
ip dns 192.168.2.10
```

Configurazione PCB

```
set pcname PCB
ip dhcp
ip dns 192.168.2.10
```

Configurazione PCC

```
set pcname PCC
ip dhcp
ip dns 192.168.2.10
```

Configurazione PCD

```
set pcname PCD
ip dhcp
ip dns 192.168.2.10
```

Configurazione HOST

```
set pcname HOST
ip dhcp
ip dns 192.168.2.10
```

Configurazione DNS INTERNO

```
set pcname DNS-INT
ip 192.168.2.10/24 192.168.2.2
```

Configurazione DNS DMZ

```
set pcname DNS-DMZ
ip 192.168.5.10/24 192.168.5.2
```

Configurazione Mail-Server

```
set pcname Mail-Server
ip 192.168.5.4/24 192.168.5.2
ip dns 192.168.5.10
```

Configurazione Web-Server

```
set pcname Web-Server
ip 192.168.5.3/24 192.168.5.2
ip dns 192.168.5.10
```

Configurazione Proxy-Server

```
set pcname Proxy-Server
ip 192.168.5.5/24 192.168.5.2
ip dns 192.168.5.10
```

Configurazione DNS Interno

File resolv.conf

```
domain pharmanova.it
search pharmanova.it

nameserver 192.168.2.10
nameserver 192.168.5.10

nameserver 1.1.1.1
nameserver 1.0.0.1
```

File named.conf

```
zone "reteb.pharmanova.it" {
    type master;
    file "/etc/bind/reteb.pharmanova.it.db";
}:
zone "2.168.192.in-addr.arpa" {
    type master;
    file "/etc/bind/2.168.192.in-addr.arpa.db";
};
// Slave
zone "pharmanova.it" {
    type slave;
    file "/etc/bind/pharmanova.it.bk";
    masters { 192.168.5.10; }
};
zone "168.192.in-addr.arpa" {
    type slave;
    file "/etc/bind/168.192.in-addr.arpa.bk";
    masters {192.168.5.10;} ;
}:
// DMZ
zone "dmz.pharmanova.it" {
    type slave;
    file "/etc/bind/dmz.pharmanova.it.bk";
    masters { 192.168.5.10; };
};
zone "5.168.192.in-addr.arpa" {
```

```
    type slave;
    file "/etc/bind/5.168.192.in-addr.arpa.bk";
    masters { 192.168.5.10; };
};
```

File named.conf.options

```
acl "trusted-nameservers" {
    localhost;
    192.168.2.10;
    192.168.5.10;
};
acl "trusted-networks" {
    localhost;
    192.168.1.0/24;
    192.168.2.0/24;
    192.166.3.0/24;
    192.168.4.0/24;
    192.168.5.0/24;
    192.168.6.0/24;
    192.168.7.0/24;
    192.166.8.0/24;
    192.168.9.0/24;
    192.168.10.0/24;
    192.168.11.0/24;
    192.168.12.0/24;
};
options {
    directory "/var/cache/bind";
    dnssec-validation auto;
    auth-nxdomain no;
    version "Not disclosed";
    notify yes;
    allow-transfer { trusted-nameservers; };
    allow-query { trusted-networks; };
    forwarders { 1.1.1.1; };
    recursion yes;
};
```

File reteb.pharmanova.it.db

```
$TTL 86400
$ORIGIN reteb.pharmanova.it.
@ IN SOA dns.reteb.pharmanova.it. root.reteb.pharmanova.it. (
     2018112701 ; serial
     43200 ; refresh
     3600 ; retry after 1 hour
     3600000 ; expire after 1000 hours
     2592000 ; default ttl
)
; Definizione dei nameserver e dei server mail
IN NS dns.dmz.pharmanova.it.
IN NS dns.reteb.pharmanova.it.
IN NS dns.cloudflare.com.
IN MX 10 mail.pharmanova.it.


; Host di Rete B
RouterB IN A 192.168.2.2
dns IN A 192.168.2.10
```

File 2.168.192.in-addr.arpa.db

```
$TTL 86400
$ORIGIN 2.168.192.in-addr.arpa.
@ IN SOA dns.reteb.pharmanova.it. root.reteb.pharmanova.it. (
     2024071401 ; serial
     43200 ; refresh
     3600 ; retry after 1 hour
     3600000 ; expire after 1000 hours
     2592000 ; default ttl
)

; Definizione dei nameserver e dei server mail
IN NS dns.dmz.pharmanova.it.
IN NS dns.reteb.pharmanova.it.
IN NS dns.cloudflare.com.
IN MX 10 mail.pharmanova.it.

; Host in reteb.pharmanova.it
1 IN PTR RouterB.reteb.pharmanova.it.
10 IN PTR dns.reteb.pharmanova.it.
```

Configurazione DNS DMZ

File resolv.conf

```
domain pharmanova.it
search pharmanova.it

nameserver 192.168.5.10

nameserver 1.1.1.1
nameserver 1.0.0.1
```

File named.conf

```
zone "pharmanova.it" {
    type master;
    file "/etc/bind/pharmanova.it.db";
};
zone "168.192.in-addr.arpa" {
    type master;
    file "/etc/bind/168.192.in-addr.arpa.db";
};
// DMZ
zone "dmz.pharmanova.it" {
    type master;
    file "/etc/bind/dmz.pharmanova.it.db";
};
zone "5.168.192.in-addr.arpa" {
    type master;
    file "/etc/bind/5.168.192.in-addr.arpa.db";
  };
```

File named.conf.options

```
acl "trusted-nameservers" {
     localhost;
     192.168.5.10;
     192.168.2.10;
};
acl "trusted-networks" {
     localhost;
     192.168.2.0/24;
     192.168.5.0/24;
```

```
};
options {
     directory "/var/cache/bind";
     dnssec-validation auto;
     auth-nxdomain no;
     version "Not disclosed";
     notify yes;
     allow-transfer {  trusted-nameservers; };
     allow-query { "any"; };
     forwarders { 1.1.1.1; };
     recursion yes;
     allow-recursion  {any;};
};
```

File dmz.pharmanova.it.db

```
$TTL 86400
$ORIGIN dmz.pharmanova.it.
@ IN SOA dns.dmz.pharmanova.it. root.dmz.pharmanova.it. (
     2024071401 ; serial
     43200 ; refresh
     3600 ; retry after 1 hour
     3600000 ; expire after 1000 hours
     2592000 ; default ttl
)
; Definizione dei nameserver e dei server mail
IN NS dns.dmz.pharmanova.it.
IN NS dns.cloudflare.com.
IN MX 10 mail.dmz.pharmanova.it.

; Host di DMZ
RouterF IN A 192.168.5.2
Firewall IN A 192.168.5.1
dns IN A 192.168.5.10
www IN A 192.168.5.3
mail IN A 192.168.5.4
proxy IN A 192.168.5.5
```

File pharmanova.it.db

```
$TTL 86400
$ORIGIN pharmanova.it.
@ IN SOA dns.pharmanova.it. root.pharmanova.it. (
```

```
      2024071401 ; serial
      43200 ; refresh
      3600 ; retry after 1 hour
      3600000; expire after 1000 hours
      2592000 ; default ttl
)
; Definizione dei nameserver e dei server mail
IN NS dns.pharmanova.it.
IN NS dns.cloudflare.com.
IN MX 10 mail.pharmanova.it.

; Sottodomini
dmz IN A 198.168.5.0

; Host
mail IN A 198.168.5.4
dns IN A 198.168.5.10
@ IN A 192.168.5.3
www IN CNAME @
proxy IN A 198.168.5.5
```

File 168.192.in-addr.arpa.db

```
$TTL 86400
$ORIGIN 168.192.in-addr.arpa.
@ IN SOA dns.pharmanova.it. root.dmz.pharmanova.it. (
      2024071401 ; serial
      43200 ; refresh
      3600 ; retry after 1 hour
      3600000 ; expire after 1000 hours
      2592000 ; default ttl
)
; Definizione dei nameserver e dei server mail
IN NS dns.pharmanova.it.
IN NS dns.cloudflare.com.
IN MX 10 mail.pharmanova.it.

; Sottodomini
0.5 IN PTR dmz.pharmanova.it

; Host
4.5 IN PTR mail.pharmanova.it.
3.5 IN PTR www.pharmanova.it.
```

```
10.5 IN PTR dns.pharmanova.it
5.5 IN PTR proxy.pharmanova.it
```

File 5.168.192.in-addr.arpa.db

```
$TTL 86400
$ORIGIN 5.168.192.in-addr.arpa.
@ IN SOA dns.dmz.pharmanova.it. root.dmz.pharmanova.it.(
     2024071401; serial
     43200 ; refresh
     3600 ; retry after 1 hour
     3600000 ; expire after 1000 hours
     2592000 ; default ttl
)
; Definizione dei nameserver e dei server mail
IN NS dns.dmz.pharmanova.it.
IN NS dns.cloudflare.com.
IN MX 10 mail.dmz.pharmanova.it.

; Host
1 IN PTR firewall.dmz.pharmanova.it.
2 IN PTR routerf.dmz.pharmanova.it.
4 IN PTR mail.dmz.pharmanova.it.
10 IN PTR dns.dmz.pharmanova.it.
3 IN PTR www.dmz.pharmanova.it.
5 IN PTR proxy.dmz.pharmanova.it.
```

Configurazione Mail Server

File etc/mail/access

```
Connect:192.168
GreetPause: 192.168
ClientRate:192.168
ClientConn:192.168
spammer1@badsite.com REJECT
spammer2@badsite.com REJECT
spammer3@badsite.com REJECT
spammer4@badsite.com REJECT
pharmanova.it RELAY
192.168 RELAY
```

File etc/mail/aliases

```
postmaster: damiano
admin: damiano, danilo
dmz: admindmz
admindmz: vittorio, francesco
```

File etc/mail/local-host-names

```
localhost
mail.pharmanova.it
pharmanova.it
dmz.pharmanova.it
```

File /etc/mail/sendmail.mc

```
DAEMON_OPTIONS( 'Family=inet, Name=MTA-v4, Port=smtp' )dnl
…
FEATURE ('relay_entire_domain' )dnl
```

Creazione utenti

```
useradd --create-home -s /sbin/nologin damiano; passwd laboratorio0
useradd --create-home -s /sbin/nologin danilo; passwd laboratorio1
useradd --create-home -s /sbin/nologin vittorio; passwd laboratorio2
useradd --create-home -s /sbin/nologin francesco; passwd laboratorio
```

File /etc/mail/virtusertable

```
root@pharmanova.it root
postmaster@pharmanova.it postmaster
admin@pharmanova.it admin
dmz@pharmanova.it dmz
danilo@pharmanova.it danilo
vittorio@pharmanova.it vittorio
francesco@pharmanova.it francesco
damiano@pharmanova.it damiano
```

Configurazione Firewall

```
no access-list 100
no access-list 101
no access-list 102

//ACL per DNS
```

```
access-list 100 permit udp any host 192.168.5.10 eq 53
access-list 100 permit tcp any host 192.168.5.10 eq 53

//ACL per SMTP, POP3, IMAP
access-list 100 permit tcp any host 192.168.5.4 eq 25
access-list 100 permit tcp any host 192.168.5.4 eq 110
access-list 100 permit tcp any host 192.168.5.4 eq 143

//ACL per HTTP, HTTPS
access-list 100 permit tcp any host 192.168.5.3 eq 80
access-list 100 permit tcp any host 192.168.5.3 eq 443

//Permetti traffico esistente
access-list 100 permit tcp any any established
access-list 100 permit udp any any established

interface FastEthernet0/0
ip access-group 100 in

interface FastEthernet1/0
ip access-group 100 out
```

Configurazione Firewall(Router F)

```
no access-list 101

\\ ACL per permettere SMTP, POP3, IMAP, DNS, HTTPS, HTTP
access-list 101 permit tcp any host 192.168.5.4 eq 25
access-list 101 permit tcp any host 192.168.5.4 eq 110
access-list 101 permit tcp any host 192.168.5.4 eq 143
access-list 101 permit tcp any host 192.168.5.10 eq 53
access-list 101 permit udp any host 192.168.5.10 eq 53
access-list 101 permit tcp any host 192.168.5.3 eq 443
access-list 101 permit tcp any host 192.168.5.5 eq 80

\\Permetti traffico esistente
access-list 101 permit tcp any any established
access-list 101 permit udp any any
access-list 101 deny ip any any

\\Applicare l'ACL 101 all'interfaccia di ingresso
interface FastEthernet1/0
 ip access-group 101 in
```

```
\\Configurazione dell'interfaccia interna ed esterna
interface FastEthernet1/0
ip nat outside
interface FastEthernet0/0
ip nat inside

\\Redirezione pacchetti mail
ip nat inside source static tcp 192.168.5.4 25 interface
FastEthernet0/0 25

\\Redirezione pacchetti DNS
ip nat inside source static udp 192.168.5.10 53 interface
FastEthernet1/0 53
ip nat inside source static tcp 192.168.5.10 53 interface
FastEthernet1/0 53

\\Redirezione pacchetti Proxy
ip nat inside source static tcp 192.168.5.5 80 interface
FastEthernet1/0 80

\\Redirezione pacchetti Web
ip nat inside source static tcp 192.168.5.3 443 interface
FastEthernet1/0 443

\\Mascheramento IP per pacchetti uscenti
ip nat inside source list 101 interface FastEthernet1/0 overload
```

PREVENTIVO DI SPESA

COMPONENTE	QUANTITÀ	PREZZO UNITARIO	PREZZO TOTALE
Cavo STP	500 m	€ 1,00/m	€ 500,00
Cavo UTP	600 m	€ 0,50/m	€ 300,00
Router Cisco C927-4P	5 pz	€ 436,00	€ 2.180,00
Smart Switch Cisco SG220-50	4 pz	€ 399,00	€ 1.596,00
Switch Cisco Business CBS110-16T-D	1 pz	€ 136,00	€ 136,00
RJ45 Connettori 100 Pezzi	5 pz	€ 16,90	€ 84,50
Cisco Business 150AX Wi-Fi 6 2x2 Access Point	1 pz	€ 127,90	€ 127,90
Dominio	-	€ 15/anno	-
Progettazione	80 h (8 h * 10 gg)	€ 25,00/ora	€ 2.000,00
Installazione	96 h (8 h * 12 gg)	€ 42,00/ora	€ 4.092,00
			TOTALE € 11.031,40