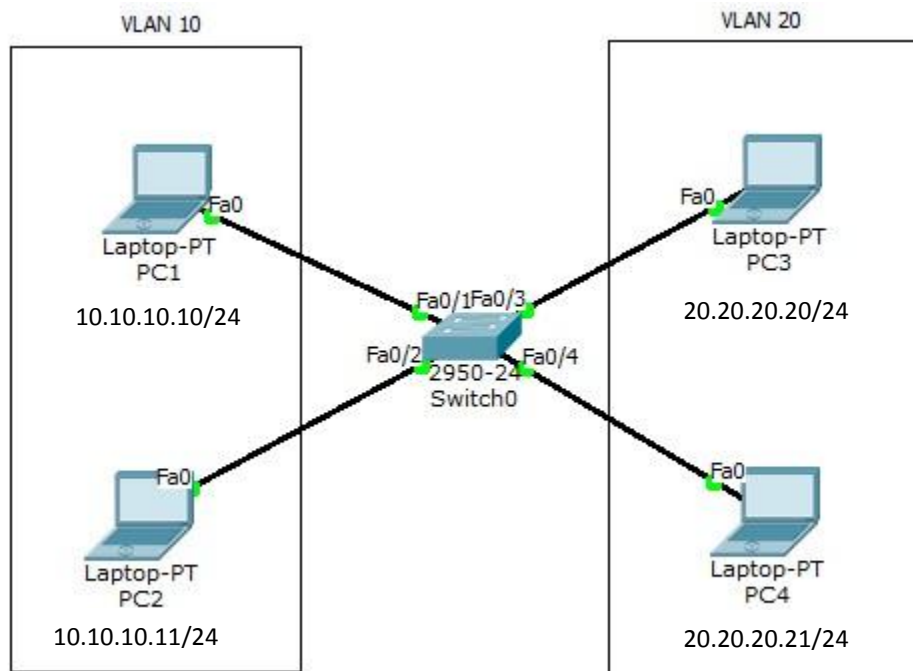


## Virtual LAN (VLAN)

Virtual LAN (VLAN) membagi satu broadcast domain menjadi beberapa broadcast domain, sehingga dalam satu switch bisa saja terdiri dari beberapa network. Host yang berbeda VLAN tidak akan tersambung sehingga meningkatkan security jaringan.

VLAN adalah fasilitas yang dimiliki oleh switch manageable, contohnya cisco. Pada switch unmanageable, port-port nya hanya dapat digunakan untuk koneksi ke network yang sama (satu network) sehingga tidak mendukung fasilitas VLAN.



Buatlah topologi seperti pada gambar diatas pada packet tracer. Konfigurasi VLAN pada switch dengan VLAN10 berikan nama Marketing dan VLAN20 dengan nama Sales.

```
Switch>enable
Switch#conf t
Switch(config)#vlan 10
Switch(config-vlan)#name Marketing
Switch(config-vlan)#vlan 20
Switch(config-vlan)#name Sales
Switch(config-vlan)#int f0/1
Switch(config-if)#switchport access vlan 10
Switch(config-if)#int f0/2
Switch(config-if)#switchport access vlan 10
Switch(config-if)#int f0/3
Switch(config-if)#switchport access vlan 20
Switch(config-if)#int f0/4
Switch(config-if)#switchport access vlan 20
```

Untuk pengecekan, ping dari satu PC ke PC lain dan ketikkan perintah show vlan pada switch. PC tidak bisa ping ke beda VLAN.

```

PC>ping 10.10.10.11

Pinging 10.10.10.11 with 32 bytes of data:

Reply from 10.10.10.11: bytes=32 time=0ms TTL=128
Reply from 10.10.10.11: bytes=32 time=0ms TTL=128
Reply from 10.10.10.11: bytes=32 time=0ms TTL=128
Reply from 10.10.10.11: bytes=32 time=0ms TTL=128

Ping statistics for 10.10.10.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

PC>ping 20.20.20.21

Pinging 20.20.20.21 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.20.20.21:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>

```

```

Switch#show vlan
VLAN Name                Status    Ports
-----
---
1    default                active    Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                           Fa0/9,   Fa0/10,  Fa0/11,
Fa0/12
                                           Fa0/13,  Fa0/14,  Fa0/15,
Fa0/16
                                           Fa0/17,  Fa0/18,  Fa0/19,
Fa0/20
                                           Fa0/21,  Fa0/22,  Fa0/23,
Fa0/24
10   VLAN0010                active    Fa0/1, Fa0/2
20   VLAN0020                active    Fa0/3, Fa0/4
1002 fddi-default            act/unsup
1003 token-ring-default    act/unsup
1004 fddinet-default        act/unsup
1005 trnet-default         act/unsup

VLAN Type  SAID          MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
-----
--
1    enet  100001       1500  -     -     -   -     -     0     0

```

```

10 enet 100010 1500 - - - - - 0 0
20 enet 100020 1500 - - - - - 0 0
1002 fddi 101002 1500 - - - - - 0 0
1003 tr 101003 1500 - - - - - 0 0
1004 fdnet 101004 1500 - - - - ieee 0 0
1005 trnet 101005 1500 - - - - ibm 0 0

```

Remote SPAN VLANs

--

```

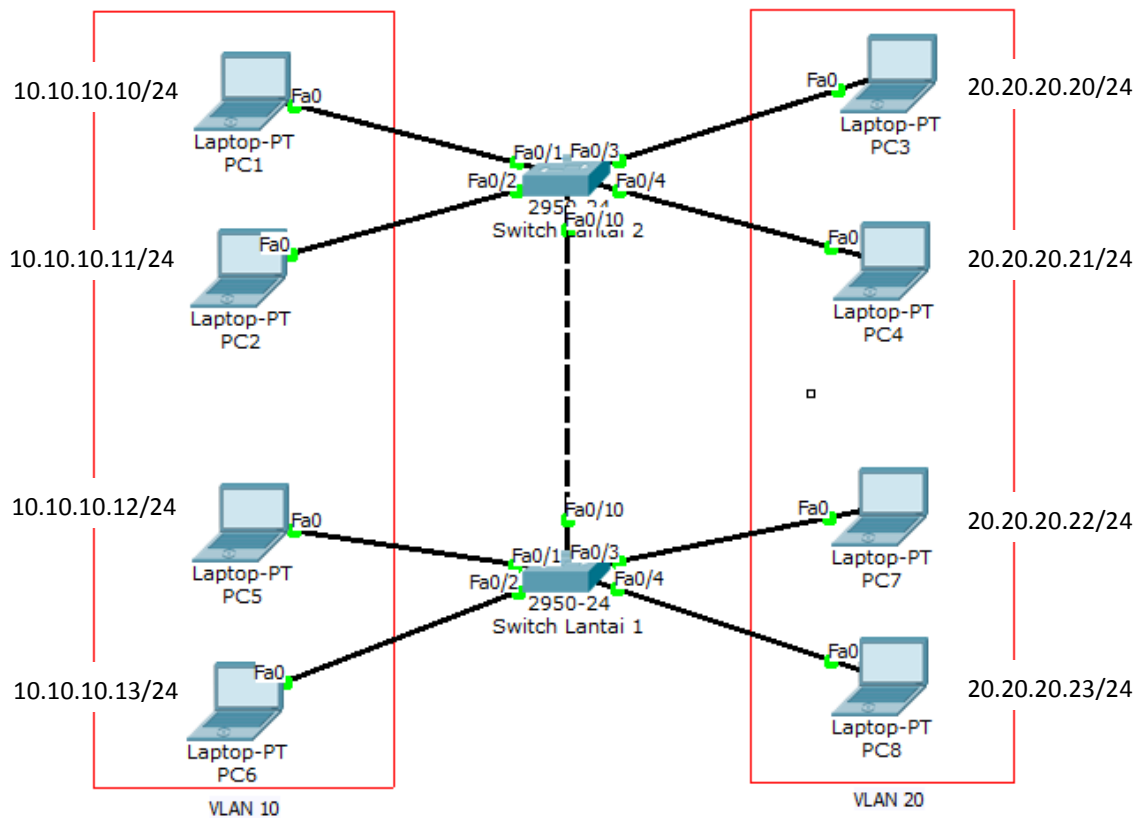
Primary Secondary Type Ports
-----

```

--

## Trunking VLAN

Trunking berfungsi melewatkan traffic VLAN dari switch yang berbeda. Antara switch lantai 1 dan lantai 2 terhubung. PC1, PC2, PC5 dan PC6 masuk dalam VLAN 10 sedang PC3, PC4, PC7 dan PC8 masuk dalam VLAN 20.



Konfigurasi VLAN pada seperti dibawah. Membuat vlan 10 dan vlan 20.

```

switch1(config)#vlan 10
switch1(config-vlan)#vlan 20
switch1(config-vlan)#int f0/1
switch1(config-if)#sw access vlan 10
switch1(config-if)#int f0/2
switch1(config-if)#sw access vlan 10
switch1(config-vlan)#int f0/3
switch1(config-if)#sw access vlan 10
switch1(config-vlan)#int f0/4
switch1(config-if)#sw access vlan 10

Switch0(config)#vlan 10
Switch0(config-vlan)#vlan 20
Switch0(config-vlan)#int f0/1
Switch0(config-if)#sw access vlan 10
Switch0(config-if)#int f0/2
Switch0(config-if)#sw access vlan 10
Switch0(config-vlan)#int f0/3
Switch0(config-if)#sw access vlan 10
Switch0(config-vlan)#int f0/4
Switch0(config-if)#sw access vlan 10

```

**Konfigurasi interface yang saling terhubung antar switch dengan mode trunk. Lakukan pada kedua switch.**

```

Switch0(config)#int f0/10
Switch0(config-if)#switchport mode trunk

Switch1(config)#int f0/10
Switch1(config-if)#switchport mode trunk

```

**Ping dari satu PC ke PC lain dan ketikkan perintah show vlan.**

```

PC>ping 10.10.10.11

Pinging 10.10.10.11 with 32 bytes of data:

Reply from 10.10.10.11: bytes=32 time=17ms TTL=128
Reply from 10.10.10.11: bytes=32 time=0ms TTL=128
Reply from 10.10.10.11: bytes=32 time=0ms TTL=128
Reply from 10.10.10.11: bytes=32 time=0ms TTL=128

Ping statistics for 10.10.10.11:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 17ms, Average = 4ms

PC>ping 10.10.10.13

Pinging 10.10.10.13 with 32 bytes of data:

Reply from 10.10.10.13: bytes=32 time=11ms TTL=128
Reply from 10.10.10.13: bytes=32 time=0ms TTL=128
Reply from 10.10.10.13: bytes=32 time=0ms TTL=128
Reply from 10.10.10.13: bytes=32 time=1ms TTL=128

Ping statistics for 10.10.10.13:

```

```

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
  Minimum = 0ms, Maximum = 11ms, Average = 3ms

PC>ping 20.20.20.20

Pinging 20.20.20.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 20.20.20.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

PC>

```

PC dapat melakukan ping ke sesama VLAN beda switch namun tidak bisa ke beda VLAN.

```

Switch1#sh int trunk
Port      Mode           Encapsulation  Status        Native vlan
Fa0/10    on             802.1q         trunking      1

Port      Vlans allowed on trunk
Fa0/10    1-1005

Port      Vlans allowed and active in management domain
Fa0/10    1,10,20

Port      Vlans in spanning tree forwarding state and not pruned
Fa0/10    1,10,20

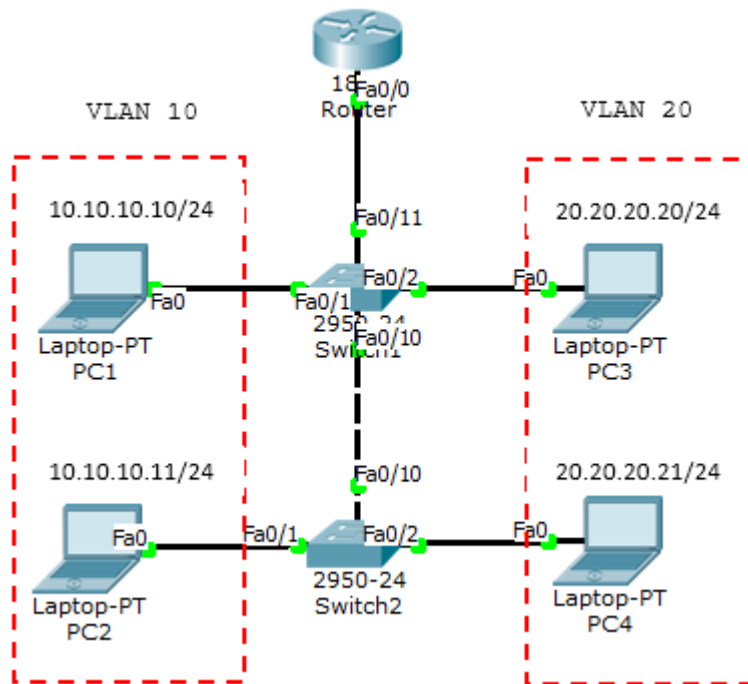
```

## Inter-VLAN - Router on a Stick

Untuk menghubungkan VLAN yang berbeda, dibutuhkan perangkat layer 3 baik itu router atau switch layer 3. Cara pertama adalah dengan menggunakan satu router melalui satu interface. Teknik ini disebut router on a stick. Kekurangan dari teknik ini adalah akan terjadi collision domain karena hanya menggunakan satu interface.

Ada 2 trunking protocol yang biasa digunakan:

- ISL = cisco proprietary, bekerja pada ethernet, token ring dan FDDI, menambah tag sebesar 30byte pada frame dan semua traffic VLAN ditag.
- IEEE 802.11Q (dot1q) = open standard, hanya bekerja pada ethernet, menambah tag sebesar 4byte pada frame.



Buat topologi seperti diatas dan konfigurasi VLAN10 dan VLAN20 seperti lab sebelumnya. Tambahkan 1 router. Karena hanya menggunakan 1 interface, maka harus dibuat sub-interface untuk dijadikan gateway VLAN. Port SW1 yang terhubung ke router harus diset mode trunk.

```
Router(config)#interface FastEthernet0/0.10
Router(config-subif)#encapsulation dot1Q 10
Router(config-subif)#ip address 10.10.10.1 255.255.255.0
Router(config-subif)#interface FastEthernet0/0.20
Router(config-subif)#encapsulation dot1Q 20
Router(config-subif)#ip address 20.20.20.1 255.255.255.0
```

Cek interface dengan perintah *show ip int brief*.

```
Router#sh ip int br
Interface                IP-Address      OK? Method Status
Protocol
FastEthernet0/0          unassigned      YES unset  up
FastEthernet0/0.10      10.10.10.1     YES manual  up
FastEthernet0/0.20      20.20.20.1     YES manual  up
FastEthernet0/0.30      30.30.30.30    YES manual  up
FastEthernet0/1          unassigned      YES unset  administratively down down
Vlan1                    unassigned      YES unset  administratively down down
Router#
```

Sekarang ping antar VLAN yang berbeda.

```

PC>ping 20.20.20.21

Pinging 20.20.20.21 with 32 bytes of data:

Request timed out.
Reply from 20.20.20.21: bytes=32 time=1ms TTL=127
Reply from 20.20.20.21: bytes=32 time=0ms TTL=127
Reply from 20.20.20.21: bytes=32 time=0ms TTL=127

Ping statistics for 20.20.20.21:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

PC>tracert 20.20.20.21

Tracing route to 20.20.20.21 over a maximum of 30 hops:

  0  30 ms    0 ms    0 ms    10.10.10.1
  1  0 ms     0 ms    0 ms    20.20.20.21

Trace complete.

```

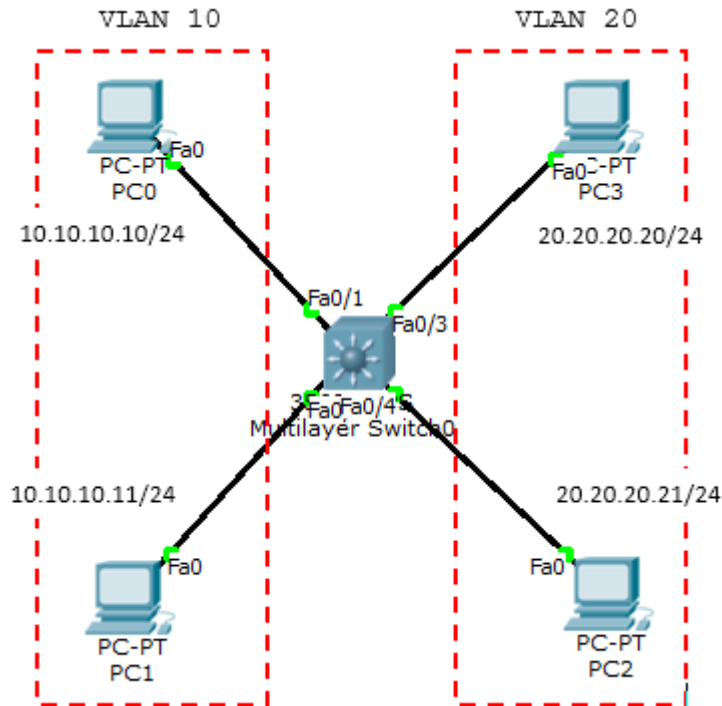
```

Router#sh ip arp
Protocol Address           Age (min)  Hardware Addr   Type   Interface
-----
Internet 10.10.10.10        4          0000.0C1B.0D20  ARPA
FastEthernet0/0.10
Internet 20.20.20.21        3          0060.7092.05A9  ARPA
FastEthernet0/0.20
Internet 30.30.30.1         1          0001.C7AE.3D52  ARPA
FastEthernet0/0.30
Router#

```

## Inter-VLAN – Switch Layer 3

Untuk menghubungkan antar VLAN dibutuhkan suatu perangkat layer 3 baik itu router atau switch layer 3. Kalau sebelum menggunakan router on a stick, kali ini kita akan menggunakan switch L3 (layer 3). Inilah kerennya cisco, kalo switch yang lain bekerja pada layer 2, switch cisco dapat bekerja pada layer 3 dan menjalankan routing. Namun, meski untuk routing yang lebih luas lebih dianjurkan menggunakan router sesuai fungsinya.



Konfigurasi port ke VLANnya masing-masing.

```
Switch(config)#interface FastEthernet0/1
Switch(config-if)#switchport access vlan 10
Switch(config-if)#switchport mode access
Switch(config-if)#
Switch(config-if)#interface FastEthernet0/2
Switch(config-if)#switchport access vlan 10
Switch(config-if)#switchport mode access
Switch(config-if)#
Switch(config-if)#interface FastEthernet0/3
Switch(config-if)#switchport access vlan 20
Switch(config-if)#switchport mode access
Switch(config-if)#interface FastEthernet0/4
Switch(config-if)#switchport access vlan 20
Switch(config-if)#switchport mode access
```

Buat interface VLAN dan beri ip address.

```
Switch(config)#int vlan 10
Switch(config-if)#ip add 10.10.10.1 255.255.255.0
Switch(config-if)#int vlan 20
Switch(config-if)#ip add 20.20.20.1 255.255.255.0
```

Ketiikkan perintah ip routing untuk merouting VLAN.

```
Switch(config)#ip routing
```

Sekarang tes ping.

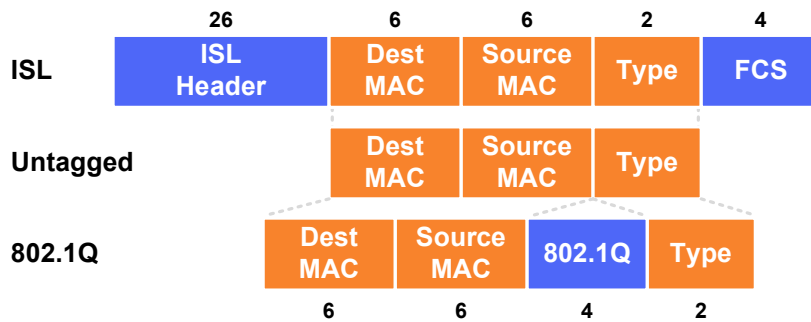
```
PC>ping 20.20.20.21
```

```
Pinging 20.20.20.21 with 32 bytes of data:
```



```
Request timed out.  
Reply from 20.20.20.21: bytes=32 time=0ms TTL=127  
Reply from 20.20.20.21: bytes=32 time=0ms TTL=127  
Reply from 20.20.20.21: bytes=32 time=0ms TTL=127  
  
Ping statistics for 20.20.20.21:  
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),  
    Approximate round trip times in milli-seconds:  
        Minimum = 0ms, Maximum = 0ms, Average = 0ms  
  
PC>
```

## Trunk Encapsulation



## VLAN Creation

```
Switch(config)# vlan 100
Switch(config-vlan)# name Engineering
```

## Access Port Configuration

```
Switch(config-if)# switchport mode access
Switch(config-if)# switchport nonegotiate
Switch(config-if)# switchport access vlan 100
Switch(config-if)# switchport voice vlan 150
```

## Trunk Port Configuration

```
Switch(config-if)# switchport mode trunk
Switch(config-if)# switchport trunk encapsulation dot1q
Switch(config-if)# switchport trunk allowed vlan 10,20-30
Switch(config-if)# switchport trunk native vlan 10
```

## SVI Configuration

```
Switch(config)# interface vlan100
Switch(config-if)# ip address 192.168.100.1 255.255.255.0
```

## VLAN Trunking Protocol (VTP)

### Domain

Common to all switches participating in VTP

### Server Mode

Generates and propagates VTP advertisements to clients; default mode on unconfigured switches

### Client Mode

Receives and forwards advertisements from servers; VLANs cannot be manually configured on switches in client mode

### Transparent Mode

Forwards advertisements but does not participate in VTP; VLANs must be configured manually

### Pruning

VLANs not having any access ports on an end switch are removed from the trunk to reduce flooded traffic

## VTP Configuration

```
Switch(config)# vtp mode {server | client | transparent}
Switch(config)# vtp domain <name>
Switch(config)# vtp password <password>
Switch(config)# vtp version {1 | 2}
Switch(config)# vtp pruning
```

## Trunk Types

	802.1Q	ISL
<b>Header Size</b>	4 bytes	26 bytes
<b>Trailer Size</b>	N/A	4 bytes
<b>Standard</b>	IEEE	Cisco
<b>Maximum VLANs</b>	4094	1000

## VLAN Numbers

<b>0</b> Reserved	<b>1004</b> fdnet
<b>1</b> default	<b>1005</b> trnet
<b>1002</b> fddi-default	<b>1006-4094</b> Extended
<b>1003</b> tr	<b>4095</b> Reserved

## Terminology

### Trunking

Carrying multiple VLANs over the same physical connection

### Native VLAN

By default, frames in this VLAN are untagged when sent across a trunk

### Access VLAN

The VLAN to which an access port is assigned

### Voice VLAN

If configured, enables minimal trunking to support voice traffic in addition to data traffic on an access port

### Dynamic Trunking Protocol (DTP)

Can be used to automatically establish trunks between capable ports (insecure)

### Switched Virtual Interface (SVI)

A virtual interface which provides a routed gateway into and out of a VLAN

## Switch Port Modes

### trunk

Forms an unconditional trunk

### dynamic desirable

Attempts to negotiate a trunk with the far end

### dynamic auto

Forms a trunk only if requested by the far end

### access

Will never form a trunk

## Troubleshooting

```
show vlan
```

```
show interface [status | switchport]
```

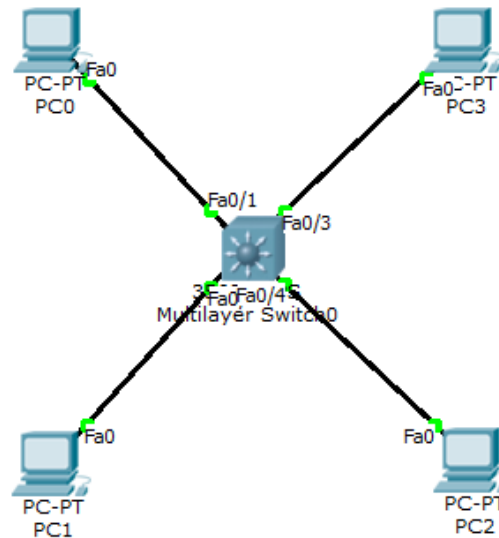
```
show interface trunk
```

```
show vtp status
```

```
show vtp password
```

## DHCP menggunakan Switch

Fungsi DHCP adalah memberikan alamat IP secara otomatis kepada host.



### Konfigurasi DHCP.

```
Switch(config)#ip dhcp pool vlan10
Switch(dhcp-config)#network 10.10.10.0 255.255.255.0
Switch(dhcp-config)#default-router 10.10.10.1
Switch(dhcp-config)#dns-server 8.8.8.8
Switch(dhcp-config)#ip dhcp pool vlan20
Switch(dhcp-config)#network 20.20.20.0 255.255.255.0
Switch(dhcp-config)#default-router 20.20.20.1
Switch(dhcp-config)#dns-server 8.8.8.8
```

jika ada ip yg tidak ingin digunakan dalam DHCP masukkan perintah `ip dhcp excluded-address`.

```
ip dhcp excluded-address 10.10.10.2 10.10.10.10
```

Perintah `show ip dhcp binding` menampilkan client yang mendapat ip dhcp.

```
Switch#sh ip dhcp binding
IP address      Client-ID/
                Hardware address
10.10.10.12     0003.E4A2.9D08
10.10.10.11     0001.64C9.674C
20.20.20.11     0001.4266.50B0
20.20.20.12     0002.1638.8C69
Switch#
```

IP address	Client-ID/ Hardware address	Lease expiration	Type
10.10.10.12	0003.E4A2.9D08	--	Automatic
10.10.10.11	0001.64C9.674C	--	Automatic
20.20.20.11	0001.4266.50B0	--	Automatic
20.20.20.12	0002.1638.8C69	--	Automatic

DHCP juga dapat diset manual untuk client dengan MAC Address tertentu.

```
ip dhcp pool PC_MANAGER
host 20.20.20.100
default router 20.20.20.1
client-id 0102.c7f8.0004.22
client-name Komputer_IDN
```