

LAPORAN PRAKTIKUM JARINGAN KOMPUTER 2025
STUDI KASUS: MAMAK PUNYA LIGA (MPL) - SOAL TIPE 3

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BAB 1: ANALISIS KEBUTUHAN & PERENCANAAN SUBNETTING

1.1 Deskripsi Masalah

Sebagai Chief Network Engineer untuk turnamen E-Sports "Mamak Punya Liga (MPL)", penulis diminta merancang infrastruktur jaringan untuk venue besar yang terbagi menjadi 3 zona utama: **Main Stage Arena**, **Streaming Studio**, dan **Bootcamp Area**.

Tantangan utama dalam perancangan ini meliputi pemenuhan spesifikasi teknis berikut:

1. **Segmentasi Jaringan:** Setiap role (Referees, Ticketing, Broadcasters, Atlet) harus memiliki VLAN masing-masing.
2. **Konektivitas:** Seluruh zona harus saling terhubung (Inter-Zone Routing) dan antar role dapat berkomunikasi (Inter-VLAN Routing).
3. **Performansi:** Jaringan harus memiliki bandwidth cepat (implementasi EtherChannel) dan bebas dari *looping* (implementasi Spanning Tree Protocol).
4. **Keamanan & Limitasi:** Membatasi jumlah perangkat yang terhubung sesuai dengan jumlah host yang dialokasikan.
5. **Layanan Terpusat:** Web Server ditempatkan di Streaming Studio, sedangkan DNS & Email Server terpusat di Bootcamp Area.

1.2 Perhitungan Host (Kelompok 30)

Berdasarkan Nomor Kelompok X = 30, berikut adalah rincian perhitungan kebutuhan host untuk setiap role di masing-masing zona:

A. Main Stage Arena

- **Referees:** $(15 * 30) / 5 = 90$ Host
- **Ticketing:** $(144 * 30) / 12 = 360$ Host
- **Broadcasters:** $(30 * 30) / 2 = 900 / 2 = 450$ Host
- **Atlet:** $30 * 30 = 900$ Host (**Kebutuhan Terbesar**)

B. Streaming Studio

- **Referees:** $2 * 30 = 60$ Host
- **Ticketing:** $(27 * 30) / 9 = 90$ Host
- **Broadcasters:** $2 * (30 + 25) = 110$ Host
- **Atlet:** $2 * (30 + 15) = 90$ Host

C. Bootcamp Area

- **Referees:** $30 + 5 = 35$ Host
- **Ticketing:** $2 * 30 = 60$ Host
- **Broadcasters:** $(2 * 30) + 66 = 126$ Host
- **Atlet:** $((4 * 30) / 20) * 25 = 150$ Host

1.3 Tabel Subnetting VLSM

Alokasi IP Address menggunakan **IP Base 10.30.0.0/16** dengan metode **VLSM** (*Variable Length Subnet Mask*) untuk menghemat ruang alamat IP. Tabel diurutkan dari kebutuhan host terbesar ke terkecil untuk menghindari overlapping IP.

Zona	VLAN ID	Role	Host	Subnet	Network Address	Usable IP Range	Broadcast Address
Main	10	Atlet	900	/22	10.30.0.0	10.30.0.2 - 10.30.3.254	10.30.3.255
	20	Broadcasters	450	/23	10.30.4.0	10.30.4.2 - 10.30.5.254	10.30.5.255
	30	Ticketing	360	/23	10.30.6.0	10.30.6.2 - 10.30.7.254	10.30.7.255
	40	Referees	90	/25	10.30.8.0	10.30.8.2 - 10.30.8.126	10.30.8.127
	99	WLAN (Bonus)	250	/24	10.30.9.0	10.30.9.2 - 10.30.9.254	10.30.9.255
Stream	20	Broadcasters	110	/25	10.30.10.0	10.30.10.2 - 10.30.10.126	10.30.10.127
	30	Ticketing	90	/25	10.30.10.128	10.30.10.130 - 10.30.10.254	10.30.10.255

	10	Atlet	90	/25	10.30.11.0	10.30.11.2 - 10.30.11.126	10.30.11.127
	40	Referees	60	/26	10.30.11.128	10.30.11.130 - 10.30.11.190	10.30.11.191
	50	Web Server	1	/27	10.30.11.192	10.30.11.194 (Static)	10.30.11.223
	99	WLAN (Bonus)	250	/24	10.30.12.0	10.30.12.2 - 10.30.12.254	10.30.12.255
Boot	10	Atlet	150	/24	10.30.13.0	10.30.13.2 - 10.30.13.254	10.30.13.255
	20	Broadcasters	126	/24	10.30.14.0	10.30.14.2 - 10.30.14.254	10.30.14.255
	30	Ticketing	60	/26	10.30.15.0	10.30.15.2 - 10.30.15.62	10.30.15.63
	40	Referees	35	/26	10.30.15.64	10.30.15.66 - 10.30.15.126	10.30.15.127
	50	Main Server	1	/27	10.30.15.128	10.30.15.130 (Static)	10.30.15.159
	99	WLAN (Bonus)	250	/24	10.30.16.0	10.30.16.2 - 10.30.16.254	10.30.16.255

BAB 2: DESAIN TOPOLOGI

2.1 Topologi Logical

Perancangan jaringan menggunakan pendekatan **Hierarchical Design** sederhana yang terdiri dari 3 lapisan utama untuk menjamin skalabilitas dan kemudahan manajemen:

1. Core Layer (Router Backbone):

Menggunakan 3 unit Router Cisco 1941 yang saling terhubung membentuk topologi Full Mesh (Segitiga). Koneksi antar router menggunakan kabel Serial untuk mensimulasikan koneksi jarak jauh (WAN) dan menyediakan redundansi jalur. Jika satu jalur putus, routing protokol RIPv2 akan otomatis mengalihkan lalu lintas ke jalur lain.

2. Distribution Layer (Switch 1):

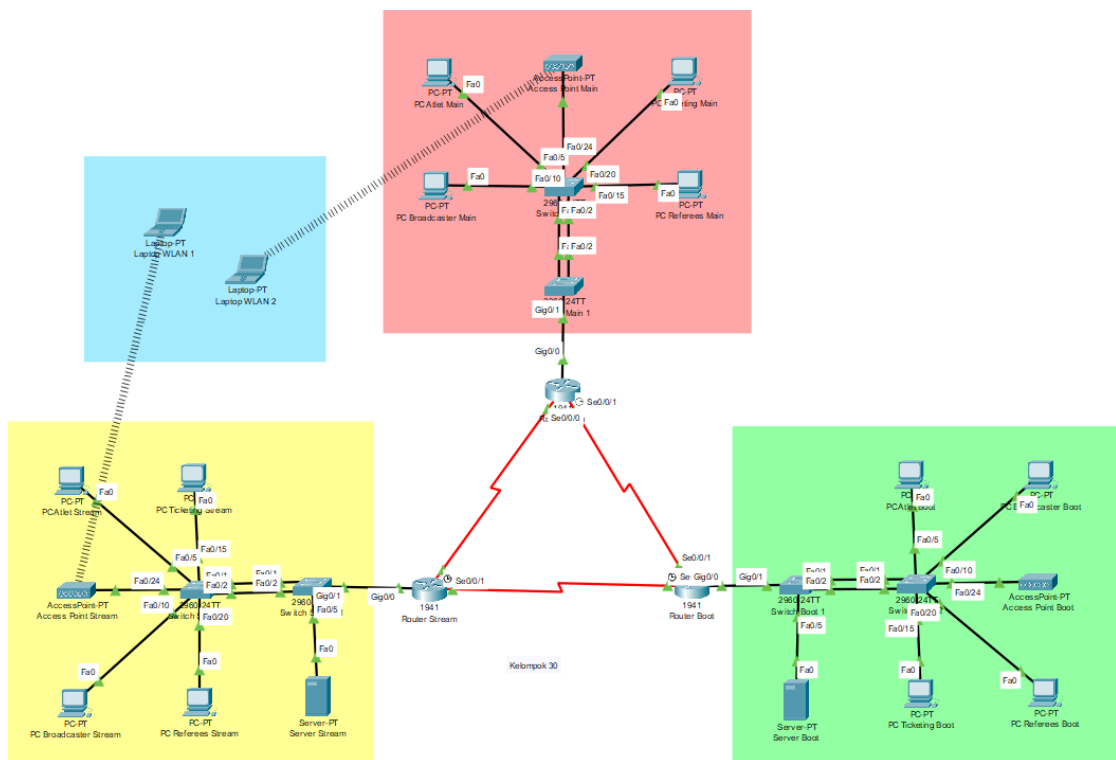
Menggunakan Switch Cisco 2960 di setiap zona yang berfungsi sebagai uplink ke Router dan penghubung ke Server Farm (Web/DHCP/DNS).

3. Access Layer (Switch 2):

Menggunakan Switch Cisco 2960 yang terhubung langsung ke perangkat pengguna (End Devices) seperti PC, Laptop, dan Access Point. Pemisahan switch ini bertujuan untuk membagi beban trafik.

Fitur Redundansi & Bandwidth:

Antara Switch Distribution dan Switch Access dihubungkan menggunakan teknologi EtherChannel (LACP). Konfigurasi ini menggabungkan 2 kabel fisik menjadi 1 link logis, yang berfungsi untuk meningkatkan kapasitas bandwidth antar-switch dan mencegah bottleneck trafik dari ratusan host.



2.2 Topologi Physical

Sesuai ketentuan soal untuk visualisasi keadaan sebenarnya, implementasi fisik dibagi menjadi **3 Kota (Cities)** dan **4 Gedung (Buildings)**. Ini merepresentasikan bahwa ketiga zona tersebut berada di lokasi geografis yang terpisah namun tetap terhubung dalam satu jaringan WAN.

1. Main_City (Zona Merah):

- o Terdiri dari 2 Gedung: "Arena Panggung Utama" dan "Ruang Panitia".

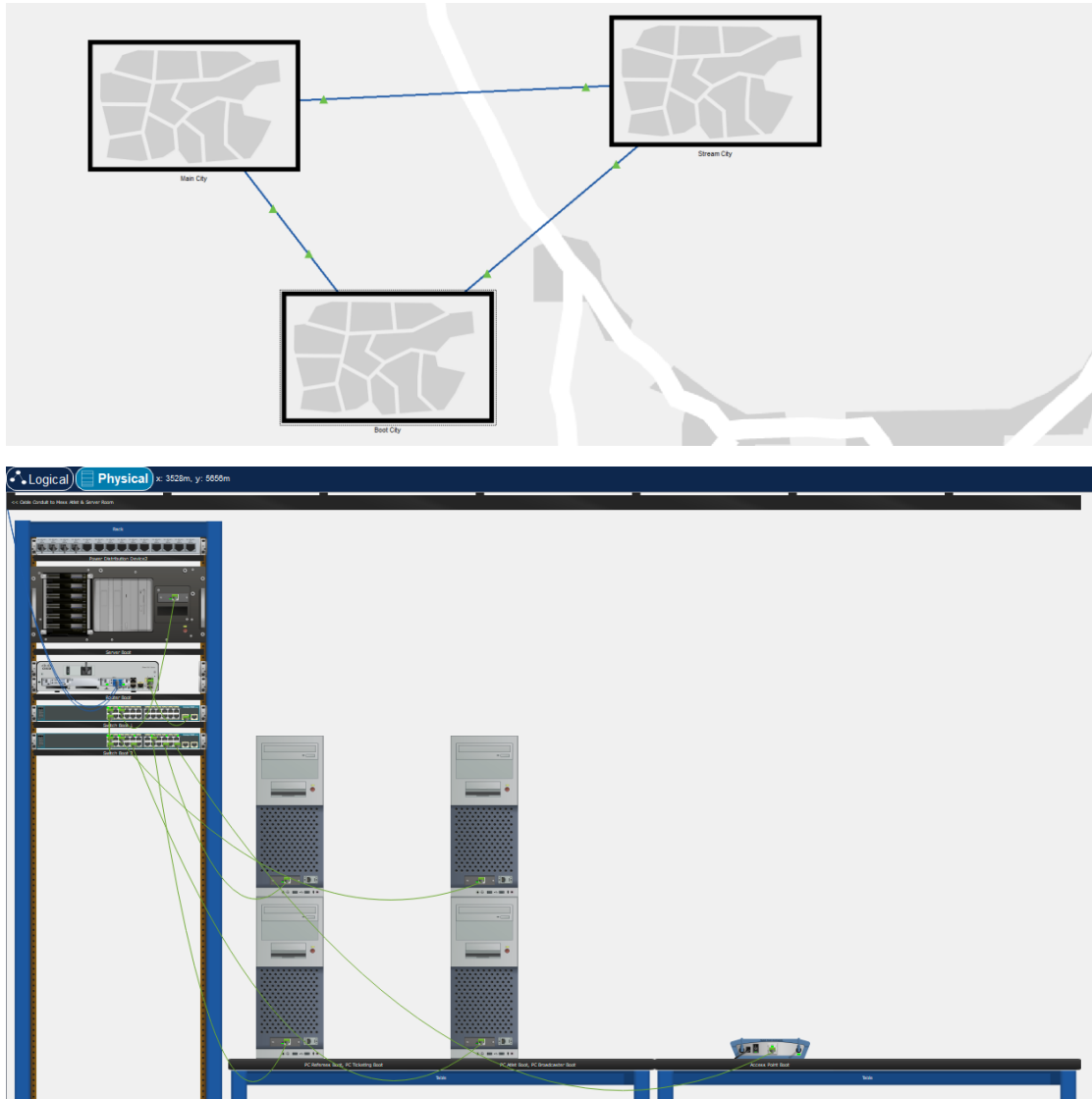
- Berisi Router Main, Switch Main, dan mayoritas host Atlet/Panitia.

2. Stream_City (Zona Kuning):

- Terdiri dari 1 Gedung: "Studio Streaming".
- Berisi Web Server dan perangkat Broadcaster.

3. Boot_City (Zona Hijau):

- Terdiri dari 1 Gedung: "Mess Atlet & Server Room".
- Berisi Server Pusat (DHCP/DNS/Email) yang diletakkan di Rack Server khusus.



BAB 3: IMPLEMENTASI DAN KONFIGURASI

Bab ini menjelaskan detail konfigurasi CLI (*Command Line Interface*) yang diterapkan pada perangkat. Konfigurasi dikelompokkan berdasarkan fungsi dan fiturnya.

3.1 Konfigurasi Router (Layer 3)

Konfigurasi router difokuskan pada tiga fungsi utama: koneksi WAN, Gateway VLAN, dan Routing Dinamis.

A. Konfigurasi Interface Serial (Koneksi WAN)

Digunakan untuk menghubungkan router dengan router lain di zona berbeda.

Command	Penjelasan & Alasan
interface	Masuk ke antarmuka Serial.
ip address	Memberikan IP Address dengan subnet mask /30. Subnet /30 dipilih karena koneksi antar-router bersifat <i>Point-to-Point</i> (hanya butuh 2 IP), sehingga sangat efisien.
no shutdown	Mengaktifkan antarmuka agar link status menjadi UP.
Router Main	<pre> Router>enable Router#conf t Enter configuration commands, one per line. End with CNTL/Z. Router(config)#hostname R_MAIN R_MAIN(config)#interface s0/0/0 R_MAIN(config-if)#ip address 10.30.99.1 255.255.255.252 R_MAIN(config-if)#no shutdown %LINK-5-CHANGED: Interface Serial0/0/0, changed state to down R_MAIN(config-if)#exit R_MAIN(config)#interface s0/0/1 R_MAIN(config-if)#ip address 10.30.99.10 255.255.255.252 R_MAIN(config-if)#no shutdown %LINK-5-CHANGED: Interface Serial0/0/1, changed state to down R_MAIN(config-if)#exit R_MAIN(config)#interface g0/0 R_MAIN(config-if)#no shutdown </pre>
Router Streaming	<pre> Router>enable Router#conf t Enter configuration commands, one per line. End with CNTL/Z. Router(config)#hostname R_STREAM R_STREAM(config)#interface s0/0/0 R_STREAM(config-if)#ip address 10.30.99.2 255.255.255.252 R_STREAM(config-if)#no shutdown R_STREAM(config-if)#exit R_STREAM(config)#interface s0/0/1 R_STREAM(config-if)#ip address 10.30.99.5 255.255.255.252 R_STREAM(config-if)#no shutdown %LINK-5-CHANGED: Interface Serial0/0/1, changed state to down R_STREAM(config-if)#exit R_STREAM(config)#interface g0/0 R_STREAM(config-if)#no shutdown </pre>

Router Bootcamp	<pre> Router>enable Router#conf t Enter configuration commands, one per line. End with CNTL/Z. Router(config)#hostname R_BOOT R_BOOT(config)#interface s0/0/0 R_BOOT(config-if)#ip address 10.30.99.6 255.255.255.252 R_BOOT(config-if)#no shutdown R_BOOT(config-if)#exit R_BOOT(config)#interface s0/0/1 R_BOOT(config-if)#ip address 10.30.99.9 255.255.255.252 R_BOOT(config-if)#no shutdown R_BOOT(config-if)#exit R_BOOT(config)#interface g0/0 R_BOOT(config-if)#no shutdown </pre>
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B. Konfigurasi Inter-VLAN & DHCP Relay (Router on a Stick)

Digunakan agar router bisa menjadi gateway bagi banyak VLAN sekaligus dan meneruskan permintaan IP ke server pusat.

Command	Penjelasan & Alasan
interface	Membuat sub-interface logis untuk VLAN pada port fisik.
encapsulation dot1Q	Mengaktifkan protokol 802.1Q agar router bisa membaca tag VLAN dari switch.
ip address	Menetapkan IP Gateway untuk VLAN sesuai tabel subnetting VLSM.
ip helper-address	DHCP Relay Agent. Perintah krusial ini berfungsi meneruskan (relay) pesan broadcast "minta IP" dari PC Client ke IP Server DHCP yang berada di zona Bootcamp. Tanpa ini, client tidak akan mendapatkan IP.

<p style="text-align: center;">Router Main</p>	<pre> R_MAIN(config-if)#exit R_MAIN(config)#interface g0/0.10 R_MAIN(config-subif)#encapsulation dot1Q 10 R_MAIN(config-subif)#ip address 10.30.0.1 255.255.252.0 R_MAIN(config-subif)#ip helper-address 10.30.15.130 R_MAIN(config-subif)#exit R_MAIN(config)#interface g0/0.20 R_MAIN(config-subif)#encapsulation dot1Q 20 R_MAIN(config-subif)#ip address 10.30.4.1 255.255.254.0 R_MAIN(config-subif)#ip helper-address 10.30.15.130 R_MAIN(config-subif)#exit R_MAIN(config)#interface g0/0.30 R_MAIN(config-subif)#encapsulation dot1Q 30 R_MAIN(config-subif)#ip address 10.30.6.1 255.255.254.0 R_MAIN(config-subif)#ip helper-address 10.30.15.130 R_MAIN(config-subif)#exit R_MAIN(config)#interface g0/0.40 R_MAIN(config-subif)#encapsulation dot1Q 40 R_MAIN(config-subif)#ip address 10.30.8.1 255.255.255.128 R_MAIN(config-subif)#ip helper-address 10.30.15.130 R_MAIN(config-subif)#exit R_MAIN(config)#interface g0/0.99 R_MAIN(config-subif)#encapsulation dot1Q 99 R_MAIN(config-subif)#ip address 10.30.9.1 255.255.255.0 R_MAIN(config-subif)#ip helper-address 10.30.15.130 R_MAIN(config-subif)#exit </pre>
<p style="text-align: center;">Router Streaming</p>	<pre> R_STREAM(config-if)#exit R_STREAM(config)#interface g0/0.10 R_STREAM(config-subif)#encapsulation dot1Q 10 R_STREAM(config-subif)#ip address 10.30.11.1 255.255.255.128 R_STREAM(config-subif)#ip helper-address 10.30.15.130 R_STREAM(config-subif)#exit R_STREAM(config)#interface g0/0.20 R_STREAM(config-subif)#encapsulation dot1Q 20 R_STREAM(config-subif)#ip address 10.30.10.1 255.255.255.128 R_STREAM(config-subif)#ip helper-address 10.30.15.130 R_STREAM(config-subif)#exit R_STREAM(config)#interface g0/0.30 R_STREAM(config-subif)#encapsulation dot1Q 30 R_STREAM(config-subif)#ip address 10.30.10.129 255.255.255.128 R_STREAM(config-subif)#ip helper-address 10.30.15.130 R_STREAM(config-subif)#exit R_STREAM(config)#interface g0/0.40 R_STREAM(config-subif)#encapsulation dot1Q 40 R_STREAM(config-subif)#ip address 10.30.11.129 255.255.255.192 R_STREAM(config-subif)#ip helper-address 10.30.15.130 R_STREAM(config-subif)#exit R_STREAM(config)#interface g0/0.50 R_STREAM(config-subif)#encapsulation dot1Q 50 R_STREAM(config-subif)#ip address 10.30.11.193 255.255.255.224 R_STREAM(config-subif)#ip helper-address 10.30.15.130 R_STREAM(config-subif)#exit R_STREAM(config)#interface g0/0.99 R_STREAM(config-subif)#encapsulation dot1Q 99 R_STREAM(config-subif)#ip address 10.30.12.1 255.255.255.0 R_STREAM(config-subif)#ip helper-address 10.30.15.130 R_STREAM(config-subif)#exit </pre>

Router Bootcamp	<pre> R_BOOT(config-if)#exit R_BOOT(config)#interface g0/0.10 R_BOOT(config-subif)#encapsulation dot1Q 10 R_BOOT(config-subif)#ip address 10.30.13.1 255.255.255.0 R_BOOT(config-subif)#ip helper-address 10.30.15.130 R_BOOT(config-subif)#exit R_BOOT(config)#interface g0/0.20 R_BOOT(config-subif)#encapsulation dot1Q 20 R_BOOT(config-subif)#ip address 10.30.14.1 255.255.255.0 R_BOOT(config-subif)#ip helper-address 10.30.15.130 R_BOOT(config-subif)#exit R_BOOT(config)#interface g0/0.30 R_BOOT(config-subif)#encapsulation dot1Q 30 R_BOOT(config-subif)#ip address 10.30.15.1 255.255.255.192 R_BOOT(config-subif)#ip helper-address 10.30.15.130 R_BOOT(config-subif)#exit R_BOOT(config)#interface g0/0.40 R_BOOT(config-subif)#encapsulation dot1Q 40 R_BOOT(config-subif)#ip address 10.30.15.65 255.255.255.192 R_BOOT(config-subif)#ip helper-address 10.30.15.130 R_BOOT(config-subif)#exit R_BOOT(config)#interface g0/0.50 R_BOOT(config-subif)#encapsulation dot1Q 50 R_BOOT(config-subif)#ip address 10.30.15.129 255.255.255.224 R_BOOT(config-subif)#exit R_BOOT(config)#interface g0/0.99 R_BOOT(config-subif)#encapsulation dot1Q 99 R_BOOT(config-subif)#ip address 10.30.16.1 255.255.255.0 R_BOOT(config-subif)#ip helper-address 10.30.15.130 R_BOOT(config-subif)#exit </pre>
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C. Konfigurasi Routing Dinamis (RIPv2)

Digunakan untuk pertukaran rute otomatis antar ketiga zona.

Command	Penjelasan & Alasan
router rip	Mengaktifkan protokol routing RIP.
version 2	Menggunakan versi 2 yang mendukung VLSM (Variable Length Subnet Mask).
no auto-summary	Wajib diaktifkan. Mencegah router menggabungkan subnet-subnet kecil (/22, /23) menjadi satu network besar (/8), yang bisa menyebabkan konflik routing.
network 10.0.0.0	Mendaftarkan seluruh network 10.x.x.x agar dikenali oleh router tetangga.
Router Main	<pre> R_MAIN(config)#router rip R_MAIN(config-router)#version 2 R_MAIN(config-router)#no auto-summary R_MAIN(config-router)#network 10.0.0.0 R_MAIN(config-router)#exit </pre>
Router Streaming	<pre> R_STREAM(config)#router rip R_STREAM(config-router)#version 2 R_STREAM(config-router)#no auto-summary R_STREAM(config-router)#network 10.0.0.0 R_STREAM(config-router)#exit </pre>

Router Bootcamp	<pre>R_BOOT(config)#router rip R_BOOT(config-router)#version 2 R_BOOT(config-router)#no auto-summary R_BOOT(config-router)#network 10.0.0.0 R_BOOT(config-router)#exit</pre>
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3.2 Konfigurasi Switch (Layer 2)

Konfigurasi switch dibagi menjadi manajemen VLAN, optimasi bandwidth, dan keamanan.

A. Konfigurasi Database VLAN

Langkah awal untuk memisahkan trafik antar divisi.

Command	Penjelasan & Alasan
vlan 10	Membuat VLAN dengan ID 10.
name ATLET	Memberikan nama identitas. Hal ini mempermudah admin jaringan dalam manajemen dan troubleshooting di kemudian hari.
<i>(Ulangi untuk VLAN 20, 30, 40, 50, 99)</i>	Dilakukan untuk semua role sesuai ketentuan soal.
Switch Main 1	<pre>Switch>enable Switch#conf t Enter configuration commands, one per line. End with CNTL/Z. Switch(config)#hostname SW_MAIN_1 SW_MAIN_1(config)#vlan 10 SW_MAIN_1(config-vlan)#name ATLET SW_MAIN_1(config-vlan)#vlan 20 SW_MAIN_1(config-vlan)#name BROADCASTERS SW_MAIN_1(config-vlan)#vlan 30 SW_MAIN_1(config-vlan)#name TICKETING SW_MAIN_1(config-vlan)#vlan 40 SW_MAIN_1(config-vlan)#name REFEREES SW_MAIN_1(config-vlan)#vlan 50 SW_MAIN_1(config-vlan)#name SERVERS SW_MAIN_1(config-vlan)#vlan 99 SW_MAIN_1(config-vlan)#name WLAN SW_MAIN_1(config-vlan)#exit</pre>
Switch Main 2	<pre>Switch> Switch>enable Switch#conf t Enter configuration commands, one per line. End with CNTL/Z. Switch(config)#hostname SW_MAIN_2 SW_MAIN_2(config)#vlan 10 SW_MAIN_2(config-vlan)#name ATLET SW_MAIN_2(config-vlan)#vlan 20 SW_MAIN_2(config-vlan)#name BROADCASTERS SW_MAIN_2(config-vlan)#vlan 30 SW_MAIN_2(config-vlan)#name TICKETING SW_MAIN_2(config-vlan)#vlan 40 SW_MAIN_2(config-vlan)#name REFEREES SW_MAIN_2(config-vlan)#vlan 50 SW_MAIN_2(config-vlan)#name SERVERS SW_MAIN_2(config-vlan)#vlan 99 SW_MAIN_2(config-vlan)#name WLAN SW MAIN 2(config-vlan)#exit</pre>

<p>Switch Stream 1</p>	<pre> Switch>enable Switch#conf t Enter configuration commands, one per line. End with CNTL/Z. Switch(config)#hostname SW_STR_1 SW_STR_1(config)#vlan 10 SW_STR_1(config-vlan)#name ATLET SW_STR_1(config-vlan)#vlan 20 SW_STR_1(config-vlan)#name BROADCASTERS SW_STR_1(config-vlan)#vlan 30 SW_STR_1(config-vlan)#name TICKETING SW_STR_1(config-vlan)#vlan 40 SW_STR_1(config-vlan)#name REFEREES SW_STR_1(config-vlan)#vlan 50 SW_STR_1(config-vlan)#name SERVERS SW_STR_1(config-vlan)#vlan 99 SW_STR_1(config-vlan)#name WLAN SW_STR_1(config-vlan)#exit </pre>
<p>Switch Stream 2</p>	<pre> Switch> Switch>enable Switch#conf t Enter configuration commands, one per line. End with CNTL/Z. Switch(config)#hostname SW_STR_2 SW_STR_2(config)#vlan 10 SW_STR_2(config-vlan)#name ATLET SW_STR_2(config-vlan)#vlan 20 SW_STR_2(config-vlan)#name BROADCASTERS SW_STR_2(config-vlan)#vlan 30 SW_STR_2(config-vlan)#name TICKETING SW_STR_2(config-vlan)#vlan 40 SW_STR_2(config-vlan)#name REFEREES SW_STR_2(config-vlan)#vlan 50 SW_STR_2(config-vlan)#name SERVERS SW_STR_2(config-vlan)#vlan 99 SW_STR_2(config-vlan)#name WLAN SW_STR_2(config-vlan)#exit </pre>
<p>Switch Boot 1</p>	<pre> Switch> Switch>enable Switch#conf t Enter configuration commands, one per line. End with CNTL/Z. Switch(config)#hostname SW_BOOT_1 SW_BOOT_1(config)#vlan 10 SW_BOOT_1(config-vlan)#name ATLET SW_BOOT_1(config-vlan)#vlan 20 SW_BOOT_1(config-vlan)#name BROADCASTERS SW_BOOT_1(config-vlan)#vlan 30 SW_BOOT_1(config-vlan)#name TICKETING SW_BOOT_1(config-vlan)#vlan 40 SW_BOOT_1(config-vlan)#name REFEREES SW_BOOT_1(config-vlan)#vlan 50 SW_BOOT_1(config-vlan)#name SERVERS SW_BOOT_1(config-vlan)#vlan 99 SW_BOOT_1(config-vlan)#name WLAN SW_BOOT_1(config-vlan)#exit </pre>

Switch Boot 2	<pre> Switch> Switch>enable Switch#conf t Enter configuration commands, one per line. End with CNTL/Z. Switch(config)#hostname SW_BOOT_2 SW_BOOT_2(config)#vlan 10 SW_BOOT_2(config-vlan)#name ATLET SW_BOOT_2(config-vlan)#vlan 20 SW_BOOT_2(config-vlan)#name BROADCASTERS SW_BOOT_2(config-vlan)#vlan 30 SW_BOOT_2(config-vlan)#name TICKETING SW_BOOT_2(config-vlan)#vlan 40 SW_BOOT_2(config-vlan)#name REFEREES SW_BOOT_2(config-vlan)#vlan 50 SW_BOOT_2(config-vlan)#name SERVERS SW_BOOT_2(config-vlan)#vlan 99 SW_BOOT_2(config-vlan)#name WLAN SW_BOOT_2(config-vlan)#exit </pre>
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B. Konfigurasi Spanning Tree Protocol (STP)

Untuk mencegah looping pada topologi yang memiliki jalur kabel ganda.

Command	Penjelasan & Alasan
spanning-tree mode rapid-pvst	Mengaktifkan mode Rapid-PVST (Per-VLAN Spanning Tree). Mode ini dipilih karena memiliki waktu konvergensi (pemulihan) yang jauh lebih cepat dibanding STP standar jika terjadi perubahan topologi atau kabel putus.
Switch Main 1	<code>SW_MAIN_1(config)#spanning-tree mode rapid-pvst</code>
Switch Main 2	<code>SW_MAIN_2(config)#spanning-tree mode rapid-pvst</code>
Switch Stream 1	<code>SW_STR_1(config)#spanning-tree mode rapid-pvst</code>
Switch Stream 2	<code>SW_STR_2(config)#spanning-tree mode rapid-pvst</code>
Switch Boot 1	<code>SW_BOOT_1(config)#spanning-tree mode rapid-pvst</code>
Switch Boot 2	<code>SW_BOOT_2(config)#spanning-tree mode rapid-pvst</code>

C. Konfigurasi EtherChannel (LACP)

Menggabungkan dua kabel fisik menjadi satu jalur logis.

Command	Penjelasan & Alasan
interface range	Memilih dua port sekaligus yang terhubung ke switch pasangan.
channel-group 1 mode active	Mengaktifkan protokol LACP (<i>Link Aggregation Control Protocol</i>) secara aktif untuk negosiasi pembentukan EtherChannel.
interface port-channel 1	Masuk ke antarmuka logis hasil penggabungan tadi untuk dikonfigurasi sebagai Trunk.

switchport mode trunk	Dikonfigurasi pada port yang mengarah ke Router dan Switch lain. Mengizinkan port membawa trafik dari banyak VLAN sekaligus (Tagged).
Switch Main 1	<pre>SW_MAIN_1(config)#interface range fa0/1-2 SW_MAIN_1(config-if-range)#channel-group 1 mode active SW_MAIN_1(config-if-range)#no shutdown SW_MAIN_1(config-if-range)#exit SW_MAIN_1(config)#interface port-channel 1 SW_MAIN_1(config-if)#switchport mode trunk SW_MAIN_1(config-if)#no shutdown SW_MAIN_1(config-if)#exit</pre>
Switch Main 2	<pre>SW_MAIN_2(config)#interface range fa0/1-2 SW_MAIN_2(config-if-range)#channel-group 1 mode active SW_MAIN_2(config-if-range)#no shutdown SW_MAIN_2(config-if-range)#exit SW_MAIN_2(config)#interface port-channel 1 SW_MAIN_2(config-if)#switchport mode trunk SW_MAIN_2(config-if)#no shutdown SW_MAIN_2(config-if)#exit</pre>
Switch Stream 1	<pre>SW_STR_1(config)#interface range fa0/1-2 SW_STR_1(config-if-range)#channel-group 1 mode active SW_STR_1(config-if-range)#no shutdown SW_STR_1(config-if-range)#exit SW_STR_1(config)#interface port-channel 1 SW_STR_1(config-if)#switchport mode trunk SW_STR_1(config-if)#no shutdown SW_STR_1(config-if)#exit</pre>
Switch Stream 2	<pre>SW_STR_2(config)#interface range fa0/1-2 SW_STR_2(config-if-range)#channel-group 1 mode active SW_STR_2(config-if-range)#no shutdown SW_STR_2(config-if-range)#exit SW_STR_2(config)#interface port-channel 1 SW_STR_2(config-if)#switchport mode trunk SW_STR_2(config-if)#no shutdown SW_STR_2(config-if)#exit</pre>
Switch Boot 1	<pre>SW_BOOT_1(config)#interface range fa0/1-2 SW_BOOT_1(config-if-range)#channel-group 1 mode active SW_BOOT_1(config-if-range)#no shutdown SW_BOOT_1(config-if-range)#exit SW_BOOT_1(config)#interface port-channel 1 SW_BOOT_1(config-if)#switchport mode trunk SW_BOOT_1(config-if)#no shutdown SW_BOOT_1(config-if)#exit</pre>
Switch Boot 2	<pre>SW_BOOT_2(config)#interface range fa0/1-2 SW_BOOT_2(config-if-range)#channel-group 1 mode active SW_BOOT_2(config-if-range)#no shutdown SW_BOOT_2(config-if-range)#exit SW_BOOT_2(config)#interface port-channel 1 SW_BOOT_2(config-if)#switchport mode trunk SW_BOOT_2(config-if)#no shutdown SW_BOOT_2(config-if)#exit</pre>

D. Konfigurasi Port Trunk & Access

Mengatur jalur lalu lintas data.

Command (Perintah)	Penjelasan & Alasan
switchport mode trunk	Dikonfigurasi pada port yang mengarah ke Router dan Switch lain. Mengizinkan port membawa trafik dari banyak VLAN sekaligus (Tagged).
switchport mode access	Dikonfigurasi pada port yang mengarah ke PC/Laptop. Hanya mengizinkan satu VLAN spesifik.
switchport access vlan	Memasukkan port tersebut secara spesifik ke anggota VLAN.
spanning-tree portfast	Fitur optimasi pada port Access. Melewati status <i>Listening/Learning</i> STP agar port langsung aktif saat kabel dicolok, mempercepat proses DHCP PC.
Switch Main 2	<pre> SW_MAIN_2(config)#interface fa0/5 SW_MAIN_2(config-if)#switchport mode access SW_MAIN_2(config-if)#switchport access vlan 10 SW_MAIN_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... to interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/5 but will only have effect when the interface is in a non-trunking mode. SW_MAIN_2(config-if)#exit SW_MAIN_2(config)#interface fa0/10 SW_MAIN_2(config-if)#switchport mode access SW_MAIN_2(config-if)#switchport access vlan 20 SW_MAIN_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... to interface when portfast is enabled, can cause temporary bridging Use with CAUTION </pre>

	<pre> %Portfast has been configured on FastEthernet0/10 but will only have effect when the interface is in a non-trunking mode. SW_MAIN_2(config-if)#exit SW_MAIN_2(config)#interface fa0/15 SW_MAIN_2(config-if)#switchport mode access SW_MAIN_2(config-if)#switchport access vlan 30 SW_MAIN_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/15 but will only have effect when the interface is in a non-trunking mode. SW_MAIN_2(config-if)#exit SW_MAIN_2(config)#interface fa0/20 SW_MAIN_2(config-if)#switchport mode access SW_MAIN_2(config-if)#switchport access vlan 40 SW_MAIN_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION </pre>
<p>Switch Stream 1</p>	<pre> SW_STR_1(config)#interface fa0/5 SW_STR_1(config-if)#switchport mode access SW_STR_1(config-if)#switchport access vlan 50 SW_STR_1(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/5 but will only have effect when the interface is in a non-trunking mode. </pre>
<p>Switch Stream 2</p>	<pre> SW_STR_2(config)#interface fa0/5 SW_STR_2(config-if)#switchport mode access SW_STR_2(config-if)#switchport access vlan 10 SW_STR_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/5 but will only have effect when the interface is in a non-trunking mode. SW_STR_2(config-if)#exit SW_STR_2(config)#interface fa0/10 SW_STR_2(config-if)#switchport mode access SW_STR_2(config-if)#switchport access vlan 20 SW_STR_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION </pre>

	<pre> %Portfast has been configured on FastEthernet0/10 but will only have effect when the interface is in a non-trunking mode. SW_STR_2(config-if)#exit SW_STR_2(config)#interface fa0/15 SW_STR_2(config-if)#switchport mode access SW_STR_2(config-if)#switchport access vlan 30 SW_STR_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/15 but will only have effect when the interface is in a non-trunking mode. SW_STR_2(config-if)#exit SW_STR_2(config)#interface fa0/20 SW_STR_2(config-if)#switchport mode access SW_STR_2(config-if)#switchport access vlan 40 SW_STR_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION </pre>
<p>Switch Boot 1</p>	<pre> SW_BOOT_1(config-if)#no shutdown SW_BOOT_1(config-if)#exit SW_BOOT_1(config)#interface fa0/5 SW_BOOT_1(config-if)#switchport mode access SW_BOOT_1(config-if)#switchport access vlan 50 SW_BOOT_1(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/5 but will only have effect when the interface is in a non-trunking mode. </pre>
<p>Switch Boot 2</p>	<pre> SW_BOOT_2(config)#interface fa0/5 SW_BOOT_2(config-if)#switchport mode access SW_BOOT_2(config-if)#switchport access vlan 10 SW_BOOT_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/5 but will only have effect when the interface is in a non-trunking mode. SW_BOOT_2(config-if)#exit SW_BOOT_2(config)#interface fa0/10 SW_BOOT_2(config-if)#switchport mode access SW_BOOT_2(config-if)#switchport access vlan 20 SW_BOOT_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION </pre>

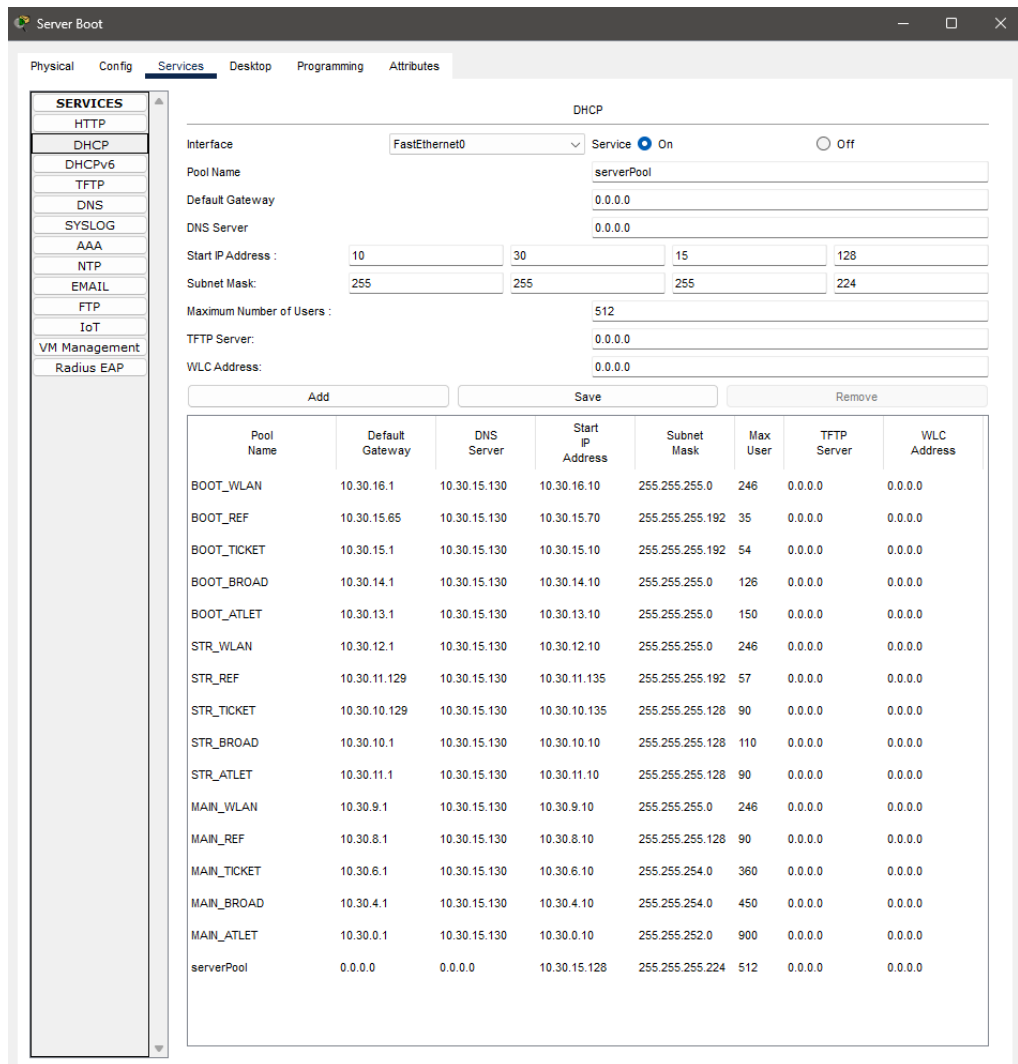
	<pre> %Portfast has been configured on FastEthernet0/10 but will only have effect when the interface is in a non-trunking mode. SW_BOOT_2(config-if)#exit SW_BOOT_2(config)#interface fa0/15 SW_BOOT_2(config-if)#switchport mode access SW_BOOT_2(config-if)#switchport access vlan 30 SW_BOOT_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/15 but will only have effect when the interface is in a non-trunking mode. SW_BOOT_2(config-if)#exit SW_BOOT_2(config)#interface fa0/20 SW_BOOT_2(config-if)#switchport mode access SW_BOOT_2(config-if)#switchport access vlan 40 SW_BOOT_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/20 but will only have effect when the interface is in a non-trunking mode. SW_BOOT_2(config-if)#exit SW_BOOT_2(config)#interface fa0/24 SW_BOOT_2(config-if)#switchport mode access SW_BOOT_2(config-if)#switchport access vlan 99 SW_BOOT_2(config-if)#spanning-tree portfast %Warning: portfast should only be enabled on ports connected to a host. Connecting hubs, concentrators, switches, bridges, etc... t interface when portfast is enabled, can cause temporary bridging Use with CAUTION %Portfast has been configured on FastEthernet0/24 but will only have effect when the interface is in a non-trunking mode. SW_BOOT_2(config-if)#exit Creating a port-channel interface Port-channel 1 </pre>
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3.3 Konfigurasi Server (Layanan Terpusat)

Konfigurasi dilakukan melalui antarmuka GUI (*Graphical User Interface*) pada Server Bootcamp dan Server Streaming.

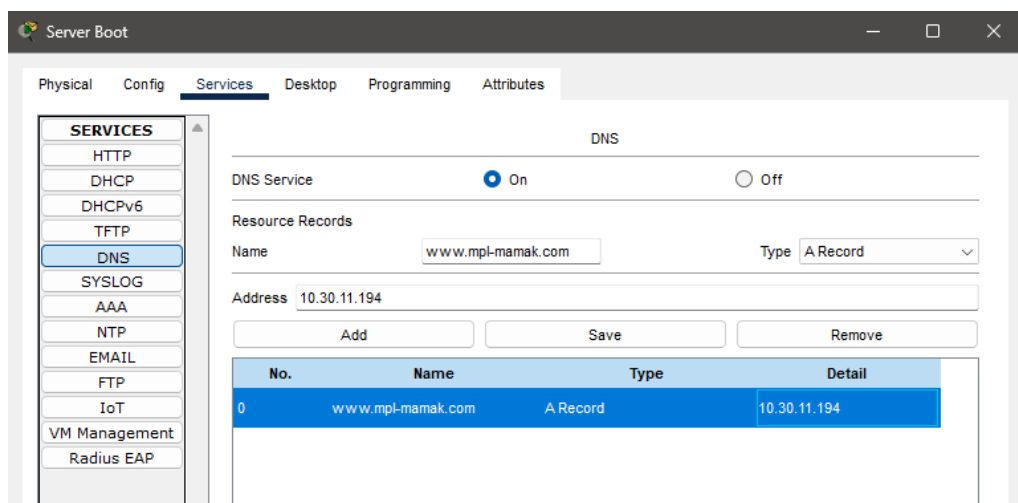
1. DHCP Server:

- Dibuat 15 DHCP Pool terpisah untuk melayani setiap VLAN di 3 zona berbeda.
- Parameter *Default Gateway* pada setiap pool disesuaikan dengan IP Router di zona masing-masing.
- Parameter *DNS Server* diarahkan ke 10.30.15.130.



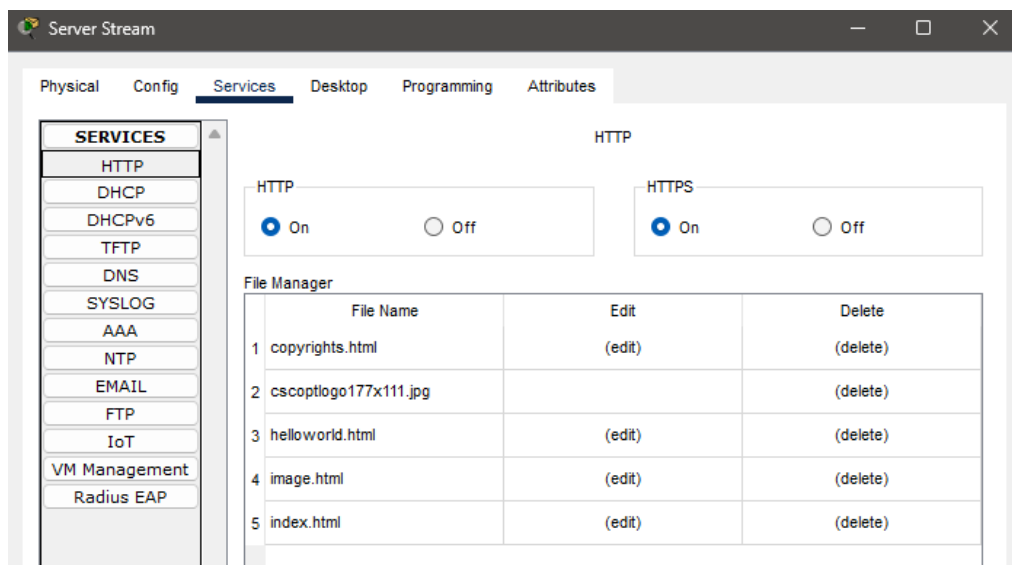
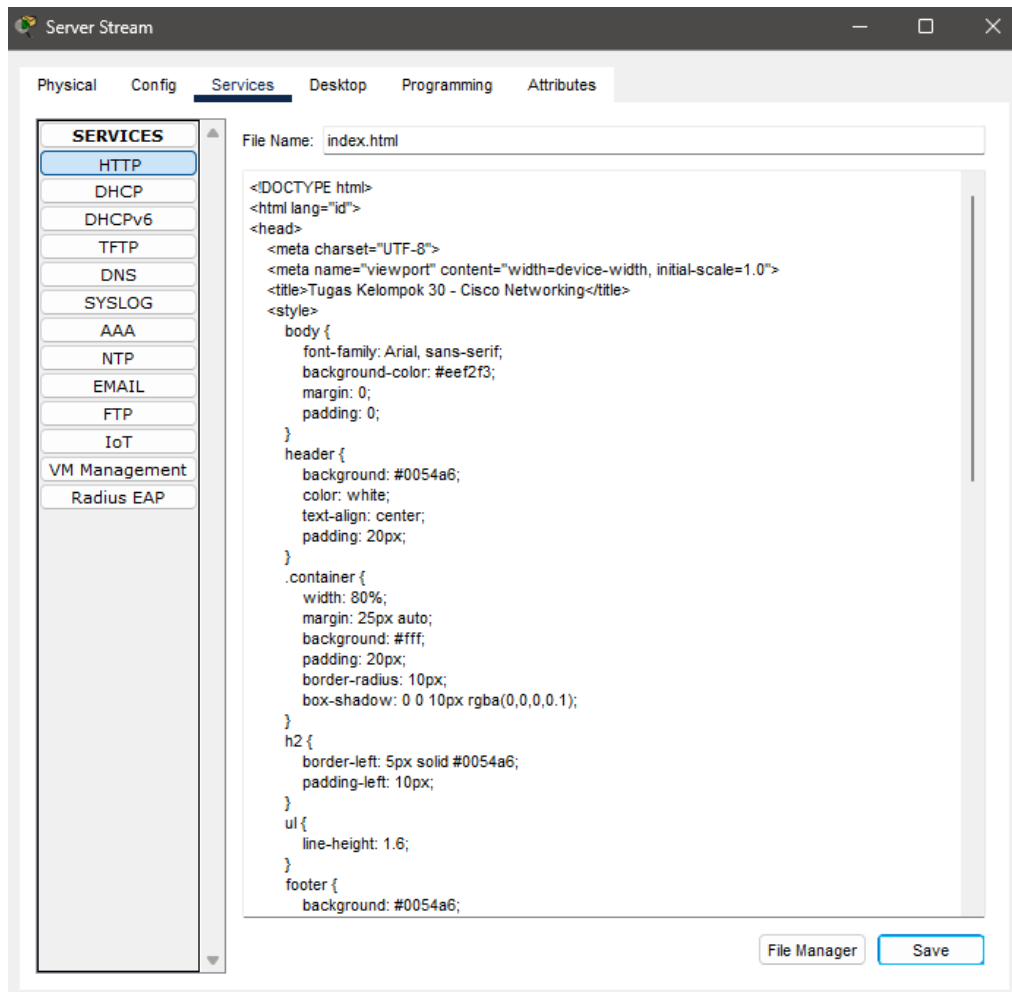
2. DNS Server:

- Dibuat *A Record* untuk domain www.mpl-mamak.com yang dipetakan ke IP 10.30.11.194.



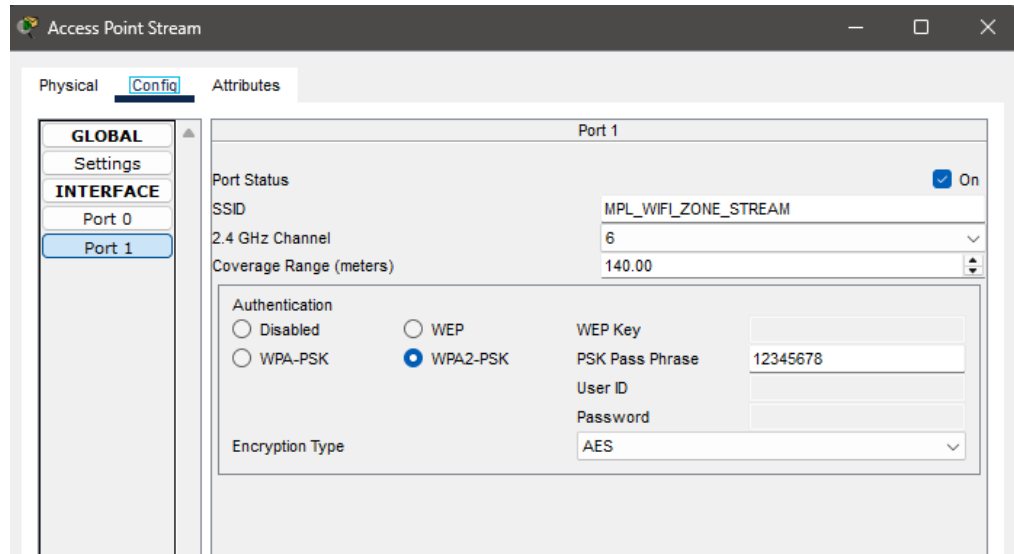
3. Web Server:

- Mengaktifkan layanan HTTP/HTTPS dan menyunting file index.html sebagai halaman informasi turnamen.



4. Access Point:

- Mengaktifkan layanan implementasi fitur tambahan WLAN.



BAB 4: DOKUMENTASI DAN PENGUJIAN









Bab ini melampirkan bukti visual konfigurasi yang telah diterapkan serta hasil pengujian konektivitas untuk memvalidasi performa jaringan.

4.1 Pengujian Konektivitas (Ping & Web)

Pengujian dilakukan menggunakan perintah ping dan Web Browser pada PC Client untuk memastikan seluruh persyaratan soal terpenuhi.

Skenario 1: Pengujian Inter-VLAN Routing

- **Sumber:** PC Atlet (VLAN 10) di Main Stage.
- **Tujuan:** PC Ticketing (VLAN 30) di Main Stage.
- **Hasil: Reply/Successful.** Hal ini membuktikan bahwa Router on a Stick berfungsi baik dalam menghubungkan VLAN yang berbeda.
- **Screenshot:**

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC Atlet Main	PC Ticketing Main	ICMP		0.000	N	0	(edit)	
	Successful	PC Atlet Main	PC Broadcaster Main	ICMP		0.000	N	1	(edit)	
	Successful	PC Atlet Main	PC Referees Main	ICMP		0.000	N	2	(edit)	
	Successful	PC Ticketing Main	PC Referees Main	ICMP		0.000	N	3	(edit)	

Skenario 2: Pengujian Inter-Zone Routing (WAN)

- **Sumber:** PC Atlet (Zona Merah).
- **Tujuan:** Web Server (Zona Kuning).

- **Hasil: Reply/Successful.** Hal ini membuktikan protokol routing RIPv2 berhasil menghubungkan zona yang terpisah secara geografis.
- **Screenshot:**

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit	Delete
	Successful	PC Atlet Main	Server Stream	ICMP		0.000	N	0	(edit)	
	Successful	PC Atlet Main	PC Atlet Stream	ICMP		0.000	N	1	(edit)	
	Successful	PC Atlet Main	PC Ticketing Boot	ICMP		0.000	N	2	(edit)	
	Successful	PC Broadcaster...	PC Referees Stream	ICMP		0.000	N	3	(edit)	

Skenario 3: Pengujian Web Server & DNS

- **Aktivitas:** Mengakses alamat www.mpl-mamak.com melalui Web Browser PC Client.
- **Hasil:** Halaman web berhasil ditampilkan. Hal ini membuktikan DNS Server berhasil memetakan domain ke IP Address dan Web Server aktif.
- **Screenshot:**

The screenshot shows a web browser window with the following content:

Web Browser (Title Bar)

URL: <http://www.mpl-mamak.com>

TUGAS JARINGAN CISCO

Kelompok 30 - Netlab

Anggota Kelompok

- Marshal Afa Diliyana
- M. Rifqi Fadil Itsnain
- Yusri Sukur

Judul Proyek

Konfigurasi Jaringan pada Cisco Packet Tracer

Deskripsi Singkat

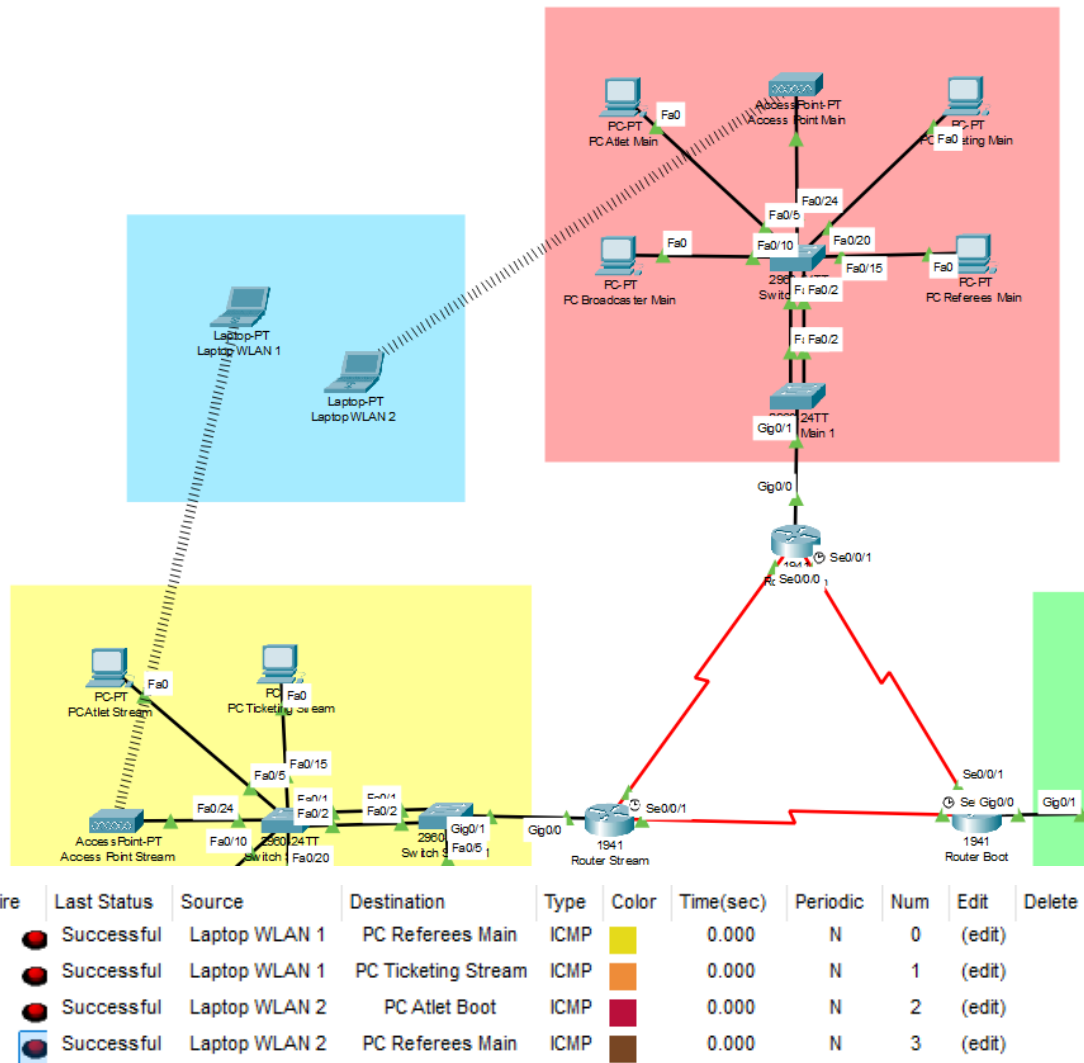
Pada proyek ini, kelompok 30 melakukan perancangan topologi jaringan menggunakan router, switch, dan end-device. Konfigurasi dilakukan melalui CLI untuk menerapkan addressing, routing, dan pengujian konektivitas antar perangkat pada jaringan.

4.2 Pengujian Wireless LAN (Bonus +10)

Pengujian implementasi fitur tambahan WLAN dilakukan menggunakan perangkat Smartphone.

- **Aktivitas:** Menghubungkan Smartphone ke SSID MPL_WIFI_ZONE_1 dengan password yang telah disetting.
- **Hasil:** Smartphone berhasil terkoneksi, mendapatkan IP Address dinamis dari VLAN 99 (DHCP), dan dapat melakukan ping ke Gateway.
- **Screenshot:**





BAB 5: KESIMPULAN

Berdasarkan perancangan, implementasi, dan pengujian yang telah dilakukan untuk studi kasus infrastruktur jaringan MPLS Kelompok 30, dapat ditarik kesimpulan sebagai berikut:

1. **Efisiensi Pengalamatan IP:** Penggunaan metode **VLSM** dengan IP Base 10.30.0.0/16 berhasil mengakomodasi kebutuhan host yang masif (termasuk 900 host Atlet) tanpa pemborosan ruang alamat IP.
2. **Kehandalan Jaringan:** Topologi **Mesh Segitiga** pada Core Layer memberikan redundansi jalur, sehingga jaringan tetap hidup meskipun salah satu link antar-router terputus.
3. **Optimasi Bandwidth:** Implementasi **EtherChannel (LACP)** pada Distribution Layer terbukti efektif menggandakan kapasitas bandwidth antar-switch, mencegah bottleneck saat trafik padat.

4. **Manajemen Terpusat:** Penggunaan **DHCP Relay** (ip helper-address) memungkinkan manajemen IP Address dipusatkan di satu zona (Bootcamp), menyederhanakan proses administrasi jaringan.
5. **Pemenuhan Syarat:** Seluruh persyaratan teknis dalam soal tipe 3, termasuk segmentasi VLAN, keamanan Port Security, visualisasi Physical Mode, hingga bonus implementasi WLAN, telah berhasil dipenuhi dan divalidasi fungsinya.

Sistem jaringan ini dinyatakan siap untuk diimplementasikan pada event MPL guna mendukung kelancaran pertandingan E-Sports.