

MUM VIETNAM 2019

*Mikro***Tik**

# OSPF SPECIAL AREA IMPLEMENTATION

BY  
**ANTONIUS DUTY SUSILO**

**MUM VIETNAM  
2019**





## Profile



- Antonius Duty Susilo
- Trainer And Consultant Mikrotik
- Instructor Cisco Academy and Oracle Academy (Oracle WDP)
- Ph.D Student In UTEM Malaysia (Universiti Teknikal Malaysia Melaka)
- Guest Lecturer in POLINEMA ( Politeknik Negeri Malang), STIMATA ( STMIK PPKIA Pradnya Paramita Malang, STIKI (Sekolah Tinggi Informatika dan Komputer Indonesia Malang)

MUM Vietnam 2018

## OBJECTIVE

- What is OSPF?
- What is area in OSPF?
- What is LSA?
- Why we need special area?
- How special area work?
- How to configure special area OSPF?

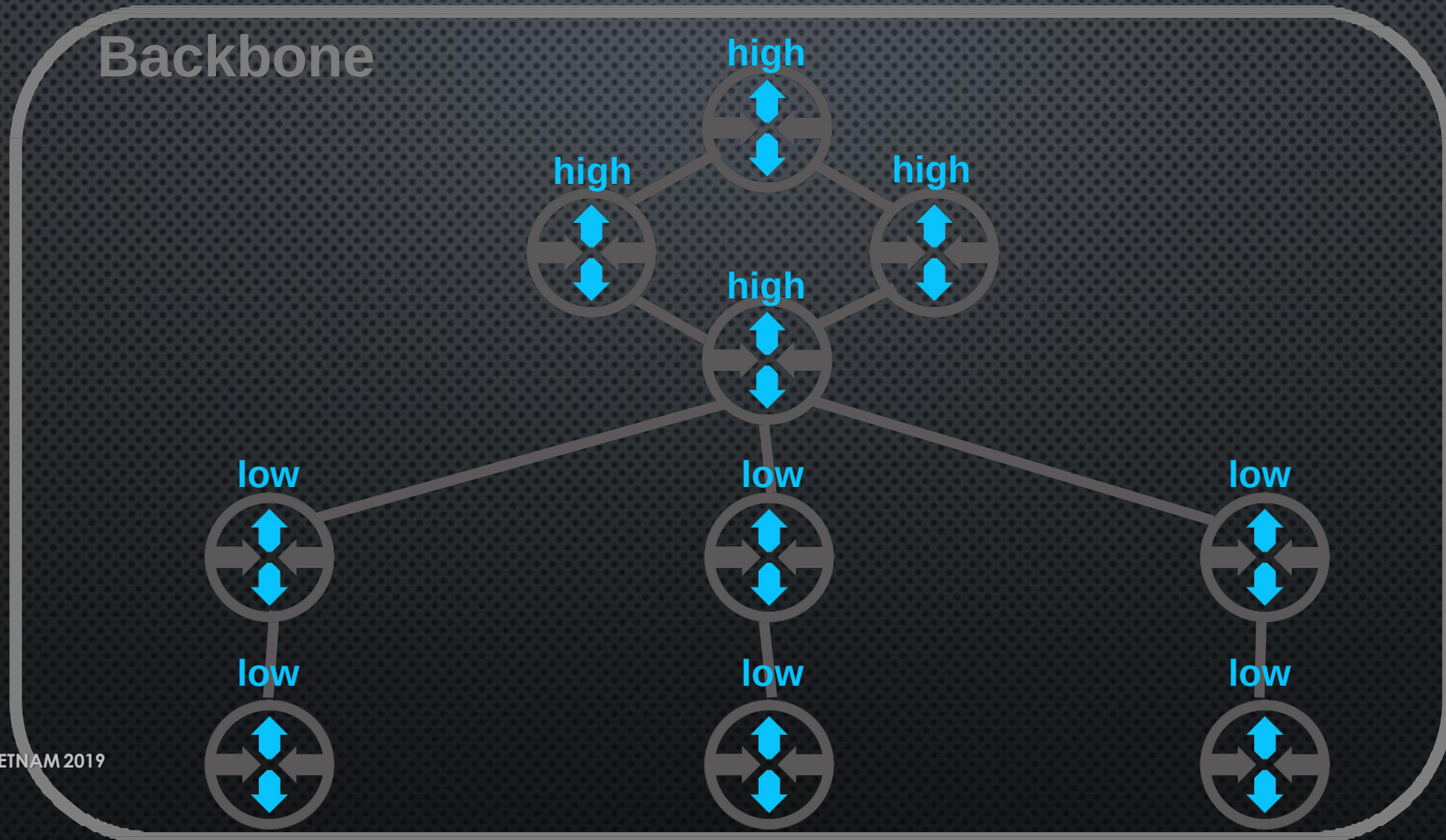


## WHAT IS OSPF?

- **Open Shortest Path First (OSPF)** is a routing protocol for Internet Protocol (IP) networks. It uses a link state routing (LSR) algorithm and falls into the group of interior gateway protocols (IGPs), operating within a single autonomous system (AS).

# WHAT IS AREA?

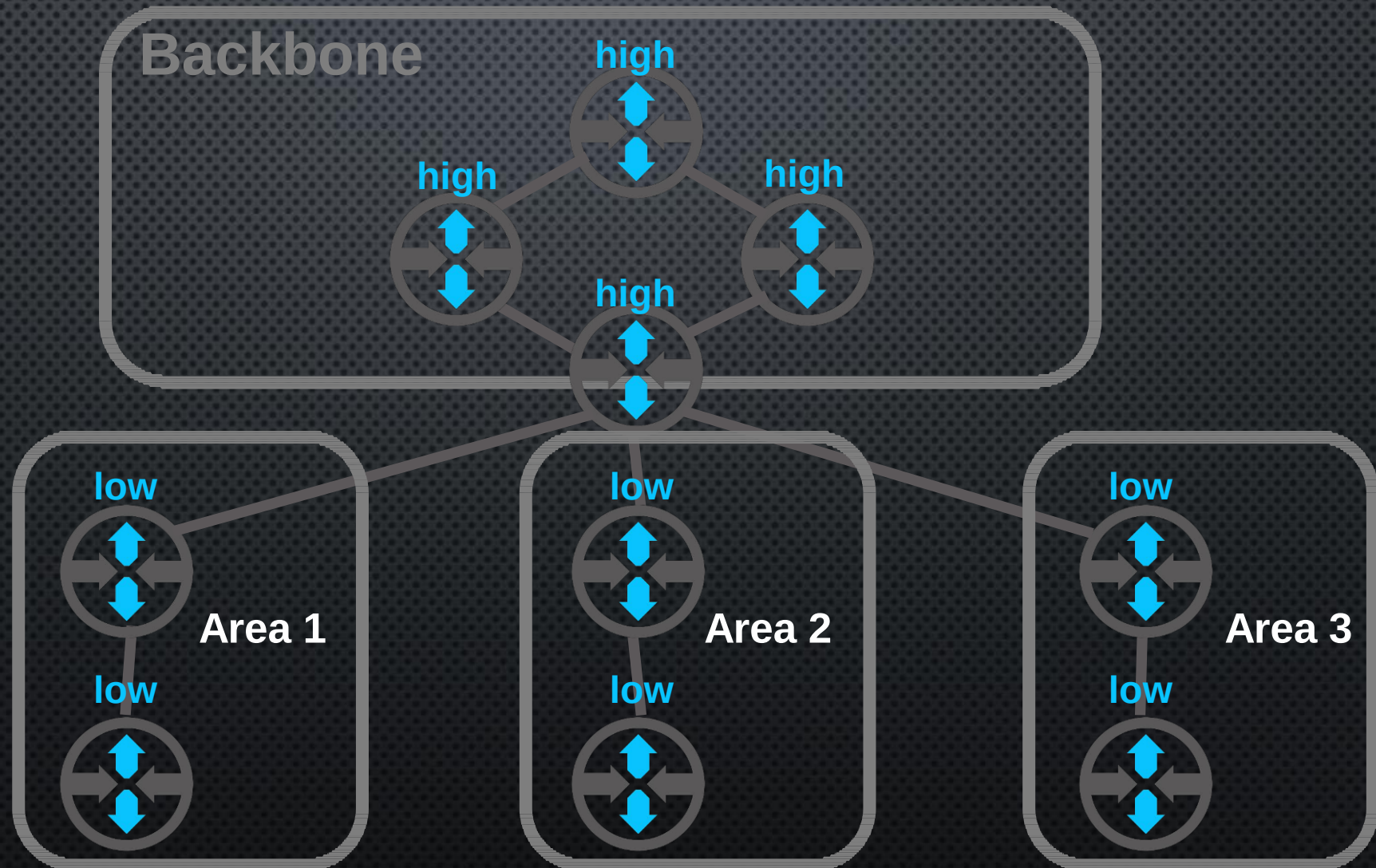
- Why we need area concept?





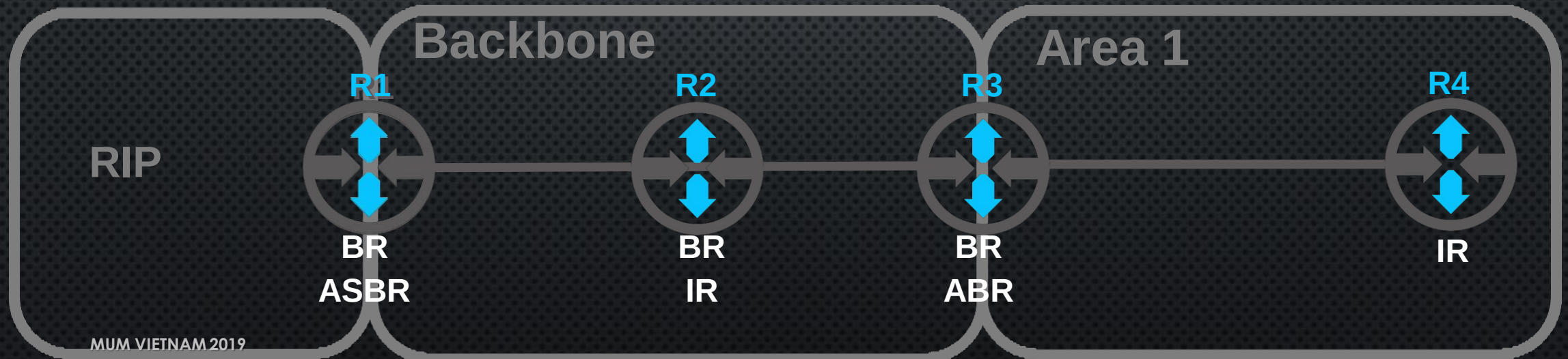
# WHAT IS AREA?

- Why we need area concept?



## TYPE OF OSPF ROUTER

- Internal Router (IR) -> all of interface in the same area
- Backbone Router (BR) -> at least one interface in the backbone area
- Area Border Router (ABR) -> connecting different area
- AS Boundary Router (ASBR) -> connecting ospf with external network





# WHAT IS LSA (LINK STATE ADVERTISEMENT)

## Types of LSA

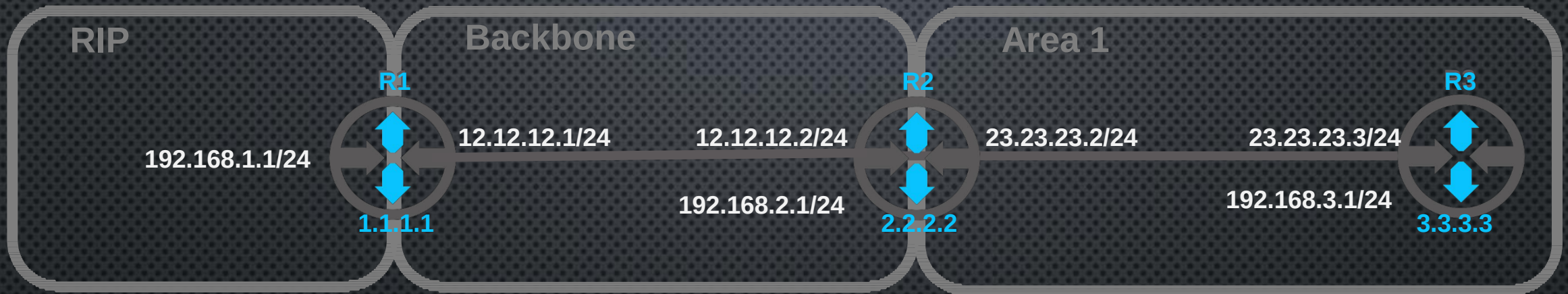
|             |                                |
|-------------|--------------------------------|
| LSA Type 1: | Router LSA                     |
| LSA Type 2: | Network LSA                    |
| LSA Type 3: | Summary LSA                    |
| LSA Type 4: | Summary ASBR LSA               |
| LSA Type 5: | Autonomous system external LSA |
| LSA Type 6: | Multicast OSPF LSA             |
| LSA Type 7: | Not-so-stubby area LSA         |
| LSA Type 8: | External attribute LSA for BGP |



## LSA TYPE 1 (ROUTER LSA)

- Each router will create LSA Type 1
- Flood within area, not flooded to other area
- Bring the information about directly connected network
- **LSA ID** will be **router-id** of each router
- **Originator** will be **router-id** of DR

# LSA TYPE 1



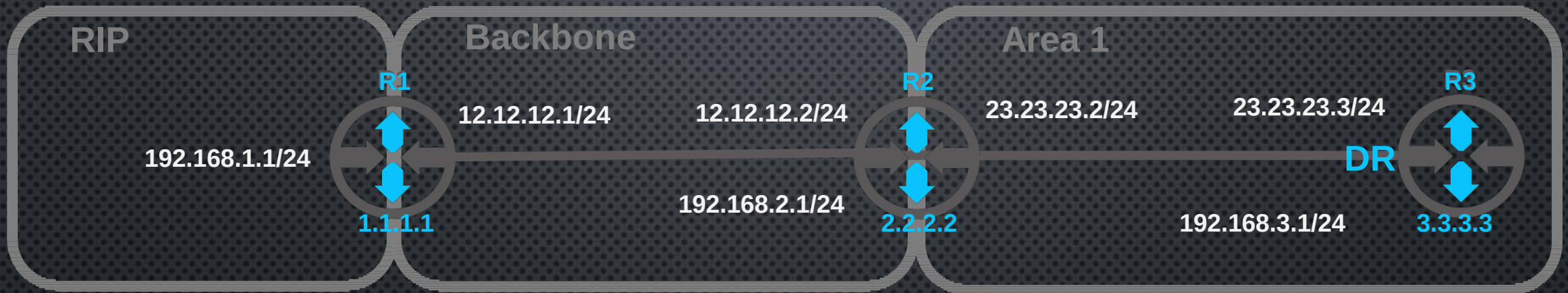
| Area   | LSA Type   | LSA ID  | Originator |
|--------|------------|---------|------------|
| Area 1 | Router LSA | 2.2.2.2 | 2.2.2.2    |
| Area 1 | Router LSA | 3.3.3.3 | 3.3.3.3    |



## LSA TYPE 2 (NETWORK LSA)

- Created by DR in the multi-access network
- Flood within area, not flooded to other area
- Bring the information about routers in one multiaccess network
- **LSA ID** will be IP **address** of DR
- **Originator** will be **router-id** of DR

# LSA TYPE 2 (NETWORK LSA)



| Area   | LSA Type    | LSA ID     | Originator |
|--------|-------------|------------|------------|
| Area 1 | Network LSA | 23.23.23.3 | 3.3.3.3    |



## LSA TYPE 3 (SUMMARY NETWORK LSA)

- Created by ABR
- Flood to other area
- Bring the information network in the other area
- **LSA ID** will be **ip network** of network in other area
  - 12.12.12.0/24                      -> 12.12.12.0
- **Originator** will be **router-id** of ABR

# LSA TYPE 3 (SUMMARY NETWORK LSA)



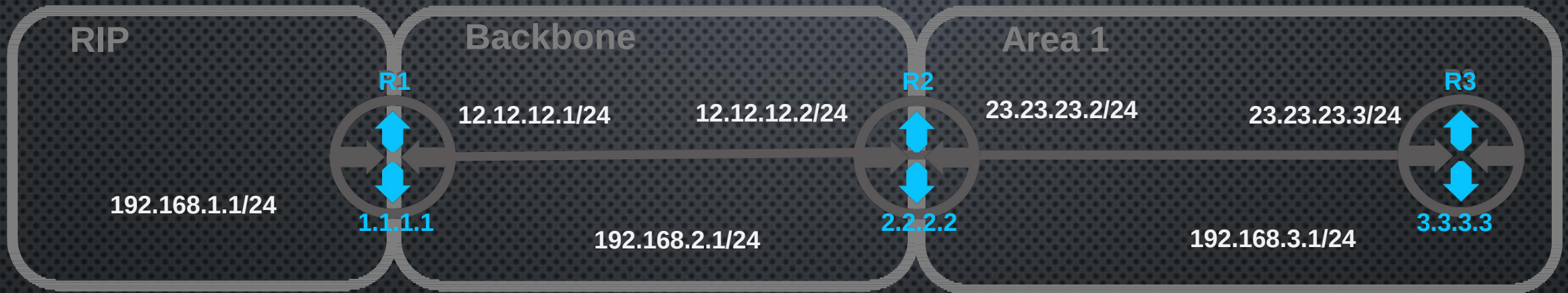
| Area   | LSA Type            | LSA ID      | Originator |
|--------|---------------------|-------------|------------|
| Area 1 | Summary Network LSA | 12.12.12.0  | 2.2.2.2    |
| Area 1 | Summary Network LSA | 192.168.2.0 | 2.2.2.2    |
| Area 1 | Summary Network LSA | 1.1.1.1     | 2.2.2.2    |
| Area 1 | Summary Network LSA | 2.2.2.2     | 2.2.2.2    |



## LSA TYPE 4 ( SUMMARY ASBR LSA)

- Created by Area Border Router
- Flood to other area
- Bring the information about ASBR
- **LSA ID** will be **router id** of ASBR
- **Originator** will be **router-id** of ABR

# LSA TYPE 4 (SUMMARY ASBR LSA)



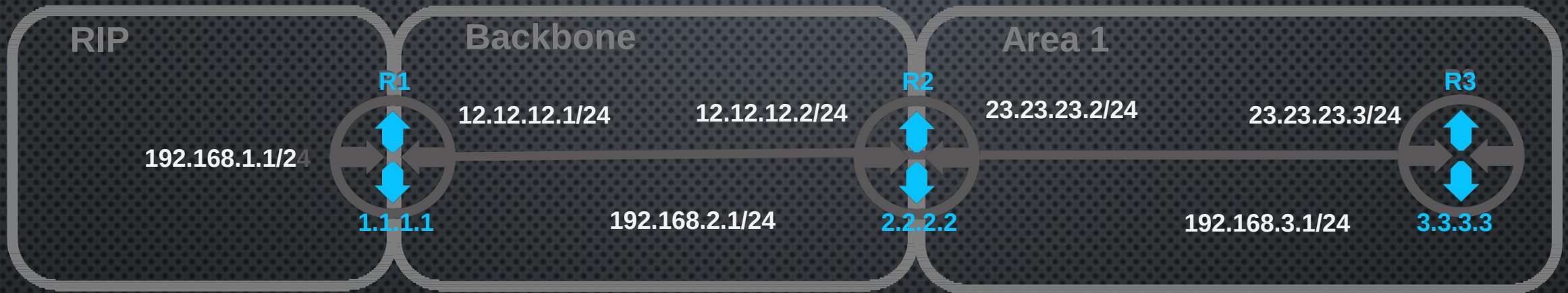
| Area   | LSA Type     | LSA ID  | Originator |
|--------|--------------|---------|------------|
| Area 1 | Summary ASBR | 1.1.1.1 | 2.2.2.2    |



## LSA TYPE 5 (AS EXTERNAL LSA)

- Created by Autonomous System Boundary Router
- Bring the information about network in the external network
- **LSA ID** will be **ip network** of network in external
  - 192.168.1.0/24 -> 192.168.1.0
- **Originator** will be **router-id** of ASBR

# LSA TYPE 5 (AS EXTERNAL LSA)



| Area   | LSA Type    | LSA ID      | Originator |
|--------|-------------|-------------|------------|
| Area 1 | AS External | 192.168.1.0 | 1.1.1.1    |



# OSPF ROUTES

- **Intra Area Route**
  - > The network is in the same area, created by LSA Type 1
- **Inter Area Route**
  - > The network is in the other area, created by LSA Type 3
- **External Route**
  - > The network is in the external network, created by LSA Type 5

# OSPF SPECIAL AREA

- Stub Area
- Totally Stub Area



## STUB AREA

Stub Area in OSPF routing is an area that cannot be traversed to network using another segment, meaning this area is the most end area and there are no more branches.

The Stub area has the characteristics of not receiving LSA type 4 and type 5 packets. It means that this type of area does not accept LSA packets originating from other areas delivered by the ABR router and does not receive LSA packages from other routing protocols coming out of the ASBR router (LSA types 4 and 5).



## STUB AREA

- This router only receives information from other routers in one area
- The Stub area communicates with outside networks using **default route** that will be tasked with receiving and forwarding all information that wants to exit the area.



## TOTALLY STUB AREA

- The difference between the routing type stub area and totally stub area is that if the stub area type received is type 1, 2, and 3 but the totally stub area is more specific, type 1 and type 2 only.



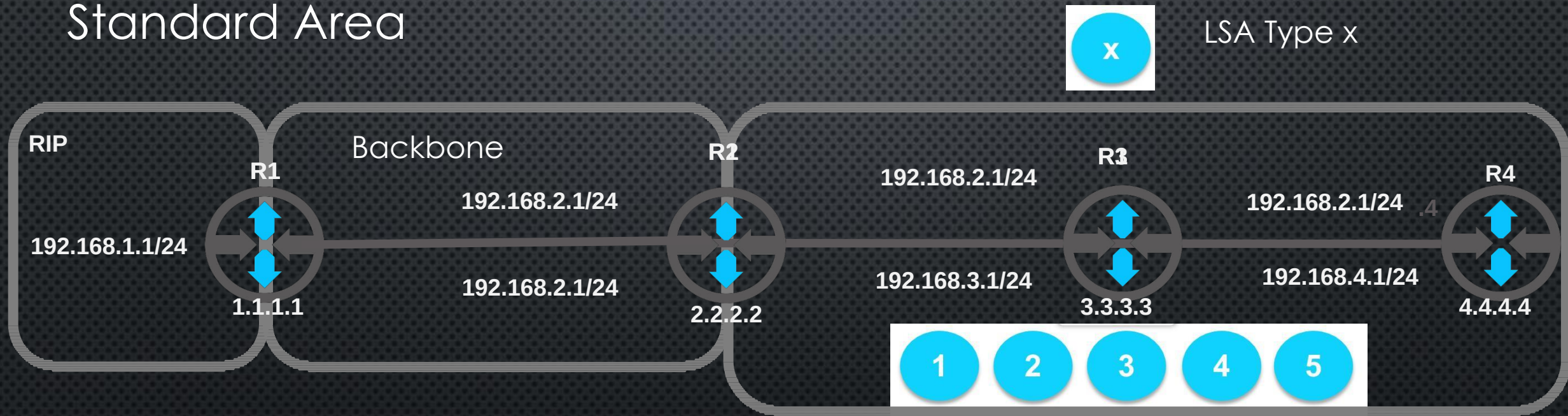
## PURPOSE OF SPECIAL AREA

The purpose of an area used as a stub area is to reduce the LSDB entry on each Router in this stub area because the Router does not receive information from outside OSPF or outside the OSPF stub area, so the Router workload in this area becomes lighter, and also calculations



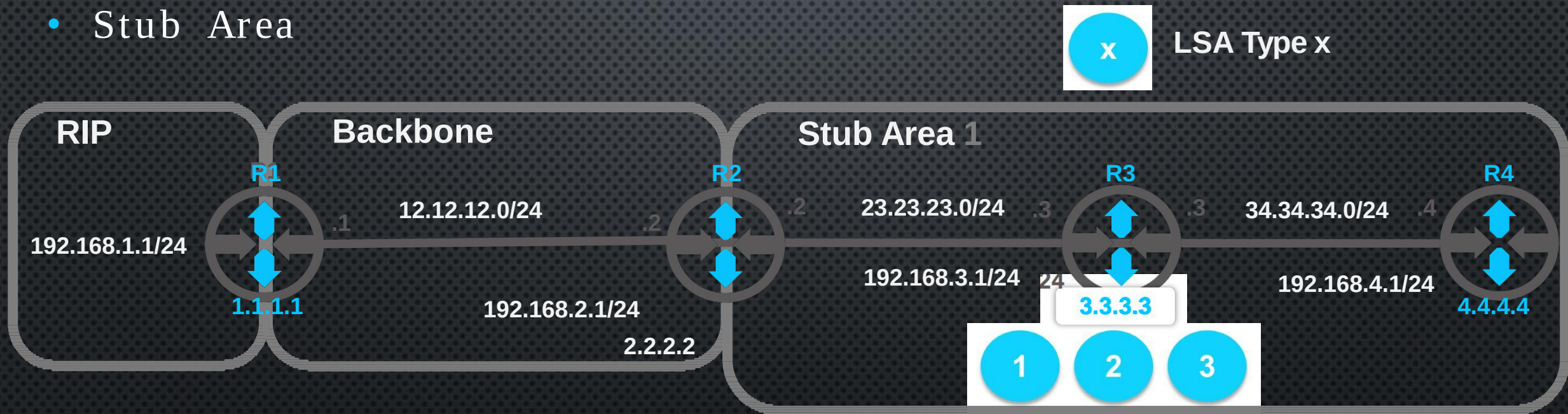
# WHY SPECIAL AREA?

## Standard Area



# WHY SPECIAL AREA?

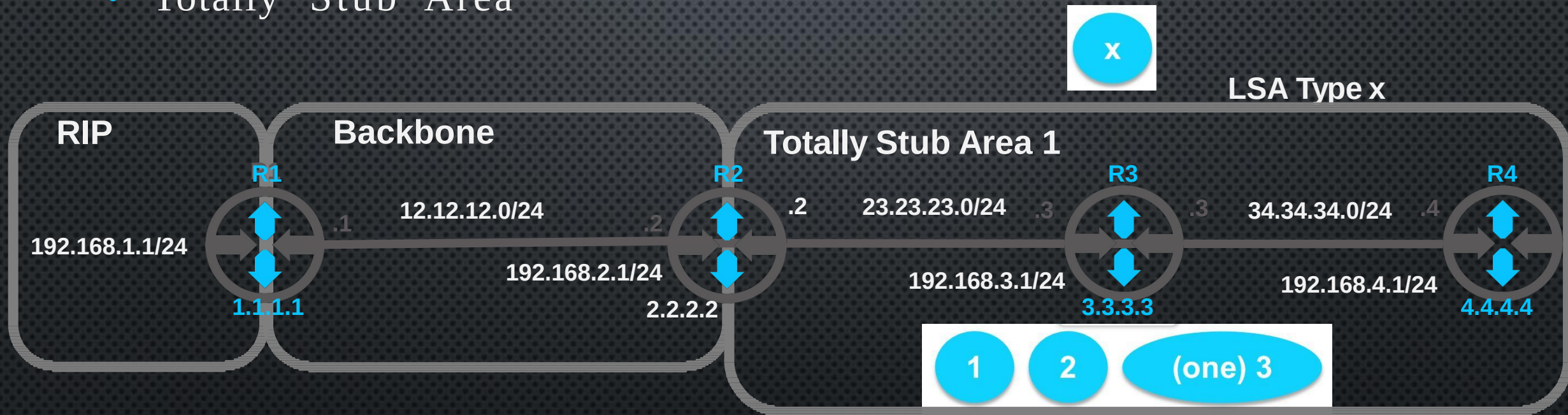
- Stub Area





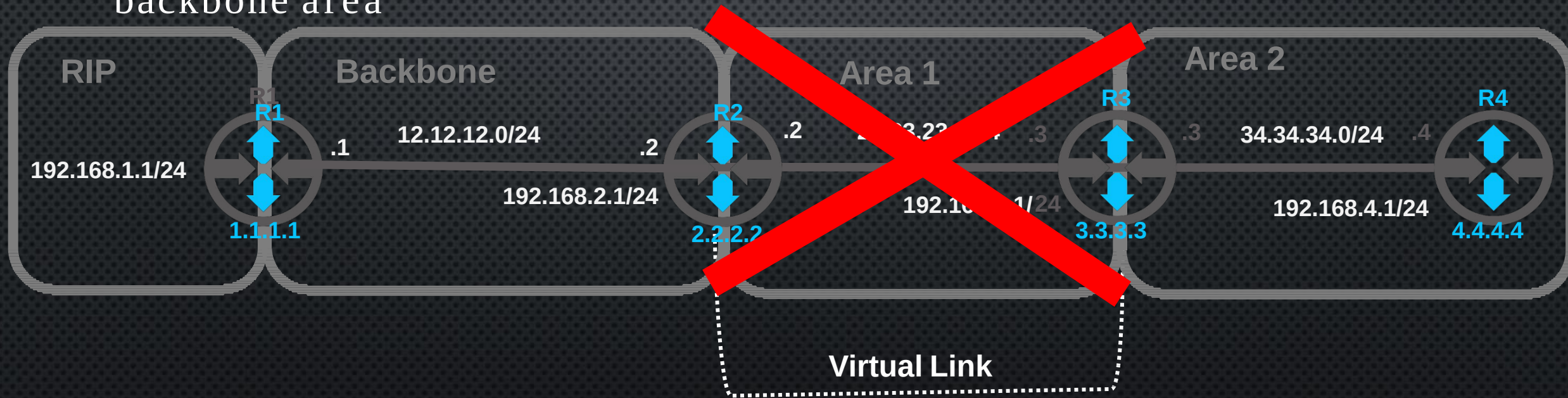
## WHY SPECIAL AREA?

- Totally Stub Area



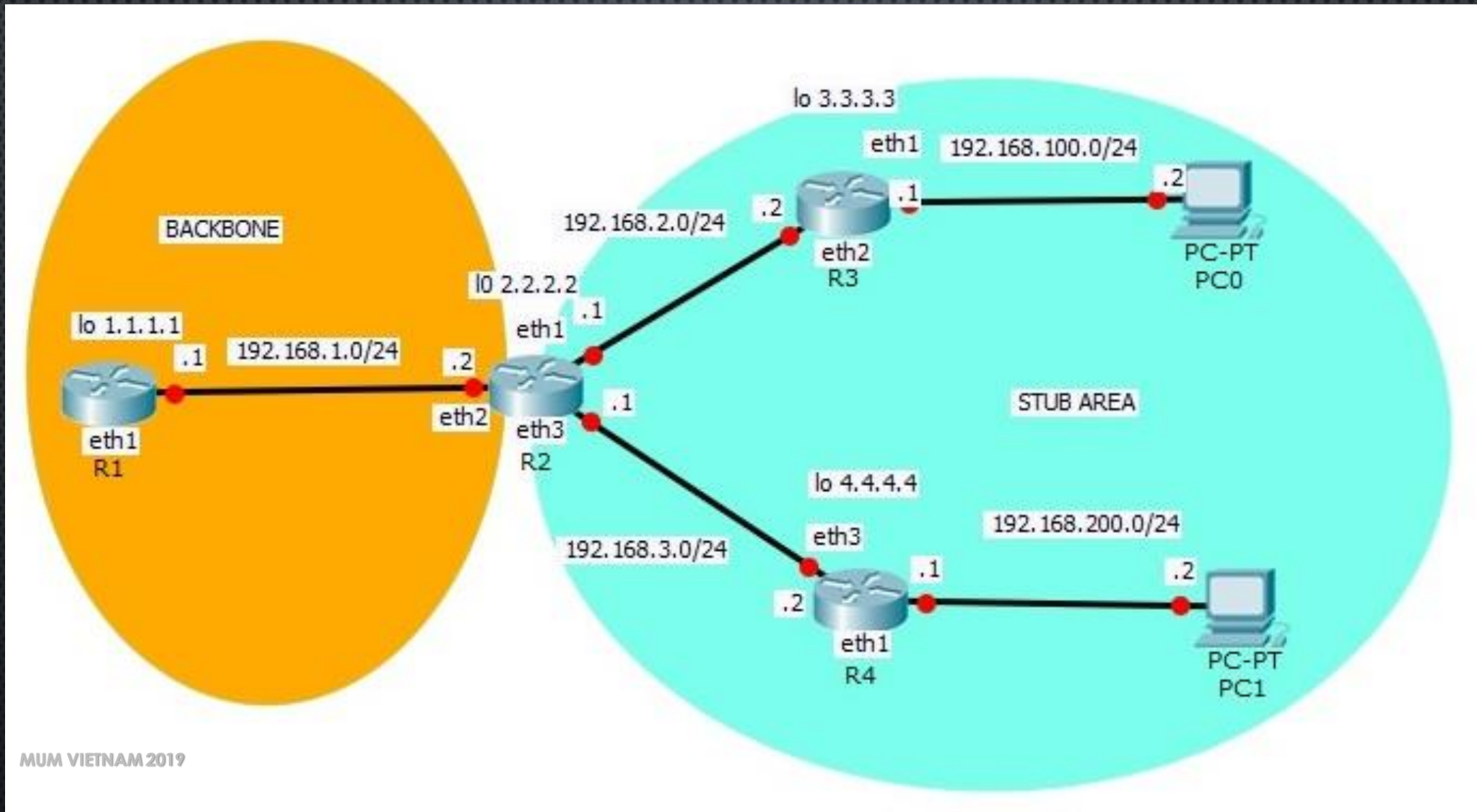
## WHEN WE MUST USE STUB/TOTALLY

- When we have many routers in our network
- When our router has low resource of CPU, Memory
- When our area is not transit area
- We will never be able to configure stub area in the backbone area





# LAB



# ROUTER 1 AS BACKBONE

| Address List                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                |             |           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-------------|-----------|
| <div>      <span>Fin</span></div> |                |             |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Address        | Network     | Interface |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1.1.1.1        | 1.1.1.1     | Loopback  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 192.168.1.1/24 | 192.168.1.0 | ether1    |

## OSPF Instance <default>

General

Metrics

MPLS

Status

Name: default

Router ID: 1.1.1.1

Redistribute Default Route: always (as type 1)

Redistribute Connected Routes: as type 1

Redistribute Static Routes: no

Redistribute RIP Routes: no

Redistribute BGP Routes: no

Redistribute Other OSPF Routes: no



# ROUTER 1 AS BACKBONE

OSPF Area <backbone>

Area Name:

Instance:  ▾

Area ID:

Type:  ▾

Translator Role:  ▾

☐ Inject Summary LSAs

Default Cost:

OK

Cancel

Apply

Disable

Comment

Copy

OSPF Network <192.168.1.0/24>

Network:

Area:  ▾

OK

Cancel

Apply

# ROUTER 2

## Address List








| Address                                                                                          | Network     | Interface |
|--------------------------------------------------------------------------------------------------|-------------|-----------|
|  2.2.2.2        | 2.2.2.2     | loopback  |
|  192.168.1.2/24 | 192.168.1.0 | ether2    |
|  192.168.2.1/24 | 192.168.2.0 | ether1    |
|  192.168.3.1/24 | 192.168.3.0 | ether3    |

## OSPF

Instances

Networks

Areas

Area Range

|                   |  |  |  |  |  |
|----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| Network                                                                                            | Area                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
|  192.168.1.0/24 | backbone                                                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
|  192.168.2.0/24 | stub-area                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   |
|  192.168.3.0/24 | stub-area                                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   |

## OSPF Instance <default>

General

Metrics

MPLS

Status

Name: default

Router ID: 2.2.2.2

Redistribute Default Route: always (as type 1)

Redistribute Connected Routes: as type 1



# ROUTER 2

OSPF

Networks Areas Area Ranges Virtual Links Neighbors NE

+ - ✓ ✗ 📁 📏

|   | Area Name ▲ | Instance | Area ID | Type    | Defa |
|---|-------------|----------|---------|---------|------|
| + | 🌐 backbone  | default  | 0.0.0.0 | default |      |
|   | 🌐 stub-area | default  | 0.0.0.1 | stub    |      |

OSPF Area <stub-area> [ ] [X]

Area Name: stub-area [OK]

Instance: default [v] [Cancel]

Area ID: 0.0.0.1 [Apply]

Type: stub [v] [Disable]

Translator Role: translate never [v] [Comment]

☒ Inject Summary LSAs [Copy]

Default Cost: 1 [Remove]

MUM VIETNAM 2019

# ROUTER 3

| Address List                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                        |               |           |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|---------------|-----------|--|
| <div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div><div><div></div><div></div><div></div><div></div><div></div><div></div></div></div> <div>Find</div> |                                        |               |           |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Address                                | Network       | Interface |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <div><div></div>3.3.3.3</div>          | 3.3.3.3       | loopback  |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <div><div></div>192.168.2.2/24</div>   | 192.168.2.0   | ether2    |  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <div><div></div>192.168.100.1/24</div> | 192.168.100.0 | ether1    |  |

OSPF Instance <default>

General

Metrics

MPLS

Status

Name:

default

Router ID:

3.3.3.3

Redistribute Default Route:

always (as type 1)

Redistribute Connected Routes:

as type 1

Redistribute Static Routes:

no

Redistribute RIP Routes:

no

Redistribute BGP Routes:

no

Redistribute Other OSPF Routes:

no



# ROUTER 3

OSPF

Instances Networks Areas Area Ranges

+ - ✓ ✗ 📁 📏

| Network          | Area      |
|------------------|-----------|
| 192.168.2.0/24   | stub-area |
| 192.168.100.0/24 | stub-area |

OSPF

Networks Areas Area Ranges Virtual Links

+ - ✓ ✗ 📁 📏

| Area Name | Instance | Area ID |
|-----------|----------|---------|
| backbone  | default  | 0.0.0.0 |
| stub-area | default  | 0.0.0.1 |

OSPF Area <stub-area>

Area Name: stub-area

Instance: default

Area ID: 0.0.0.1

Type: stub

Translator Role: translate never

☒ Inject Summary LSAs

Default Cost: 1

# ROUTER 4

| Address List                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                    |               |           |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------|-----------|
| <div>      <input type="text" value="Find"/></div> |                                                                                                    |               |           |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Address                                                                                            | Network       | Interface |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  4.4.4.4          | 4.4.4.4       | loopback  |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  192.168.3.2/24   | 192.168.3.0   | ether3    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  192.168.200.1... | 192.168.200.0 | ether1    |

OSPF Instance <default>

General

Metrics

MPLS

Status

Name:

default

Router ID:

4.4.4.4

Redistribute Default Route:

always (as type 1)

⌵

Redistribute Connected Routes:

as type 1

⌵

Redistribute Static Routes:

no

⌵

Redistribute RIP Routes:

no

⌵

Redistribute BGP Routes:

no

⌵



# ROUTER 4

OSPF

Instances Networks Areas Area Ranges Virtual Links

+ - ✓ ✗ [icon] [icon]

|  | Network          | Area      |
|--|------------------|-----------|
|  | 192.168.3.0/24   | stub-area |
|  | 192.168.200.0/24 | stub-area |

OSPF

Networks Areas Area Ranges Virtual Links Neighbors

+ - ✓ ✗ [icon] [icon]

|   | Area Name | Instance | Area ID | Type    | Default |
|---|-----------|----------|---------|---------|---------|
| * | backbone  | default  | 0.0.0.0 | default |         |
|   | stub-area | default  | 0.0.0.1 | stub    |         |

OSPF Area <stub-area>

Area Name: stub-area

Instance: default

Area ID: 0.0.0.1

Type: stub

Translator Role: translate never

☒ Inject Summary LSAs

OK Cancel Apply Disable Comment

## RESULT FROM R4 TO R1 AND R3 (PC HOST)

```
[admin@R4] > ping 192.168.1.1
```

| SEQ | HOST        | SIZE | TTL | TIME | STATUS |
|-----|-------------|------|-----|------|--------|
| 0   | 192.168.1.1 | 56   | 63  | 1ms  |        |
| 1   | 192.168.1.1 | 56   | 63  | 0ms  |        |

sent=2 received=2 packet-loss=0% min-rtt=0ms avg-rtt=0ms max-rtt=1ms

```
[admin@R4] > ping 192.168.100.1
```

| SEQ | HOST          | SIZE | TTL | TIME | STATUS |
|-----|---------------|------|-----|------|--------|
| 0   | 192.168.100.1 | 56   | 63  | 0ms  |        |
| 1   | 192.168.100.1 | 56   | 63  | 0ms  |        |

sent=2 received=2 packet-loss=0% min-rtt=0ms avg-rtt=0ms max-rtt=0ms

```
[admin@R4] > ping 192.168.200.1
```

| SEQ | HOST          | SIZE | TTL | TIME | STATUS |
|-----|---------------|------|-----|------|--------|
| 0   | 192.168.200.1 | 56   | 64  | 0ms  |        |
| 1   | 192.168.200.1 | 56   | 64  | 0ms  |        |

sent=2 received=2 packet-loss=0% min-rtt=0ms avg-rtt=0ms max-rtt=0ms



# R2

|                                     |           |              |               |             |                 |            |     |
|-------------------------------------|-----------|--------------|---------------|-------------|-----------------|------------|-----|
| [admin@R2] > routing ospf lsa print |           |              |               |             |                 |            |     |
|                                     | AREA      | TYPE         | ID            | ORIGINATOR  | SEQUENCE-NUMBER | AGE        |     |
|                                     | backbone  | router       | 1.1.1.1       | 1.1.1.1     | 0x80000003      | 347        |     |
|                                     | backbone  | router       | 2.2.2.2       | 2.2.2.2     | 0x80000003      | 346        |     |
|                                     | backbone  | network      | 192.168.1.2   | 2.2.2.2     | 0x80000002      | 346        |     |
| Type 3                              | →         | backbone     | summary-n...  | 192.168.2.0 | 2.2.2.2         | 0x80000002 | 386 |
|                                     | backbone  | summary-n... | 192.168.3.0   | 2.2.2.2     | 0x80000001      | 358        |     |
|                                     | backbone  | summary-n... | 192.168.100.0 | 2.2.2.2     | 0x80000001      | 4          |     |
|                                     | backbone  | summary-n... | 192.168.200.0 | 2.2.2.2     | 0x80000001      | 4          |     |
| Type 1                              | →         | stub-area    | router        | 2.2.2.2     | 2.2.2.2         | 0x8000000D | 369 |
|                                     | stub-area | router       | 3.3.3.3       | 3.3.3.3     | 0x80000007      | 6          |     |
|                                     | stub-area | router       | 4.4.4.4       | 4.4.4.4     | 0x80000007      | 5          |     |
| Type 2                              | →         | stub-area    | network       | 192.168.2.2 | 3.3.3.3         | 0x80000002 | 368 |
|                                     | stub-area | network      | 192.168.3.2   | 4.4.4.4     | 0x80000002      | 370        |     |
| Default route                       | →         | stub-area    | summary-n...  | 0.0.0.0     | 2.2.2.2         | 0x80000002 | 386 |
|                                     | stub-area | summary-n... | 192.168.1.0   | 2.2.2.2     | 0x80000002      | 385        |     |
|                                     | external  | as-external  | 0.0.0.0       | 1.1.1.1     | 0x80000002      | 387        |     |
|                                     | external  | as-external  | 0.0.0.0       | 2.2.2.2     | 0x80000002      | 428        |     |
| Type 5                              | →         | external     | as-external   | 1.1.1.1     | 1.1.1.1         | 0x80000002 | 387 |
|                                     | external  | as-external  | 2.2.2.2       | 2.2.2.2     | 0x80000002      | 428        |     |

# R3

|                                     |             |              |             |            |
|-------------------------------------|-------------|--------------|-------------|------------|
| [admin@R3] > routing ospf lsa print |             |              |             |            |
|                                     | AREA        | TYPE         | ID          | ORIGINATOR |
| Type 1                              | → stub-area | router       | 2.2.2.2     | 2.2.2.2    |
|                                     | → stub-area | router       | 3.3.3.3     | 3.3.3.3    |
|                                     | → stub-area | router       | 4.4.4.4     | 4.4.4.4    |
| Type 2                              | → stub-area | network      | 192.168.2.2 | 3.3.3.3    |
|                                     | → stub-area | network      | 192.168.3.2 | 4.4.4.4    |
| Default Route                       | → stub-area | summary-n... | 0.0.0.0     | 2.2.2.2    |
| Type 3                              | → stub-area | summary-n... | 192.168.1.0 | 2.2.2.2    |
| [admin@R3] >                        |             |              |             |            |



# R4

|               |   |                                                          |
|---------------|---|----------------------------------------------------------|
|               |   | [admin@R4] > routing ospf lsa print                      |
|               |   | AREA            TYPE            ID            ORIGINATOR |
| Type 1        | → | stub-area    router        2.2.2.2      2.2.2.2          |
|               |   | stub-area    router        3.3.3.3      3.3.3.3          |
|               |   | stub-area    router        4.4.4.4      4.4.4.4          |
| Type 2        | → | stub-area    network      192.168.2.2   3.3.3.3          |
|               |   | stub-area    network      192.168.3.2   4.4.4.4          |
| Default Route | → | stub-area    summary-n... 0.0.0.0      2.2.2.2           |
| Type 3        | → | stub-area    summary-n... 192.168.1.0   2.2.2.2          |
|               |   | [admin@R4] >                                             |

# CONCLUSION

OSPF Special Area stub , so the Router workload in this area becomes lighter



# THANK YOU

Hp : + 62 85102077829

Email : [dutym1g@gmail.com](mailto:dutym1g@gmail.com)