```
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
------- --------- ---------------- ---------------------------------------
--
```
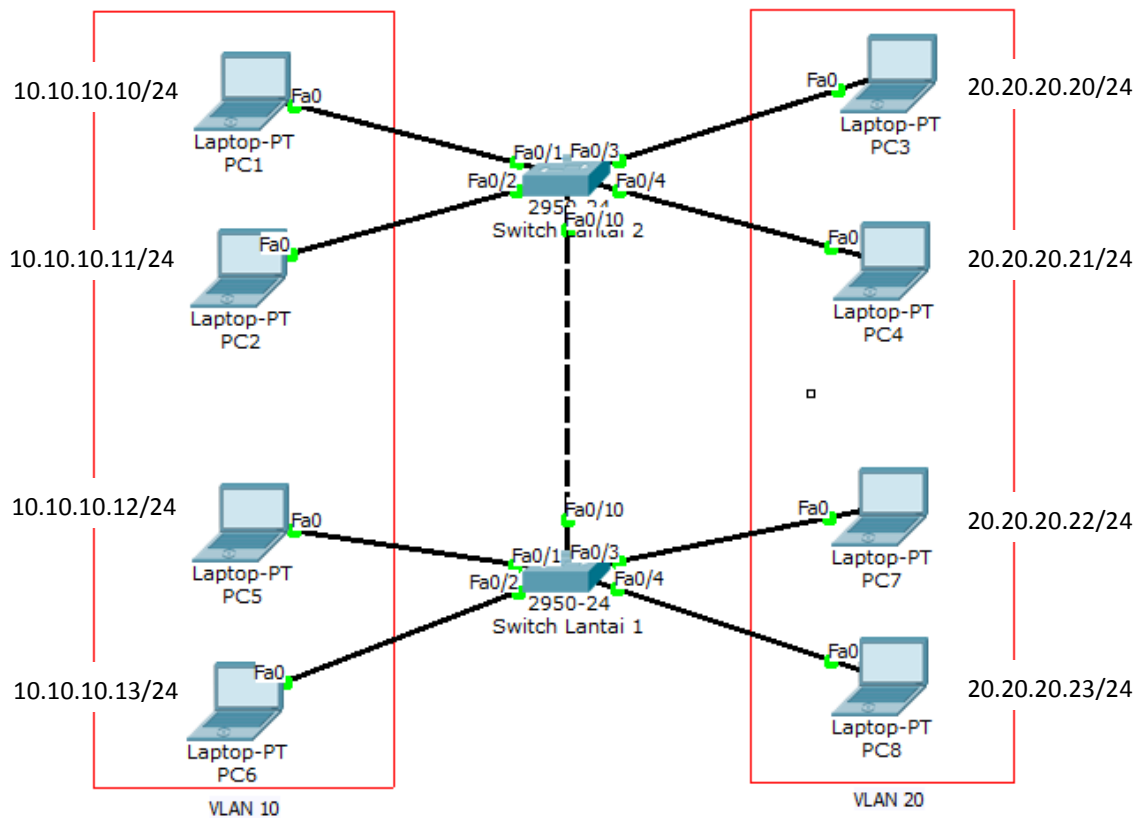
Trunking VLAN

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, PC5 dan PC6 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 sesame 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
```
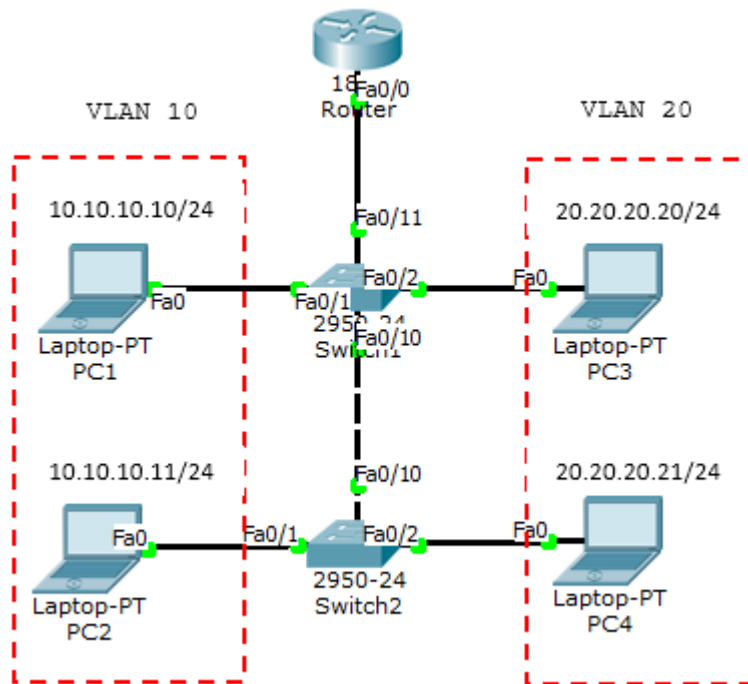
Inter-VLAN – Router on a Stick

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, menambahi tag sebesar 30byte pada frame dan semua traffic VLAN ditag.

- IEEE 802.11Q (dot1q) = open standard, hanya bekerja pada ethernet, menambahi 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                      up

FastEthernet0/0.10  10.10.10.1      YES manual up                      up

FastEthernet0/0.20  20.20.20.1      YES manual up                      up

FastEthernet0/0.30  30.30.30.30     YES manual up                      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:

  1   30 ms     0 ms      0 ms      10.10.10.1
  2   0 ms      0 ms      0 ms      20.20.20.21

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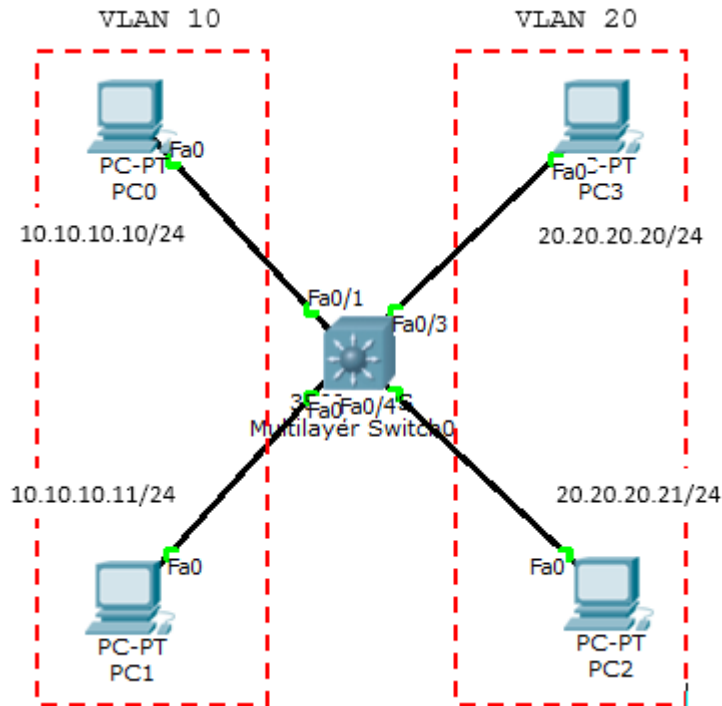
```
Router#sh ip arp
Protocol  Address         Age (min)  Hardware Addr   Type    Interface
Internet  10.10.10.10          4     0000.0C1B.0D20  ARPA
FastEthernet0/0.10
Internet  20.20.20.21          3     0060.7092.05A9  ARPA
FastEthernet0/0.20
Internet  30.30.30.1           1     0001.C7AE.3D52  ARPA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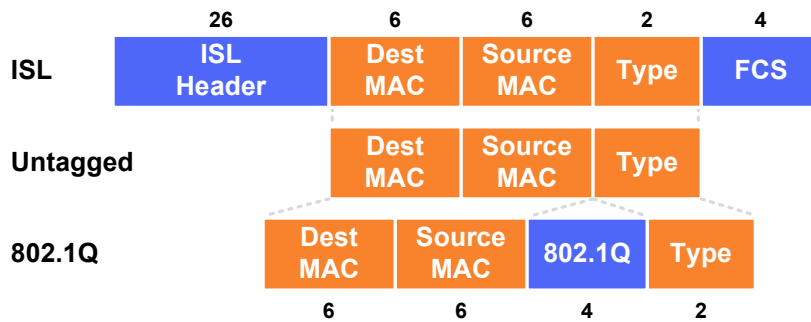
```
Switch(config)#ip routing
```

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>
```

VLANs

Trunk Encapsulation

	26	6	6	2	4
ISL	ISL Header	Dest MAC	Source MAC	Type	FCS

	6	6	2
Untagged	Dest MAC	Source MAC	Type

	6	6	4	2
802.1Q	Dest MAC	Source MAC	802.1Q	Type

Trunk Types

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

VLAN Creation

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

VLAN Numbers

0	Reserved	**1004**	fdnet
1	default	**1005**	trnet
1002	fddi-default	**1006-4094**	Extended
1003	tr	**4095**	Reserved

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
```

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

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
```

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

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

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
```

VTP Configuration

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