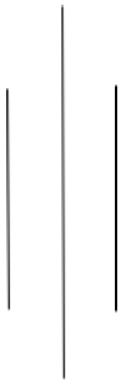
TRIBHUVAN UNIVERSITY

Institute of Engineering

Pulchowk Campus



A Report

on

Mini-Network Project

Submitted by:

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Group (B)

Submitted to:

Department of Electronics and Computer Engineering,
Pulchowk Campus

Submission Date: August 10, 2024

Computer Networks

Mini-Project Work

Network Design of "**Hello World**! AI Solutions"

Objectives

- To design a mini computer network of an imaginary company "**Hello World**! AI Solutions"

Environmental Setup

- Cisco packet tracer

The Network Design

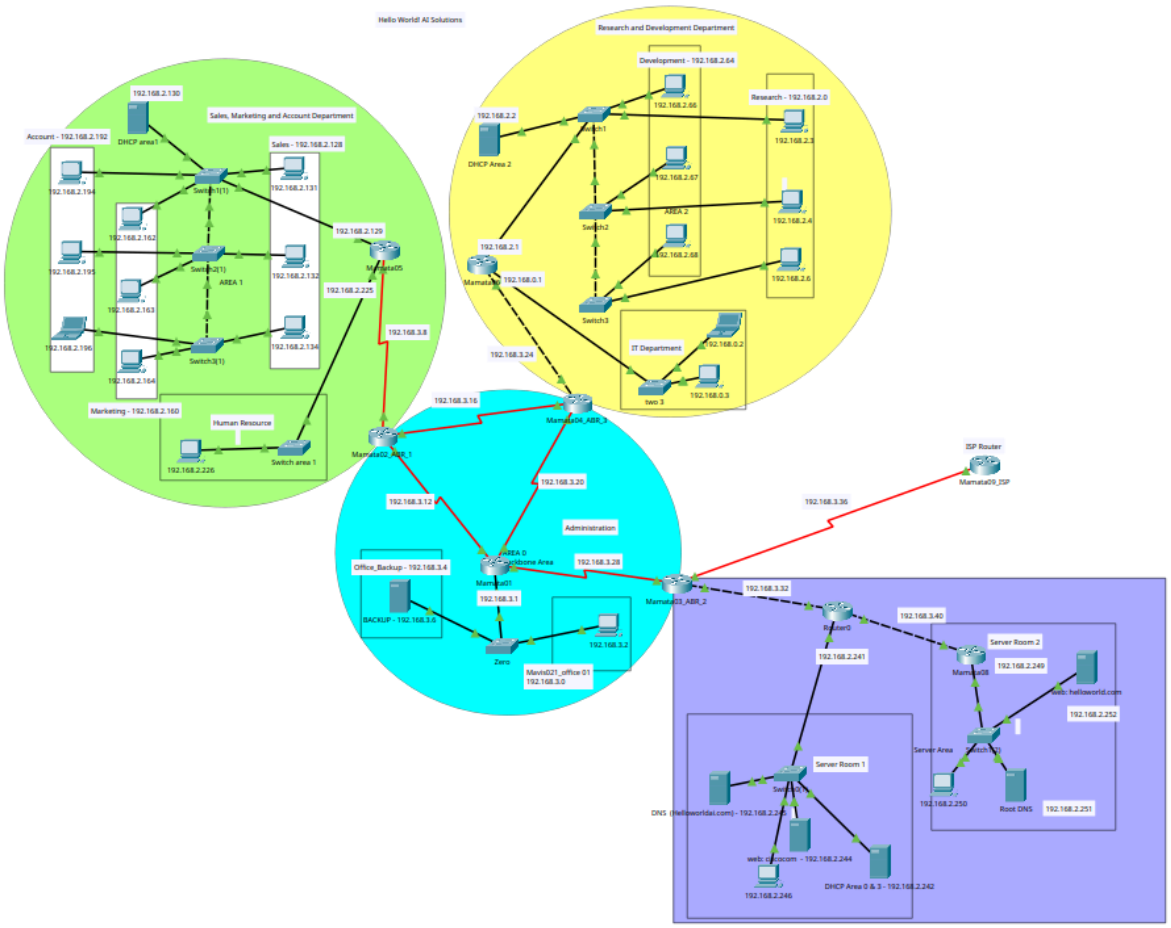


Fig: Complete Network Topology

Project Description

The Network Design of a company “Hello World! AI Solutions” consists of 4 Areas in total, each consisting of departments separated by subnets. Here subnetting is done with VLSM inorder to gain the maximum out of obtained network range.

Subnetting for each department:

IP address block: Obtained Network 192.168.0.0 /22
Network Address: 192.168.0.0
Subnet Mask: 255.255.252.0
Broadcast Address: 192.168.3.255
IP Range: 192.168.0.1 to 192.168.3.254

Departments	Hosts	Network Address	Broadcast Address	Subnet Mask	Unused Range
IT_Department	510	192.168.0.0	192.168.1.255	255.255.254.0	0
VLAN_Research	62	192.168.2.0	192.168.2.63	255.255.255.192	0
VLAN_Development	62	192.168.2.64	192.168.2.127	255.255.255.192	0
VLAN_Sales	30	192.168.2.128	192.168.2.159	255.255.255.224	0
VLAN_Marketing	25	192.168.2.160	192.168.2.191	255.255.255.224	.2.186 - .2.190
VLAN_Account	22	192.168.2.192	192.168.2.223	255.255.255.224	.2.215 - 2.222
Human_Resource	13	192.168.2.224	192.168.2.239	255.255.255.240	.2.238
ServerRoom_01	6	192.168.2.240	192.168.2.247	255.255.255.248	0
ServerRoom_02	6	192.168.2.248	192.168.2.255	255.255.255.248	0
Main Office	2	192.168.3.0	192.168.3.3	255.255.255.252	0
Backups	2	192.168.3.4	192.168.3.7	255.255.255.252	0

It has 9 routers in total and the networks for the router-router connection is divided as follows:

Router-Router	Hosts	Network Address	Broadcast Address	Subnet Mask
1	2	192.168.3.8	192.168.3.11	255.255.255.252
2	2	192.168.3.12	192.168.3.15	255.255.255.252
3	2	192.168.3.16	192.168.3.19	255.255.255.252
4	2	192.168.3.20	192.168.3.23	255.255.255.252
5	2	192.168.3.24	192.168.3.27	255.255.255.252
6	2	192.168.3.28	192.168.3.31	255.255.255.252
7	2	192.168.3.32	192.168.3.35	255.255.255.252
8	2	192.168.3.36	192.168.3.39	255.255.255.252
9	2	192.168.3.40	192.168.3.43	255.255.255.252

OSPF Areas:

1. Administration [Area 0]

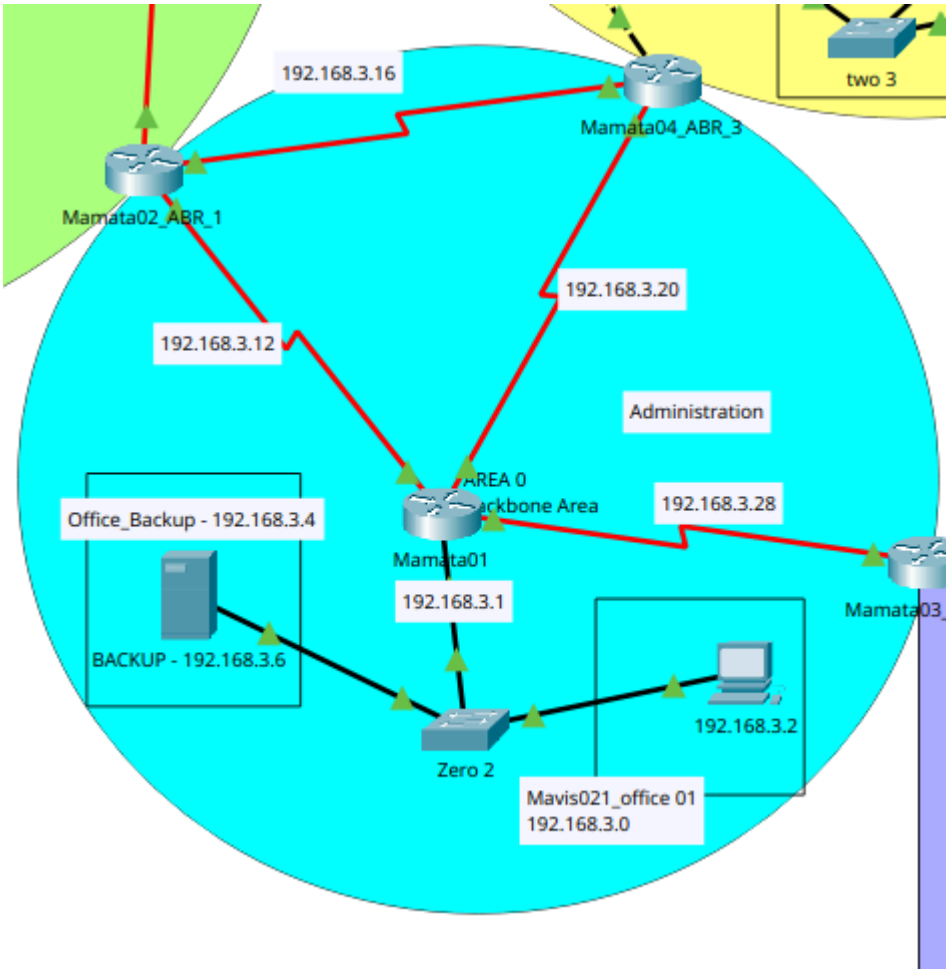


Fig : Administration Area

Component Details:

- **Routers:** Mamata01, Mamata04_ABR_3, Mamata02_ABR_1, Mamata03_ABR_2
- **Switches:** switch Zero 2 with **Mavis021_office** and **Backup** in VLAN connection
- **PCs & Servers:** PC of Owner and a backup server
- **Service Provider Link:** Connection to the ISP via Mamata03_ABR_2

The ip address of ports of the router are labeled in the design. This is the backbone area of the network which consists of a main router connected to all three area border routers, the main office and a backup section through VLAN connection at switch Zero.

2. Marketing, Sales and Account / HR Area [Area 1]

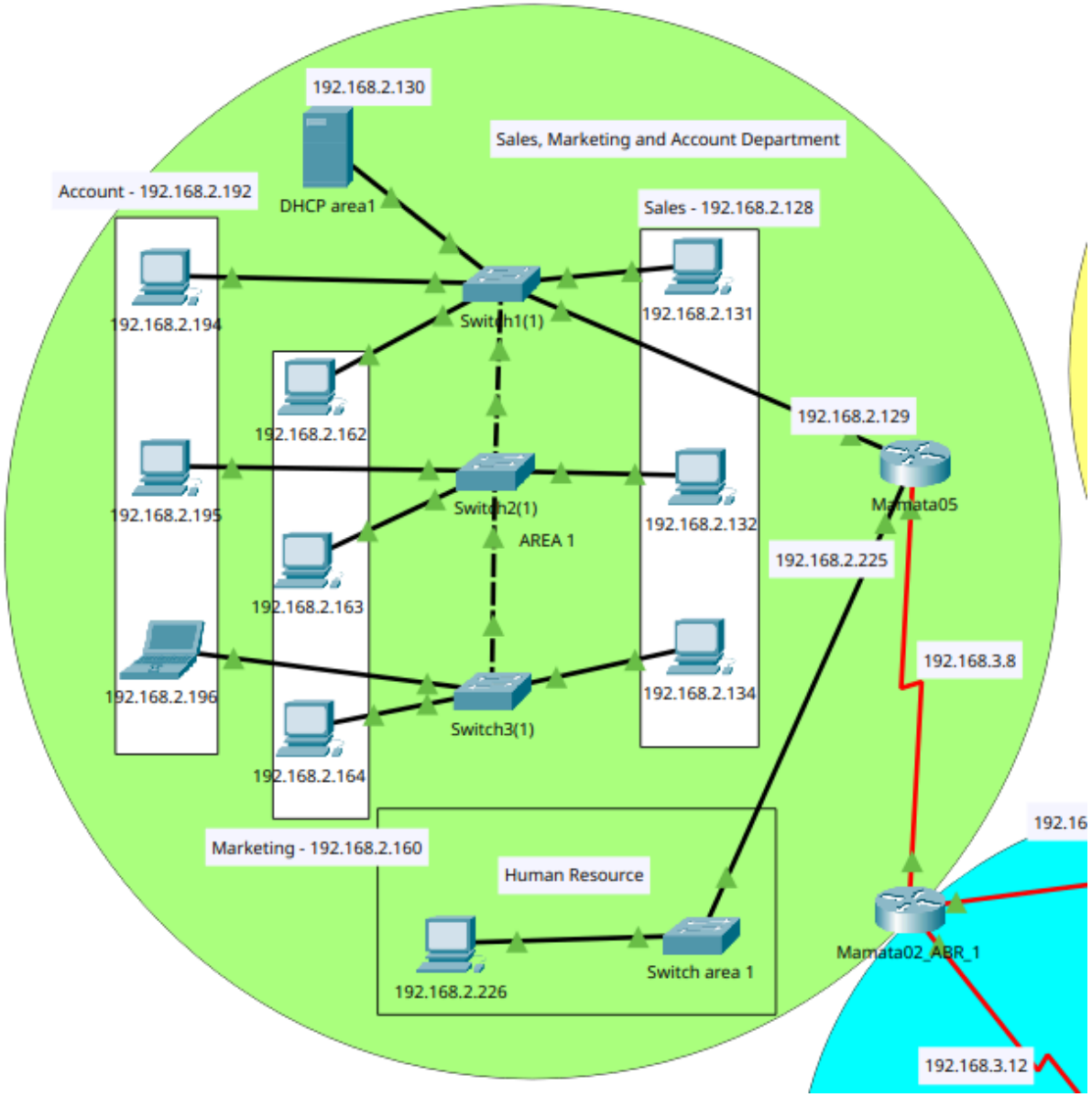


Fig : Area 1

Component Details:

- **Routers:** Mamata05, Mamata02_ABR_1,
- **Switches:**3 switches with Sales, Marketing and Account connected with VLAN, and the HR department has a separate switch connection.
- **PCs & Servers:** DHCP Server for assigning IP address to devices in area 2, PC's for employees
- **Service Provider Link:** Connection to the ISP via Mamata02_ABR_1 -> Area 0 -> Mamata09_ISP

The ip address of ports of the router are labeled and the VLANs are highlighted in the design.

3. Research and Development Area [Area 2]

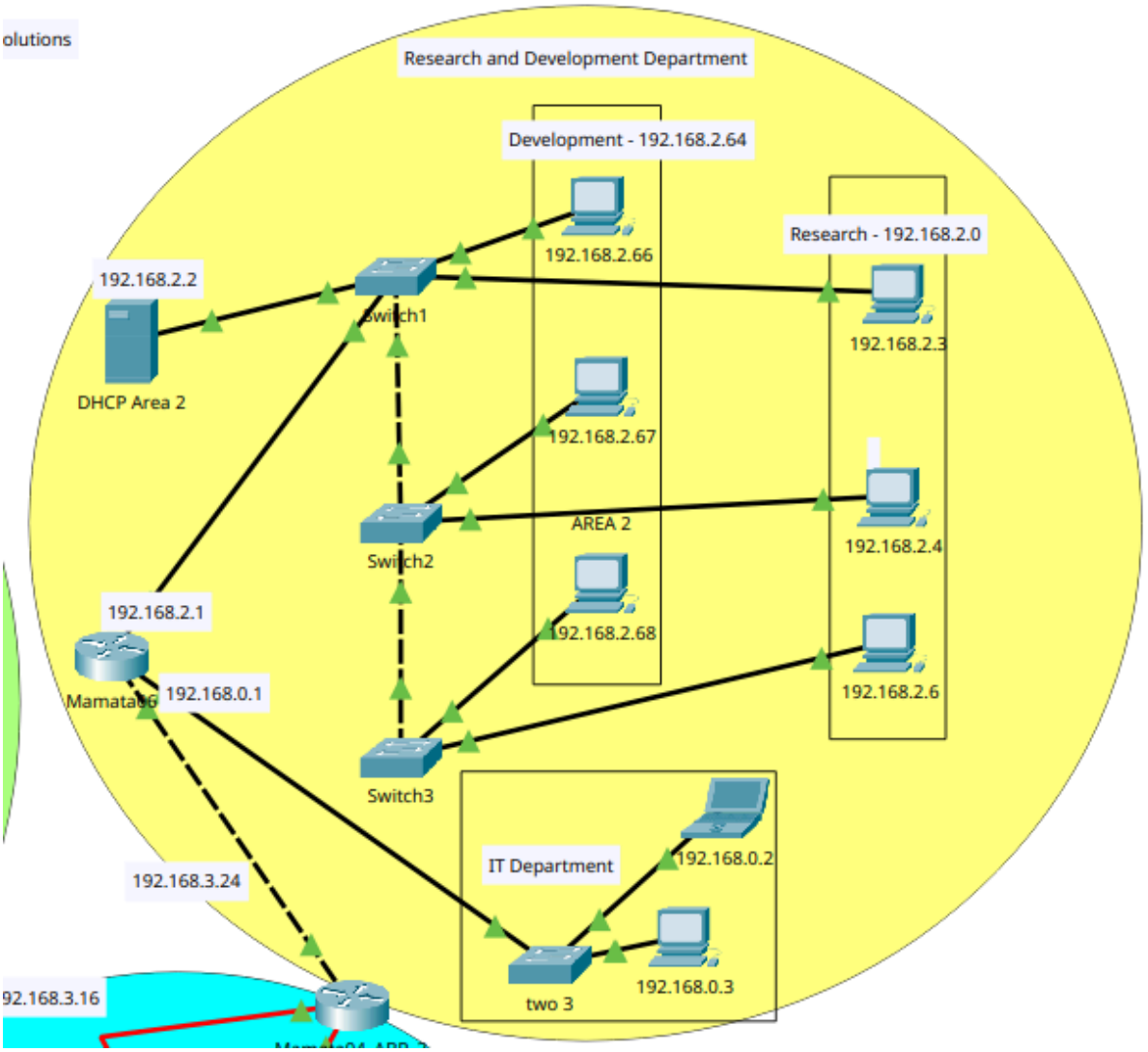


Fig : Area 2

Component Details:

- **Routers:** Mamata06, Mamata04_ABR_3,
- **Switches:**3 switches with Research and Development Departments connected with VLAN, and the IT department has a separate switch connection.
- **PCs & Servers:** DHCP Server for assigning IP address to devices in area 1, PC's for employees
- **Service Provider Link:** Connection to the ISP via Mamata02_ABR_3 -> Area 0 -> Mamata09_ISP

The ip address of ports of the router are labeled and the VLANs and the departments are highlighted in the design.

4. Server Area [Area 3]

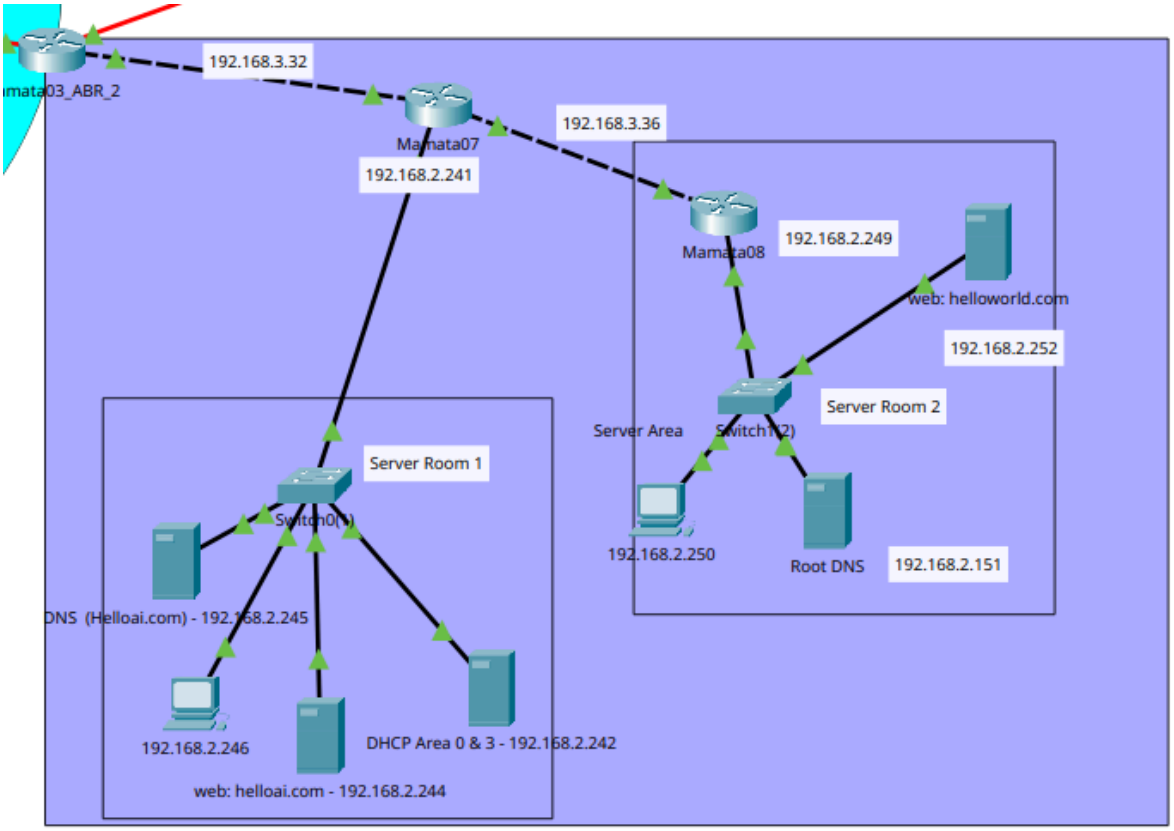


Fig : Area 3

Component Details:

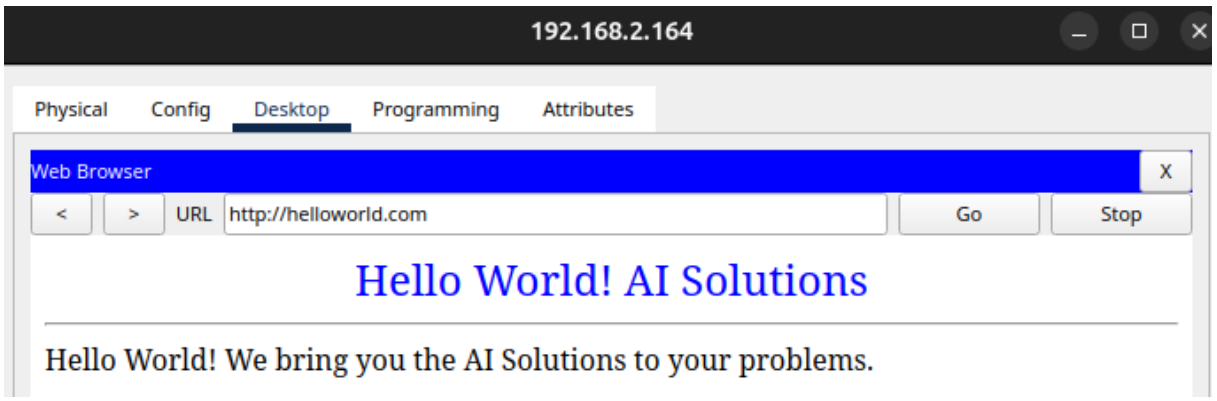
- **Routers:** Mamata07, Mamata08, Mamata03_ABR_2,
- **Switches:**2 switches in each server room 1 and server room 2
- **PCs & Servers: DHCP Server** for assigning IP address to devices in **area 0** and **area 3**, PC's for maintenance, DNS Server having Web Server cisco.com and points to Root DNS for other webpages. Root Server has **helloworld.com** and **helloai.com** listed in it and these web pages are hosted in Web: helloworld.com server
- **Service Provider Link:** Connection to the ISP via Mamata03_ABR_2 -> Area 0 -> Mamata09_ISP

The ip address of ports of the router are labeled and two server rooms are highlighted in the design.

Routing and Network Access

All the Inter-VLANs and individual departments communication is possible due to routers connecting the subnets. As an example, Here a computer belonging to the Marketing VLAN accesses the webpages of the company hosted at the server rooms.

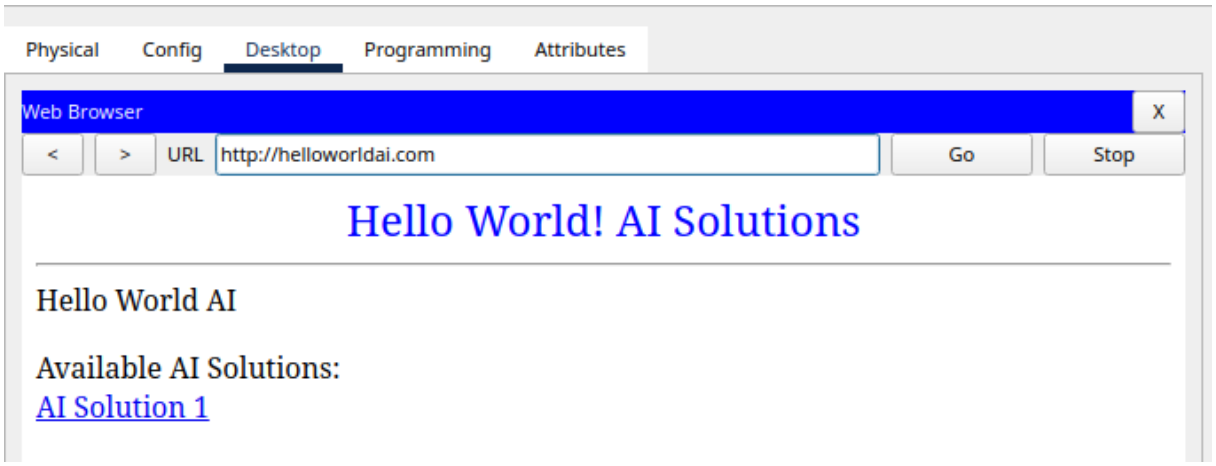
192.168.2.164 is an IP Address of a computer in Marketing VLAN. Here, helloworld.com is being hosted in server room 2. The request first goes to the DNS server at server room 1 which directs it to root DNS which contains this domain name.

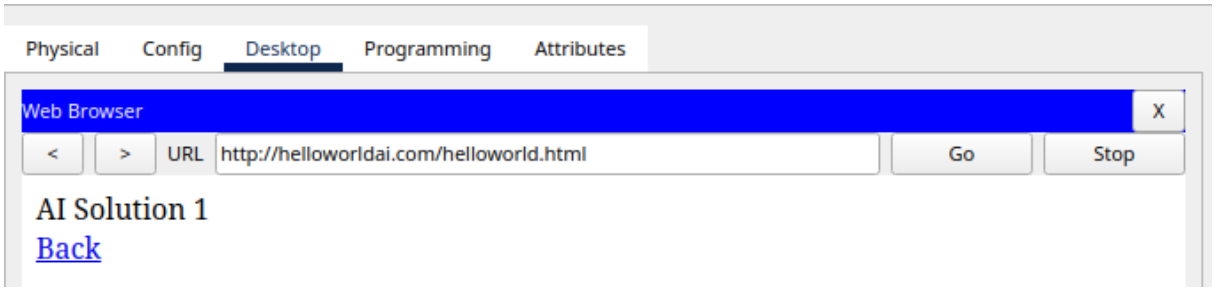



```
C:\>tracert helloworld.com

Tracing route to 192.168.2.252 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      192.168.2.161
  2    0 ms      0 ms      32 ms     192.168.3.10
  3    1 ms      41 ms     0 ms      192.168.3.14
  4    1 ms      2 ms      23 ms     192.168.3.30
  5    4 ms      35 ms     1 ms      192.168.3.34
  6    1 ms      1 ms      10 ms     192.168.3.42
  7    2 ms      0 ms      12 ms     192.168.2.252

Trace complete.
```

From 192.168.2.164 it has taken the shortest path to the DNS server from 192.168.3.34 which has directed to the root server through 192.168.3.42 and finally to the web server.

Similarly when we request helloworldai.com, the packets are addressed by the DNS Server in the server room 1 and directed to the web server registered in the list.






```
C:\>tracert helloworldai.com

Tracing route to 192.168.2.244 over a maximum of 30 hops:

  1    1 ms      0 ms      0 ms      192.168.2.161
  2    1 ms      37 ms     11 ms     192.168.3.10
  3    44 ms     54 ms     2 ms      192.168.3.14
  4    2 ms      2 ms      2 ms      192.168.3.30
  5    1 ms      1 ms      2 ms      192.168.3.34
  6    1 ms      10 ms     10 ms     192.168.2.244

Trace complete.
```

And when a network address other than 192.168.0.0 /22 was requested it was directed to the ISP router which returned a destination host unreachable when tried until 30 hops.

```
C:\>tracert 1.2.3.3

Tracing route to 1.2.3.3 over a maximum of 30 hops:

  1    0 ms      0 ms      0 ms      192.168.2.161
  2    1 ms      0 ms      0 ms      192.168.3.10
  3    0 ms      2 ms      25 ms     192.168.3.14
  4    2 ms      67 ms     26 ms     192.168.3.30
  5    3 ms      2 ms      18 ms     192.168.3.38
  6    2 ms      *         2 ms      192.168.3.38
  7    *         1 ms      *         Request timed out.
```

Analysis and Discussion

Designing this network was like going through all the exercises done during computer networks Lab. It covers all the essential concepts in computer networking such as VLANs, OSPF, Static routing, Default routing, DHCP Servers, DNS Servers, Web Servers and other topics. While VLAN is an easy concept to grasp, implementing it in this network was a bit challenging with the DHCP servers. However, configuring vlan in one area provided a lot of insights on its workings which enabled me to implement the vlan in another area with ease. Similarly, using dhcp server pools for computers across the subnet was simpler after using it in vlans. The OSPF configuration made it very easy to enable routing without specifying all the subnets but its aggregated subnets. Since, using dhcp was much easier instead of manually configuring the devices, I ended up using dhcp for the dns and web servers as well which caused issues with the address. Later it was realized that the dhcp server was providing different but available ip addresses to the dns and web server every time I freshly opened the pkt file. So, the address in the dns and web servers were made static and the network was completed.

The Root DNS has an additional entry for google.com directing to 1.1.1.1 which is an address outside given range, so it goes to the ISP router and tries to get to the address till maximum hop count is reached and returns unsuccessful because ISP router has no path to the world in this design but in reality it will definitely have a connection to the google server and this ISP router forwards any request from the outside of ISP to this company if the network is in the range of 192.168.0.0 /22.

Due to OSPF configuration, all the devices connected to this network are able to communicate with each other through the shortest route possible. Even when a connection between the triangular formation in area 0 was removed, the network was able to find other routes to reach the destination. Hence, all the devices are able to communicate with each other efficiently.

Conclusion

Implementing a network for a hypothetical company “Hello World! AI Solutions” provided much understanding of the essentials of computer networks. The Lab sheets were the elemental support for completion of this mini project. Hence, a scalable, reliable, and cost-effective network infrastructure was designed as a mini-network project in cisco packet-tracer.

Appendix

The Routes

All the routers in the network is configured as follows:

```
Mamata07(config)#line console 0
Mamata07(config-line)#password cisco
Mamata07(config-line)#login
Mamata07(config-line)#exit
Mamata07(config)#enable password class
Mamata07(config)#line vty 0 4
Mamata07(config-line)#password network
Mamata07(config-line)#login
Mamata07(config-line)#exit
```

1. Mamata01

```
Gateway of last resort is 192.168.3.30 to network 0.0.0.0

O IA 192.168.0.0/23 [110/66] via 192.168.3.21, 01:32:00, Serial3/0
     192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O IA    192.168.2.0/26 [110/66] via 192.168.3.21, 01:32:00, Serial3/0
O IA    192.168.2.64/26 [110/66] via 192.168.3.21, 01:32:00, Serial3/0
O IA    192.168.2.128/27 [110/129] via 192.168.3.13, 01:32:00, Serial2/0
O IA    192.168.2.160/27 [110/129] via 192.168.3.13, 01:32:00, Serial2/0
O IA    192.168.2.192/27 [110/129] via 192.168.3.13, 01:32:00, Serial2/0
O IA    192.168.2.224/28 [110/129] via 192.168.3.13, 01:32:00, Serial2/0
O IA    192.168.2.240/29 [110/66] via 192.168.3.30, 01:32:00, Serial4/0
O IA    192.168.2.248/29 [110/67] via 192.168.3.30, 01:32:00, Serial4/0
     192.168.3.0/30 is subnetted, 10 subnets
C       192.168.3.0 is directly connected, FastEthernet1/0.1
C       192.168.3.4 is directly connected, FastEthernet1/0.2
O IA    192.168.3.8 [110/128] via 192.168.3.13, 01:32:00, Serial2/0
C       192.168.3.12 is directly connected, Serial2/0
O       192.168.3.16 [110/128] via 192.168.3.13, 01:27:29, Serial2/0
                     [110/128] via 192.168.3.21, 01:27:29, Serial3/0
C       192.168.3.20 is directly connected, Serial3/0
O IA    192.168.3.24 [110/65] via 192.168.3.21, 01:32:00, Serial3/0
C       192.168.3.28 is directly connected, Serial4/0
O IA    192.168.3.32 [110/65] via 192.168.3.30, 01:32:00, Serial4/0
O IA    192.168.3.36 [110/66] via 192.168.3.30, 01:32:00, Serial4/0
S*   0.0.0.0/0 [1/0] via 192.168.3.30
```

2. Mamata02_ABR_1

```
Gateway of last resort is 192.168.3.14 to network 0.0.0.0
O IA 192.168.0.0/23 [110/66] via 192.168.3.18, 03:20:08, Serial4/0
     192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O IA    192.168.2.0/26 [110/66] via 192.168.3.18, 03:20:08, Serial4/0
O IA    192.168.2.64/26 [110/66] via 192.168.3.18, 03:20:08, Serial4/0
```

```
O       192.168.2.128/27 [110/65] via 192.168.3.9, 01:33:29, Serial2/0
O       192.168.2.160/27 [110/65] via 192.168.3.9, 01:33:29, Serial2/0
O       192.168.2.192/27 [110/65] via 192.168.3.9, 01:33:29, Serial2/0
O       192.168.2.224/28 [110/65] via 192.168.3.9, 01:33:29, Serial2/0
O IA    192.168.2.240/29 [110/130] via 192.168.3.14, 01:50:22, Serial3/0
O IA    192.168.2.248/29 [110/131] via 192.168.3.14, 01:50:22, Serial3/0
     192.168.3.0/30 is subnetted, 10 subnets
O       192.168.3.0 [110/65] via 192.168.3.14, 02:57:01, Serial3/0
O       192.168.3.4 [110/65] via 192.168.3.14, 02:55:58, Serial3/0
C       192.168.3.8 is directly connected, Serial2/0
C       192.168.3.12 is directly connected, Serial3/0
C       192.168.3.16 is directly connected, Serial4/0
O       192.168.3.20 [110/128] via 192.168.3.14, 01:29:03, Serial3/0
                     [110/128] via 192.168.3.18, 01:29:03, Serial4/0
O IA    192.168.3.24 [110/65] via 192.168.3.18, 03:20:08, Serial4/0
O       192.168.3.28 [110/128] via 192.168.3.14, 03:05:13, Serial3/0
O IA    192.168.3.32 [110/129] via 192.168.3.14, 02:06:30, Serial3/0
O IA    192.168.3.36 [110/130] via 192.168.3.14, 01:50:22, Serial3/0
S*   0.0.0.0/0 [1/0] via 192.168.3.14
```

3. Mamata03_ABR_2

```
Gateway of last resort is 192.168.3.38 to network 0.0.0.0
O IA 192.168.0.0/23 [110/130] via 192.168.3.29, 01:34:50, Serial2/0
    192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O IA    192.168.2.0/26 [110/130] via 192.168.3.29, 01:34:50, Serial2/0
O IA    192.168.2.64/26 [110/130] via 192.168.3.29, 01:34:50, Serial2/0
O IA    192.168.2.128/27 [110/193] via 192.168.3.29, 01:34:50, Serial2/0
O IA    192.168.2.160/27 [110/193] via 192.168.3.29, 01:34:50, Serial2/0
O IA    192.168.2.192/27 [110/193] via 192.168.3.29, 01:34:50, Serial2/0
O IA    192.168.2.224/28 [110/193] via 192.168.3.29, 01:34:50, Serial2/0
O       192.168.2.240/29 [110/2] via 192.168.3.34, 01:52:04,
FastEthernet0/0
O       192.168.2.248/29 [110/3] via 192.168.3.34, 01:52:04,
FastEthernet0/0
    192.168.3.0/30 is subnetted, 10 subnets
O       192.168.3.0 [110/65] via 192.168.3.29, 01:35:00, Serial2/0
O       192.168.3.4 [110/65] via 192.168.3.29, 01:35:00, Serial2/0
O IA    192.168.3.8 [110/192] via 192.168.3.29, 01:34:50, Serial2/0
O       192.168.3.12 [110/128] via 192.168.3.29, 01:35:00, Serial2/0
O       192.168.3.16 [110/192] via 192.168.3.29, 01:30:30, Serial2/0
O       192.168.3.20 [110/128] via 192.168.3.29, 01:35:00, Serial2/0
O IA    192.168.3.24 [110/129] via 192.168.3.29, 01:34:50, Serial2/0
C       192.168.3.28 is directly connected, Serial2/0
C       192.168.3.32 is directly connected, FastEthernet0/0
C       192.168.3.36 is directly connected, Serial3/0
S*   0.0.0.0/0 [1/0] via 192.168.3.38
```

4. Mamata04_ABR_3

```
Gateway of last resort is 192.168.3.22 to network 0.0.0.0

O    192.168.0.0/23 [110/2] via 192.168.3.26, 04:31:05, FastEthernet0/0
     192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O       192.168.2.0/26 [110/2] via 192.168.3.26, 04:07:33,
FastEthernet0/0
O       192.168.2.64/26 [110/2] via 192.168.3.26, 04:07:11,
FastEthernet0/0
```

```
O IA    192.168.2.128/27 [110/129] via 192.168.3.17, 01:31:34, Serial2/0
O IA    192.168.2.160/27 [110/129] via 192.168.3.17, 01:31:34, Serial2/0
O IA    192.168.2.192/27 [110/129] via 192.168.3.17, 01:31:34, Serial2/0
O IA    192.168.2.224/28 [110/129] via 192.168.3.17, 01:31:34, Serial2/0
O IA    192.168.2.240/29 [110/130] via 192.168.3.22, 01:36:00, Serial3/0
O IA    192.168.2.248/29 [110/131] via 192.168.3.22, 01:36:00, Serial3/0
     192.168.3.0/30 is subnetted, 10 subnets
O       192.168.3.0 [110/65] via 192.168.3.22, 01:36:00, Serial3/0
O       192.168.3.4 [110/65] via 192.168.3.22, 01:36:00, Serial3/0
O IA    192.168.3.8 [110/128] via 192.168.3.17, 01:31:34, Serial2/0
O       192.168.3.12 [110/128] via 192.168.3.17, 01:31:34, Serial2/0
                     [110/128] via 192.168.3.22, 01:31:34, Serial3/0
C       192.168.3.16 is directly connected, Serial2/0
C       192.168.3.20 is directly connected, Serial3/0
C       192.168.3.24 is directly connected, FastEthernet0/0
O       192.168.3.28 [110/128] via 192.168.3.22, 01:36:00, Serial3/0
O IA    192.168.3.32 [110/129] via 192.168.3.22, 01:36:00, Serial3/0
O IA    192.168.3.36 [110/130] via 192.168.3.22, 01:36:00, Serial3/0
S*   0.0.0.0/0 [1/0] via 192.168.3.22
```

5. Mamata05

```
Gateway of last resort is 192.168.3.10 to network 0.0.0.0

O IA 192.168.0.0/23 [110/130] via 192.168.3.10, 01:37:07, Serial2/0
     192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O IA    192.168.2.0/26 [110/130] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.2.64/26 [110/130] via 192.168.3.10, 01:37:07, Serial2/0
C       192.168.2.128/27 is directly connected, FastEthernet1/0.1
C       192.168.2.160/27 is directly connected, FastEthernet1/0.2
C       192.168.2.192/27 is directly connected, FastEthernet1/0.3
C       192.168.2.224/28 is directly connected, FastEthernet0/0
O IA    192.168.2.240/29 [110/194] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.2.248/29 [110/195] via 192.168.3.10, 01:37:07, Serial2/0
     192.168.3.0/30 is subnetted, 10 subnets
O IA    192.168.3.0 [110/129] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.4 [110/129] via 192.168.3.10, 01:37:07, Serial2/0
C       192.168.3.8 is directly connected, Serial2/0
O IA    192.168.3.12 [110/128] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.16 [110/128] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.20 [110/192] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.24 [110/129] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.28 [110/192] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.32 [110/193] via 192.168.3.10, 01:37:07, Serial2/0
O IA    192.168.3.36 [110/194] via 192.168.3.10, 01:37:07, Serial2/0
S*   0.0.0.0/0 [1/0] via 192.168.3.10
```

6. Mamata06

```
Gateway of last resort is 192.168.3.25 to network 0.0.0.0

C    192.168.0.0/23 is directly connected, GigabitEthernet0/0
     192.168.0.0/32 is subnetted, 1 subnets
L       192.168.0.1/32 is directly connected, GigabitEthernet0/0
     192.168.2.0/24 is variably subnetted, 10 subnets, 5 masks
C       192.168.2.0/26 is directly connected, GigabitEthernet0/1.1
L       192.168.2.1/32 is directly connected, GigabitEthernet0/1.1
C       192.168.2.64/26 is directly connected, GigabitEthernet0/1.2
L       192.168.2.65/32 is directly connected, GigabitEthernet0/1.2
```

```
O IA    192.168.2.128/27 [110/130] via 192.168.3.25, 01:33:22, GigabitEthernet0/2
O IA    192.168.2.160/27 [110/130] via 192.168.3.25, 01:33:22, GigabitEthernet0/2
O IA    192.168.2.192/27 [110/130] via 192.168.3.25, 01:33:22, GigabitEthernet0/2
O IA    192.168.2.224/28 [110/130] via 192.168.3.25, 01:33:22, GigabitEthernet0/2
O IA    192.168.2.240/29 [110/131] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
O IA    192.168.2.248/29 [110/132] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
     192.168.3.0/24 is variably subnetted, 11 subnets, 2 masks
O IA    192.168.3.0/30 [110/66] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
O IA    192.168.3.4/30 [110/66] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
O IA    192.168.3.8/30 [110/129] via 192.168.3.25, 01:33:22, GigabitEthernet0/2
O IA    192.168.3.12/30 [110/129] via 192.168.3.25, 03:10:21, GigabitEthernet0/2
O IA    192.168.3.16/30 [110/65] via 192.168.3.25, 04:32:58, GigabitEthernet0/2
O IA    192.168.3.20/30 [110/65] via 192.168.3.25, 03:31:13, GigabitEthernet0/2
C       192.168.3.24/30 is directly connected, GigabitEthernet0/2
L       192.168.3.26/32 is directly connected, GigabitEthernet0/2
O IA    192.168.3.28/30 [110/129] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
O IA    192.168.3.32/30 [110/130] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
O IA    192.168.3.36/30 [110/131] via 192.168.3.25, 01:37:48, GigabitEthernet0/2
S*   0.0.0.0/0 [1/0] via 192.168.3.25
```

7. Mamata07

```
Gateway of last resort is 192.168.3.33 to network 0.0.0.0

O IA 192.168.0.0/23 [110/131] via 192.168.3.33, 01:39:12, FastEthernet0/0
     192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O IA    192.168.2.0/26 [110/131] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.2.64/26 [110/131] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.2.128/27 [110/194] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.2.160/27 [110/194] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.2.192/27 [110/194] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.2.224/28 [110/194] via 192.168.3.33, 01:39:12, FastEthernet0/0
C       192.168.2.240/29 is directly connected, FastEthernet1/0
O       192.168.2.248/29 [110/2] via 192.168.3.38, 01:57:30, FastEthernet6/0
     192.168.3.0/30 is subnetted, 10 subnets
O IA    192.168.3.0 [110/66] via 192.168.3.33, 01:56:30, FastEthernet0/0
O IA    192.168.3.4 [110/66] via 192.168.3.33, 01:56:30, FastEthernet0/0
O IA    192.168.3.8 [110/193] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.3.12 [110/129] via 192.168.3.33, 01:56:30, FastEthernet0/0
O IA    192.168.3.16 [110/193] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.3.20 [110/129] via 192.168.3.33, 01:56:30, FastEthernet0/0
O IA    192.168.3.24 [110/130] via 192.168.3.33, 01:39:12, FastEthernet0/0
O IA    192.168.3.28 [110/65] via 192.168.3.33, 01:56:30, FastEthernet0/0
C       192.168.3.32 is directly connected, FastEthernet0/0
C       192.168.3.36 is directly connected, FastEthernet6/0
S*   0.0.0.0/0 [1/0] via 192.168.3.33
```

8. Mamata08

```
Gateway of last resort is 192.168.3.37 to network 0.0.0.0

O IA 192.168.0.0/23 [110/132] via 192.168.3.37, 01:39:58, FastEthernet0/0
     192.168.2.0/24 is variably subnetted, 8 subnets, 4 masks
O IA    192.168.2.0/26 [110/132] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.2.64/26 [110/132] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.2.128/27 [110/195] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.2.160/27 [110/195] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.2.192/27 [110/195] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.2.224/28 [110/195] via 192.168.3.37, 01:39:58, FastEthernet0/0
O       192.168.2.240/29 [110/2] via 192.168.3.37, 01:57:54, FastEthernet0/0
C       192.168.2.248/29 is directly connected, FastEthernet1/0
     192.168.3.0/30 is subnetted, 10 subnets
O IA    192.168.3.0 [110/67] via 192.168.3.37, 01:40:08, FastEthernet0/0
```

```
O IA    192.168.3.4 [110/67] via 192.168.3.37, 01:40:08, FastEthernet0/0
O IA    192.168.3.8 [110/194] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.3.12 [110/130] via 192.168.3.37, 01:40:08, FastEthernet0/0
O IA    192.168.3.16 [110/194] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.3.20 [110/130] via 192.168.3.37, 01:40:08, FastEthernet0/0
O IA    192.168.3.24 [110/131] via 192.168.3.37, 01:39:58, FastEthernet0/0
O IA    192.168.3.28 [110/66] via 192.168.3.37, 01:57:18, FastEthernet0/0
O       192.168.3.32 [110/2] via 192.168.3.37, 01:40:18, FastEthernet0/0
C       192.168.3.36 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 192.168.3.37
```

9. Mamata09_ISP

```
S    192.168.0.0/22 [1/0] via 192.168.3.37
     192.168.3.0/30 is subnetted, 1 subnets
C       192.168.3.36 is directly connected, Serial2/0
```

The Servers

1. DHCP Server of Area 1

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
VLAN_Marketing	192.168.2.129	192.168.2.245	192.168.2.161	255.255.255.224	25	0.0.0.0	0.0.0.0
serverPool	192.168.2.129	192.168.2.245	192.168.2.128	255.255.255.224	30	0.0.0.0	0.0.0.0
VLAN_Account	192.168.2.129	192.168.2.245	192.168.2.193	255.255.255.224	22	0.0.0.0	0.0.0.0
HR Department	192.168.2.225	192.168.2.245	192.168.2.225	255.255.255.224	13	0.0.0.0	0.0.0.0

2. DHCP Server of Area 2

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
IT Depart	192.168.0.1	192.168.2.245	192.168.0.1	255.255.254.0	510	0.0.0.0	0.0.0.0
Development	192.168.2.1	192.168.2.245	192.168.2.65	255.255.255.1...	62	0.0.0.0	0.0.0.0
serverPool	192.168.2.1	192.168.2.245	192.168.2.1	255.255.255.1...	62	0.0.0.0	0.0.0.0

3. DHCP Server at Server room

Pool Name	Default Gateway	DNS Server	Start IP Address	Subnet Mask	Max User	TFTP Server	WLC Address
mainoffice	192.168.2.241	192.168.2.245	192.168.3.1	255.255.255.252	2	0.0.0.0	0.0.0.0
backup	192.168.3.1	192.168.2.245	192.168.3.5	255.255.255.252	2	0.0.0.0	0.0.0.0
serverPool2	192.168.2.241	192.168.2.245	192.168.2.249	255.255.255.248	6	0.0.0.0	0.0.0.0
serverPool	192.168.2.241	192.168.2.245	192.168.2.243	255.255.255.248	4	0.0.0.0	0.0.0.0

4. DNS - 192.168.2.245

No.	Name	Type	Detail
0	helloworldai.com	A Record	192.168.2.244
1	com	NS	root
2	root	A Record	192.168.2.251

5. Root DNS - 192.168.2.151

No.	Name	Type	Detail
0	google.com	A Record	1.1.1.1
1	helloworld.com	A Record	192.168.2.252