Sieci Transmisji Danych

Projekt sieci komputerowej dla firmy

Prowadzący:
dr inż. Jacek Stępień

Wykonali:
Grzegorz Mazur
Jakub Płoskonka

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1 Cel ćwiczenia:

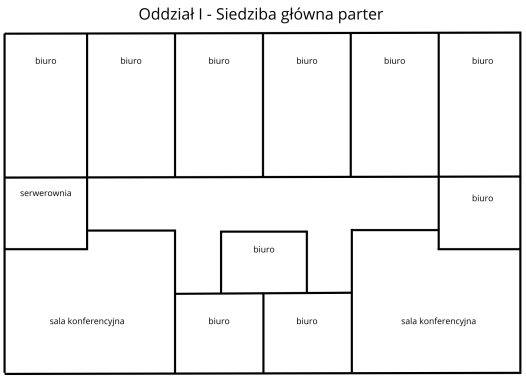
Celem zadania jest zaprojektowanie kompletnej infrastruktury sieci komputerowej dla firmy posiadającej dwa oddziały zlokalizowane w osobnych budynkach.

2 Założenia projektowe

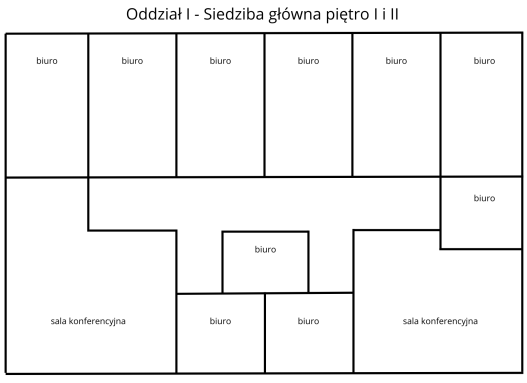
1. Oddział I – Główna siedziba
   - budynek 3-piętrowy
   - każde piętro zawiera 10 pomieszczeń biurowych, 2 sale konferencyjne
   - serwerownia na pierwszym piętrze
   - łącznie 200 komputerów, rozdzielonych na 4 VLAN-y:
     - VLAN 10 – Administracja (50 komputerów)
     - VLAN 20 – Dział IT (50 komputerów, w tym serwer HTTP)
     - VLAN 30 – Finanse (50 komputerów)
     - VLAN 40 – Obsługa klienta (50 komputerów, w tym serwer FTP)
2. Oddział II – Filia
   - Budynek 2-piętrowy
   - 100 komputerów w 3 głównych VLAN-ach:
     - VLAN 50 – Administracja (32 komputerów)
     - VLAN 60 – Obsługa klienta (z dostępem do FTP) (32 komputerów)
     - VLAN 70 – IT (36 komputerów)
   - VLAN 80 – Pracownicy zdalni (10 komputerów)

3 Schemat graficzny sieci

3.1 Oddział I – Główna siedziba

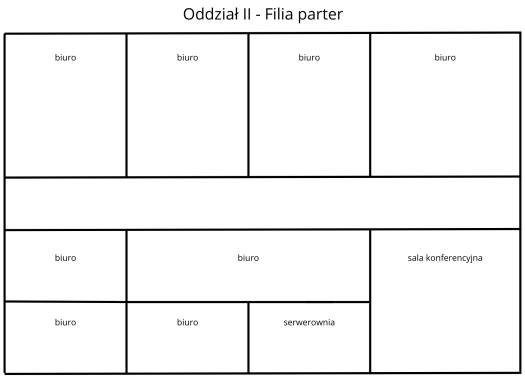


Rysunek 1: Schemat graficzny sieci w Oddziale I - parter

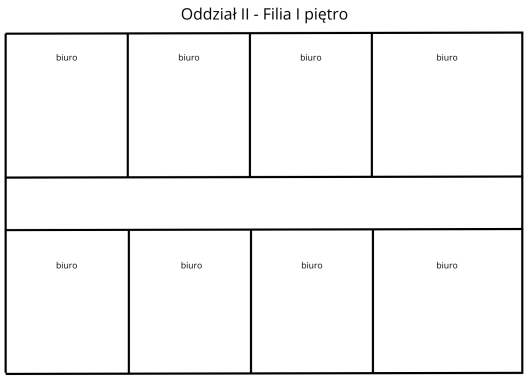


Rysunek 2: Schemat graficzny sieci w Oddziale I - piętra I i II

3.2 Oddział II – Filia



Rysunek 3: Schemat graficzny sieci w Oddziale II - parter



Rysunek 4: Schemat graficzny sieci w Oddziale II - I piętro

4 Infrastruktura fizyczna i urządzenia aktywne

Tabela 1: Rozdział adresów

VLAN / Grupa	Adres podsieci	Adresów dostępnych	Używane	Wolne
VLAN 10 - Admin (Oddział I)	192.168.0.0/26	62	50	12
VLAN 20 - IT (Oddział I)	192.168.0.64/26	62	50	12
VLAN 30 - Finanse (Oddział I)	192.168.0.128/26	62	50	12
VLAN 40 - Klienci (Oddział I)	192.168.0.192/26	62	50	12
VLAN 50 - Admin (Oddział II)	10.10.0.0/26	62	32	30
VLAN 60 - Klienci (Oddział II)	10.10.0.64/26	62	32	30
VLAN 70 - IT (Oddział II)	10.10.0.128/26	62	36	26
VLAN 80 - Zdalni (Oddział II)	10.10.0.192/28	14	10	4

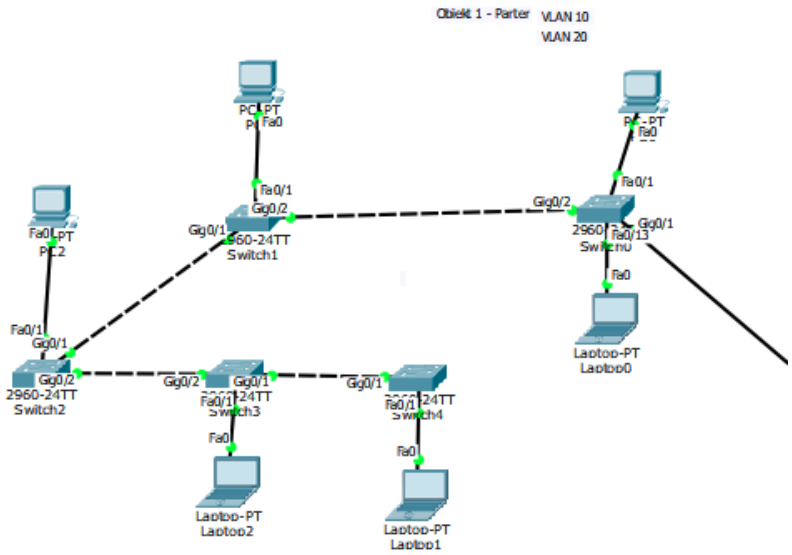
4.1 Kosztorys

1. Router Ubiquiti UniFi Dream Machine Pro
   - Ilość: 6 sztuk
   - Cena jednostkowa: 1900,00 PLN
   - Wartość: 11 400,00 PLN
2. Switch Cisco Catalyst 2960
   - Ilość: 17 sztuk
   - Cena jednostkowa: 350,00 PLN
   - Wartość: 5 950,00 PLN
3. Kabel UTP kat. 5e
   - Ilość: 2000 metrów
   - Cena jednostkowa: 0,80 PLN
   - Wartość: 1 600,00 PLN

Łączna wartość sprzętu: 18 950,00 PLN

5 Adresacja IP

5.1 Oddział I



Rysunek 5: Schemat połączenia trunk przełączników nr 0,1,2,3,4 oraz Routera 0

Poniżej przedstawiono konfigurację przełączników oraz routerów. Adresy IP, VLAN-y, OSPF, EIGRP.

```
Switch 0
--------
Switch(config)# vlan 10
Switch(config)# vlan 20

Switch(config)#interface range fastEthernet 0/1 - 12
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 10

Switch(config)#interface range fastEthernet 0/13 - 24
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 20

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 1
--------
Switch(config)# vlan 10

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 10

Switch(config)#interface  range gigabitEthernet 0/1 - 2
```

```
Switch(config-if)#switchport mode trunk

Switch 2
--------
Switch(config)# vlan 10

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 10

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 3
--------
Switch(config)# vlan 20

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 20

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 4
--------
Switch(config)# vlan 20

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 20

Switch(config)#interface gigabitEthernet 0/1
Switch(config-if)#switchport mode trunk

Switch 5
--------
Switch(config)# vlan 30

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 30

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 6
--------
Switch(config)# vlan 30
```

```
Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 30

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 7
--------
Switch(config)# vlan 30

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 30

Switch(config)#interface gigabitEthernet 0/1
Switch(config-if)#switchport mode trunk

Switch 8
--------
Switch(config)# vlan 40

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 40

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 9
--------
Switch(config)# vlan 40

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 40

Switch(config)#interface  range gigabitEthernet 0/1 - 2
Switch(config-if)#switchport mode trunk

Switch 10
--------
Switch(config)# vlan 40

Switch(config)#interface range fastEthernet 0/1 - 22
Switch(config)#switchport mode access
Switch(config)#switchport access vlan 40

Switch(config)#interface gigabitEthernet 0/1
Switch(config-if)#switchport mode trunk
```

```
Router 0
--------
Router(config)#interface fastEthernet 0/0
Router(config-if)#no shutdown

Router(config-if)#interface fastEthernet 0/0.10
Router(config-subif)#encapsulation dot1q 10
Router(config-subif)#ip address 192.168.0.1 255.255.255.192
Router(config-subif)#no shutdown

Router(config-if)#interface fa 0/0.20
Router(config-subif)#encapsulation dot1q 20
Router(config-subif)#ip address 192.168.0.65 255.255.255.192
Router(config-subif)#no shutdown

Router(config)#interface serial 0/1/1
Router(config-if)#ip address 2.2.2.2 255.255.255.252
Router(config-if)#no shutdown

Router(config)#interface serial 0/1/1
Router(config-if)#ip address 2.2.2.2 255.255.255.252
Router(config-if)#no shutdown

Router(config)#router ospf 1
Router(config-router)#network 2.2.2.0 0.0.0.3 area 1
Router(config-router)#network 192.168.0.0 0.0.0.63 area 1
Router(config-router)#network 192.168.0.64 0.0.0.63 area 1
Router(config-router)#passive-interface fastEthernet 0/0
Router(config-router)#passive-interface fastEthernet 0/0.10
Router(config-router)#passive-interface fastEthernet 0/0.20

Router# copy running-config startup-config

Router 1
--------

Router(config)#interface fastEthernet 0/0
Router(config-if)#no shutdown

Router(config-if)#interface fastEthernet 0/0.30
Router(config-subif)#encapsulation dot1q 30
Router(config-subif)#ip address 192.168.0.129 255.255.255.192
Router(config-subif)#no shutdown

Router(config)#interface serial 0/1/0
Router(config-if)#ip address 3.3.3.1 255.255.255.252
Router(config-if)#no shutdown

Router(config)#interface serial 0/1/1
```

```
Router(config-if)#ip address 2.2.2.1 255.255.255.252
Router(config-if)#no shutdown

Router(config)#router ospf 1
Router(config-router)#network 3.3.3.0 0.0.0.3 area 1
Router(config-router)#network 2.2.2.0 0.0.0.3 area 1
Router(config-router)#network 192.168.0.128 0.0.0.63 area 1
Router(config-router)#passive-interface fastEthernet 0/0
Router(config-router)#passive-interface fastEthernet 0/0.30

Router# copy running-config startup-config
```

Router 2

```
Router(config)#interface fastEthernet 0/0
Router(config-if)#no shutdown

Router(config-if)#interface fastEthernet 0/0.40
Router(config-subif)#encapsulation dot1q 40
Router(config-subif)#ip address 192.168.0.193 255.255.255.192
Router(config-subif)#no shutdown

Router(config)#interface serial 0/1/0
Router(config-if)#ip address 3.3.3.2 255.255.255.252
Router(config-if)#no shutdown

Router(config)#router ospf 1
Router(config-router)#network 3.3.3.0 0.0.0.3 area 1
Router(config-router)#network 192.168.0.192 0.0.0.63 area 1
Router(config-router)#passive-interface fastEthernet 0/0
Router(config-router)#passive-interface fastEthernet 0/0.40

Router# copy running-config startup-config
```

RouterOutOddzial1

```
Router(config)#interface serial 0/1/0
Router(config-if)#ip address 1.1.1.1 255.255.255.252
Router(config)#ip nat inside
Router(config-if)#no shutdown

Router(config)#router ospf 1
Router(config-router)#network 1.1.1.0 0.0.0.3 area 1

Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 203.0.113.1 255.255.255.252
Router(config-if)#ip nat outside
Router(config-if)#no shutdown
```

```
Router(config)#access-list 1 permit 1.1.1.0 0.0.0.3
Router(config)#ip nat inside source list 1 interface FastEthernet0/0 overload


RouterOutOddzial2
-----------------

Router(config)#interface serial 0/1/0
Router(config-if)#ip address 10.10.1.1 255.255.255.252
Router(config)#ip nat inside
Router(config-if)#no shutdown

Router(config)#router eigrp 100
Router(config-router)#network 10.10.1.0 0.0.0.3
Router(config-router)#no auto-summary

Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 203.0.113.2 255.255.255.252
Router(config-if)#ip nat outside
Router(config-if)#no shutdown

Router(config)#access-list 1 permit 10.10.1.0 0.0.0.3
Router(config)#ip nat inside source list 1 interface FastEthernet0/0
overload
```

IP adres i maska routerów:

- Router 0 fa0/0.10 192.168.0.1 255.255.255.192
- Router 0 fa0/0.20 192.168.0.65 255.255.255.192
- Router 0 serial0/1/0 1.1.1.2 255.255.255.252
- Router 0 serial0/1/1 2.2.2.2 255.255.255.252

- Router 1 fa0/0.30 192.168.0.2 255.255.255.192
- Router 1 fa0/0.20 192.168.0.65 255.255.255.192
- Router 1 serial0/0/0 2.2.2.1 255.255.255.252
- Router 1 serial0/0/1 3.3.3.1 255.255.255.252

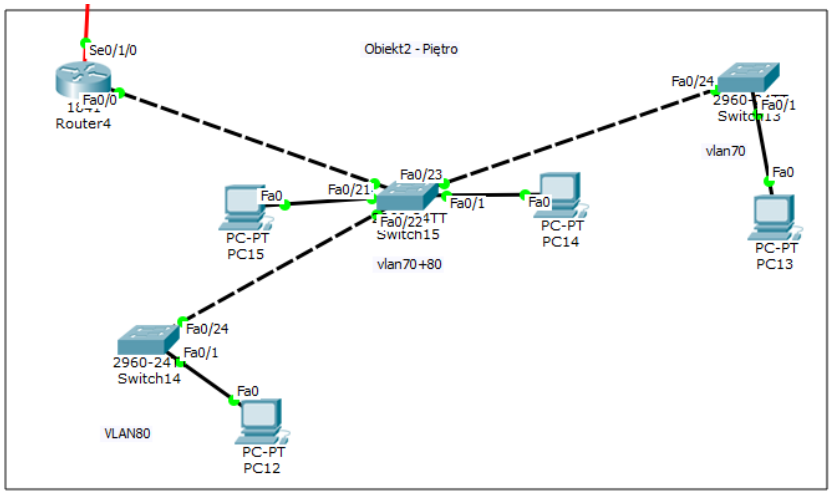
- Router 2 fa0/0.10 192.168.0.3 255.255.255.192
- Router 2 fa0/0.30 192.168.0.129 255.255.255.192

- Router 2 serial0/0/0 3.3.3.2 255.255.255.252

- RouterOutOddzial1 serial0/0/0 1.1.1.1 255.255.255.252

5.2 Oddział II

Schemat logiczny połączenia routerów oraz switchy:



Rysunek 6: Schemat logiczny połączenia routerów oraz switchy w Oddziale II na pietrze

Konfiguracja routerów i przełączników w Oddziale II:

```
RouterOutOddział2
-----------------
interface Serial0/0/0
ip address 10.10.1.1 255.255.255.252
no shutdown
exit

Router3
-------
interface FastEthernet0/0.50
encapsulation dot1Q 50
ip address 10.10.0.1 255.255.255.192
exit

interface FastEthernet0/0.60
encapsulation dot1Q 60
ip address 10.10.0.65 255.255.255.192
exit

interface Serial0/0/0
ip address 10.10.1.2 255.255.255.252
no shutdown
```

```
exit

interface Serial0/0/1
ip address 10.10.1.5 255.255.255.252
no shutdown
exit


Router4
-------
interface FastEthernet0/0.70
encapsulation dot1Q 70
ip address 10.10.0.129 255.255.255.192
exit

interface FastEthernet0/0.80
encapsulation dot1Q 80
ip address 10.10.0.193 255.255.255.240
exit

interface Serial0/1/0
ip address 10.10.1.6 255.255.255.252
no shutdown
exit
```

Przykładowa konfiguracja Switch15 (piętro – VLAN 70, 80):

```
Switch15
--------
vlan 70
exit

vlan 80
exit

interface range fa0/1 - 12
switchport mode access
switchport access vlan 70
exit

interface range fa0/13 - 21
switchport mode access
switchport access vlan 80
exit

interface range fa0/22 - 24
switchport mode trunk
exit
```

6 DHCP

6.1 Oddział I –DHCP

Konfiguracja routerów z DHCP w Oddziale II:

```
Router0
-------

Router(config)#ip dhcp pool vlan10
Router(dhcp-config)#network 192.168.0.0 255.255.255.192
Router(dhcp-config)#default-router 192.168.0.1
Router(dhcp-config)#dns-server 8.8.8.8
Router(config)#ip dhcp excluded-address 192.168.0.1

Router(config)#ip dhcp pool vlan20
Router(dhcp-config)#network 192.168.0.64 255.255.255.192
Router(dhcp-config)#default-router 192.168.0.65
Router(dhcp-config)#dns-server 8.8.8.8
Router(config)#ip dhcp excluded-address 192.168.0.65

Router1
-------

Router(config)#ip dhcp pool vlan30
Router(dhcp-config)#network 192.168.0.128 255.255.255.192
Router(dhcp-config)#default-router 192.168.0.129
Router(dhcp-config)#dns-server 8.8.8.8
Router(config)#ip dhcp excluded-address 192.168.0.129

Router2
-------
Router(config)#ip dhcp pool vlan40
Router(dhcp-config)#network 192.168.0.192 255.255.255.192
Router(dhcp-config)#default-router 192.168.0.193
Router(dhcp-config)#dns-server 8.8.8.8
Router(config)#ip dhcp excluded-address 192.168.0.193
```

6.2 Oddział II – DHCP

Konfiguracja routerów z DHCP w Oddziale II:

```
Router3
-------
ip dhcp excluded-address 10.10.0.1 10.10.0.1
ip dhcp excluded-address 10.10.0.65 10.10.0.65

ip dhcp pool VLAN50
network 10.10.0.0 255.255.255.192
default-router 10.10.0.1
dns-server 8.8.8.8
```

```
exit

ip dhcp pool VLAN60
network 10.10.0.64 255.255.255.192
default-router 10.10.0.65
dns-server 8.8.8.8
exit

Router4
-------
ip dhcp excluded-address 10.10.0.129 10.10.0.129
ip dhcp excluded-address 10.10.0.193 10.10.0.193

ip dhcp pool VLAN70
network 10.10.0.128 255.255.255.192
default-router 10.10.0.129
dns-server 8.8.8.8
exit

ip dhcp pool VLAN80
network 10.10.0.192 255.255.255.240
default-router 10.10.0.193
dns-server 8.8.8.8
exit
```

7 Routing i translacja adresów

7.1 Oddział I: OSPF

Konfiguracja routerów i OSPF w Oddziale I:

```
RouterOutOddział1
-----------------

interface serial0/0/1
ip address 203.0.113.1 255.255.255.252
no shutdown
exit

router ospf 1
network 203.0.113.0 0.0.0.3 area 0
exit
```

7.2 Oddział II: EIGRP

Konfiguracja routerów i EIGRP w Oddziale II:

```
RouterOutOddział2
-----------------
```

```
interface serial0/0/1
ip address 203.0.113.2 255.255.255.252
no shutdown
exit

router eigrp 100
network 10.10.1.0 0.0.0.3
no auto-summary
exit

router eigrp 100
network 203.0.113.0 0.0.0.3
no auto-summary
exit

Router3
-------
router eigrp 100
network 10.10.0.0 0.0.0.255
network 10.10.1.0 0.0.0.3
network 10.10.1.4 0.0.0.3
no auto-summary
exit

Router4
-------
router eigrp 100
network 10.10.0.0 0.0.0.255
network 10.10.1.4 0.0.0.3
no auto-summary
exit
```

7.3 NAT realizowany na wyjściowym routerze w każdym oddziale

Oddział 1

```
interface fa0/1
 ip address 149.156.100.1 255.255.255.252
 no shutdown
 ip nat outside
exit
interface fa0/0.10
 ip nat inside
exit
interface fa0/0.20
 ip nat inside
exit
interface se0/1/1
 ip nat inside
exit
```

```
ip route 0.0.0.0 0.0.0.0 fa0/1
access-list 10 permit 192.168.0.0 0.0.0.63
access-list 20 permit 192.168.0.64 0.0.0.63
access-list 30 permit 192.168.0.128 0.0.0.63
access-list 40 permit 192.168.0.192 0.0.0.63
access-list 2 permit 2.2.2.0 0.0.0.3
access-list 3 permit 3.3.3.0 0.0.0.3
ip nat inside source list 10 interface fa0/1 overload
ip nat inside source list 20 interface fa0/1 overload
ip nat inside source list 30 interface fa0/1 overload
ip nat inside source list 40 interface fa0/1 overload
ip nat inside source list 2 interface fa0/1 overload
ip nat inside source list 3 interface fa0/1 overload
```

Oddział 2

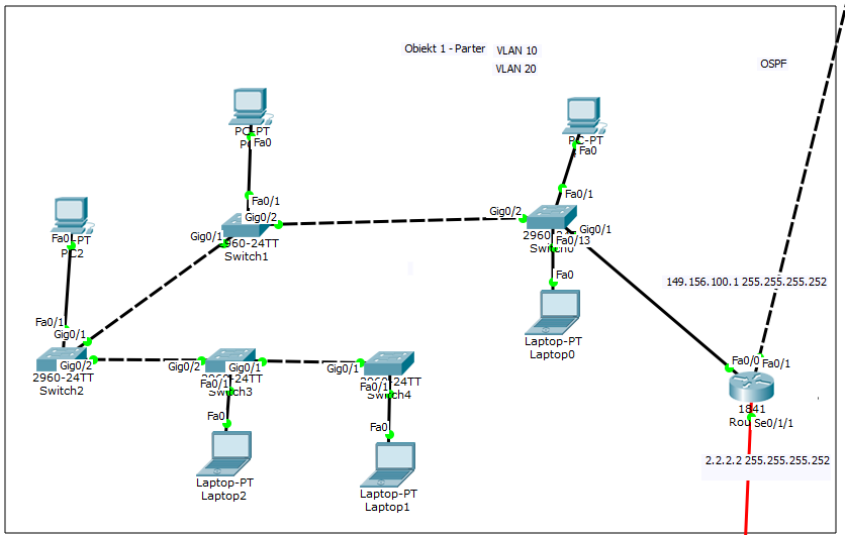
```
interface fa0/1
 ip address 149.150.200.1 255.255.255.252
 ip nat outside
exit
interface fa0/0.50
 ip nat inside
exit
interface fa0/0.60
 ip nat inside
exit
ip route 0.0.0.0 0.0.0.0 fa0/1
access-list 50 permit 10.10.0.0 0.0.0.63
access-list 60 permit 10.10.0.64 0.0.0.63
access-list 70 permit 10.10.0.128 0.0.0.63
access-list 80 permit 10.10.0.192 0.0.0.15
access-list 1 permit 10.10.1.0 0.0.0.3
ip nat inside source list 50 interface fa0/1 overload
ip nat inside source list 60 interface fa0/1 overload
ip nat inside source list 70 interface fa0/1 overload
ip nat inside source list 80 interface fa0/1 overload
ip nat inside source list 1 interface fa0/1 overload
```

Router łączący

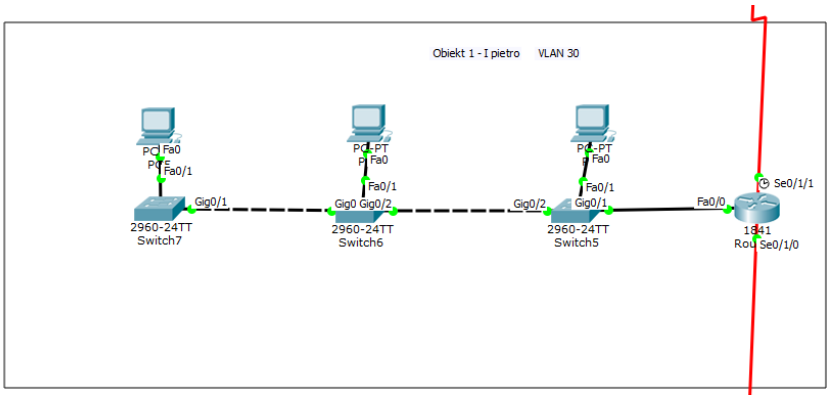
```
interface fa0/1
 ip address 149.150.200.2 255.255.255.252
 no shutdown
 ip nat inside
exit
interface fa0/0
 ip address 149.156.100.2 255.255.255.252
 no shutdown
 ip nat outside
exit
```

```
access-list 100 permit 149.150.200.0 0.0.0.3
access-list 110 permit 149.156.100.0 0.0.0.3
ip nat inside source list 100 interface fa0/0 overload
ip nat inside source list 110 interface fa0/0 overload
```

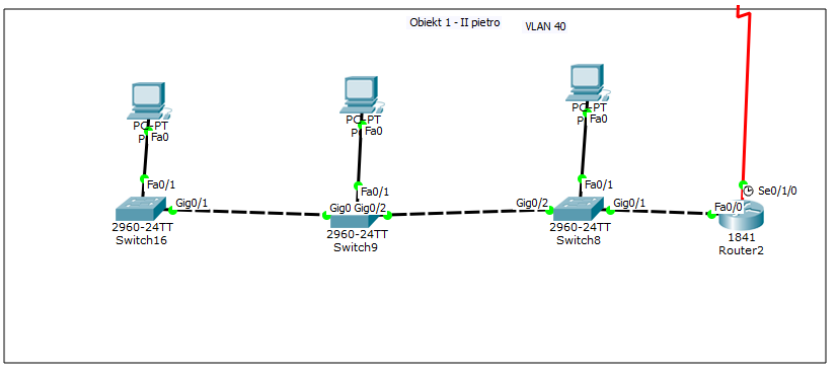
Schemat logiczny połączenia routerów Odział 1



Rysunek 7: Schemat logiczny połączenia routerów oraz switchy w Oddziale I na pietrze

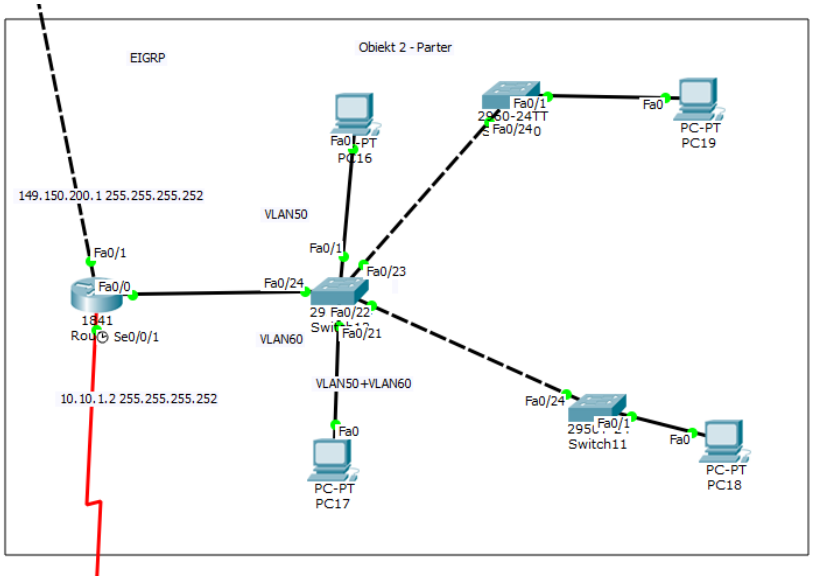


Rysunek 8: Schemat logiczny połączenia routerów oraz switchy w Oddziale I na 1 piętrze

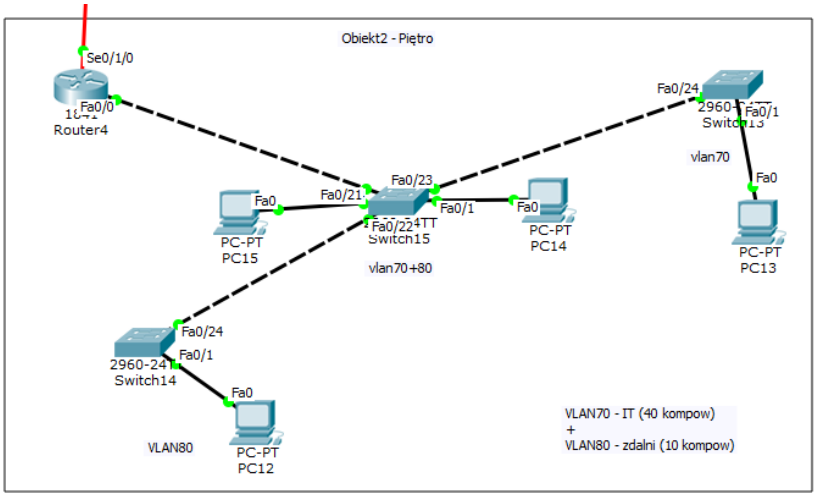


Rysunek 9: Schemat logiczny połączenia routerów oraz switchy w Oddziale I na 2 pietrze

Schemat logiczny połączenia routerów Odział 2



Rysunek 10: Schemat logiczny połączenia routerów oraz switchy w Oddziale II na pietrze



Rysunek 11: Schemat logiczny połączenia routerów oraz switchy w Oddziale II na 1 piętrze

7.4 Test OSPF

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	E
	Successful	PC6	PC4	ICMP		0.000	N	0	
	Successful	PC0	Laptop1	ICMP		0.000	N	1	
	Successful	PC1	Laptop2	ICMP		0.000	N	2	
	Successful	PC7	PC5	ICMP		0.000	N	3	
	Successful	PC3	PC6	ICMP		0.000	N	4	

Rysunek 12: Test OSPF

7.5 Test EIGRP

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num
	Successful	PC19	PC15	ICMP		0.000	N	0
	Successful	PC14	PC18	ICMP		0.000	N	1
	Successful	PC12	PC13	ICMP		0.000	N	2
	Successful	PC13	PC16	ICMP		0.000	N	3

Rysunek 13: Test Eigrp