NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF COMPUTER SCIENCE

COMPUTER NETWORKS

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Lab	12
Course	Computer Networks
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Lab – 12

IP Routing protocols

Warm-up Task [30 Minutes]

1. What are IP Routing Protocols?

Answer:
IP routing protocols are **sets of rules that routers use to communicate with each other**. They help routers discover paths, share updates, and select the most efficient route for forwarding data packets across networks. These protocols are dynamic, meaning they can adapt to changes such as link failures or new devices being added Comparitech invisiblecity.uarts.edu.

2. Name different IP Routing protocols and their working, pros, and cons.

PROTOCOL	WORKING	PROS	CONS
RIP (ROUTING INFORMATION PROTOCOL)	Distance-vector protocol; uses hop count as metric.	Simple, easy to configure.	Limited scalability (max 15 hops), slow convergence readmedium.com blog.krybot.com.
OSPF (OPEN SHORTEST PATH FIRST)	Link-state protocol; builds full topology map using LSAs.	Fast convergence, supports large networks, hierarchical design.	Complex configuration, higher resource usage readmedium.com blog.krybot.com.
EIGRP (ENHANCED INTERIOR GATEWAY ROUTING PROTOCOL)	Hybrid protocol (distance-vector + link-state); uses DUAL algorithm.	Very fast convergence, efficient bandwidth use, fault tolerant.	Cisco proprietary (less universal), more complex than RIP readmedium.com blog.krybot.com.
BGP (BORDER GATEWAY PROTOCOL)	Path-vector protocol; used for routing between autonomous systems (Internet scale).	Extremely scalable, policy-based routing.	Slow convergence, complex setup, resource intensive readmedium.com blog.krybot.com.
IS-IS (INTERMEDIATE SYSTEM TO INTERMEDIATE SYSTEM)	Link-state protocol similar to OSPF, used in large ISPs.	Scalable, flexible, supports IPv6.	Less common outside service providers routing.guru.

3. How does OSPF maintain a detailed view of the network topology?

Answer:
OSPF maintains a detailed view of the network by **exchanging Link-State Advertisements (LSAs)** between routers. Each router describes its links and neighbors in LSAs, which are flooded throughout the OSPF area. These LSAs are stored in the **Link-State Database (LSDB)**, giving every router an identical map of the network. Using this map, OSPF runs the **Shortest Path First (SPF) algorithm** to calculate the best routes netacad.fit.vutbr.cz Firewall.cx netacad.fit.vutbr.cz.
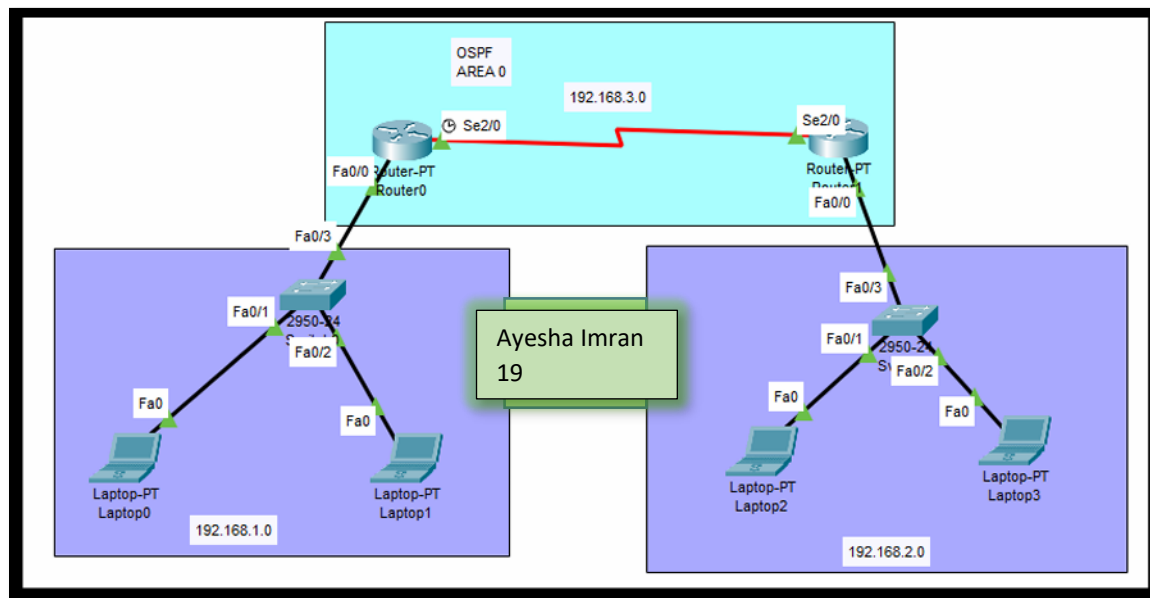
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4. What is the purpose of OSPF's Link-State Database (LSDB)?

Answer:
The LSDB is the **core of OSPF operations**. It stores all LSAs collected from routers in an area, ensuring that every router has the same synchronized view of the topology. The LSDB is **not the routing table itself**; instead, it provides the raw topology data that OSPF uses to compute routes via the SPF algorithm. Its purpose is to guarantee consistency, fast convergence, and accurate path selection across the network ospf.guru Orhan Ergun Fortinet Online Help.

In Lab Task

By using Drag and Drop draw the topology diagram as Shown below and attach a screenshot of each step.

Router 1 configuration:

```
Router>en
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip address 192.168.1.3 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int se2/0
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255
% Incomplete command.
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#
```

Router 2 Configuration:

```
Router>en
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip address 192.168.2.3 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int se2/0
Router(config-if)#ip address 192.168.3.2 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 2
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#
00:17:54: %OSPF-5-ADJCHG: Process 2, Nbr 192.168.3.1 on Serial2/0 from LOADING to FULL,
Loading Done
exit
Router#
%SYS-5-CONFIG I: Configured from console by console
```
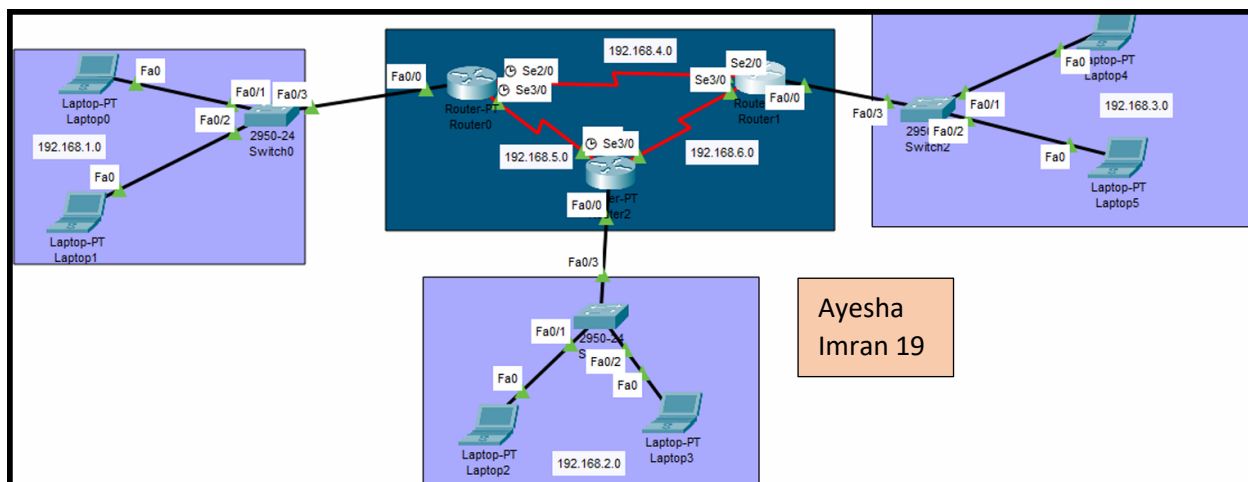
Real Time Packets:

Simulation:

Post Lab Task :-

By using Drag and Drop draw the topology diagram:

Router 1 configuration:

```
Router>en
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip address 192.168.1.3 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int se2/0
Router(config-if)#ip address 192.168.4.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#exit
Router(config)#int se3/0
Router(config-if)#ip address 192.168.5.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Router>en
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.4.0 0.0.0.255 area 0
Router(config-router)#network 192.168.5.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Router 2:

```
Router>en
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip address 192.168.2.3 255.255.255.0
Router(config-if)#bi shutdown
                  ^
% Invalid input detected at '^' marker.

Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int se2/0
Router(config-if)#ip address 192.168.5.2 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#int se
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
3/0
Router(config-if)#ip address 192.168.6.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial3/0, changed state to down
Router(config-if)#exit
Router(config)#exit
```

```
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 192.168.5.0 0.0.0.255 area 0
Router(config-router)#network 192.168.5.0 0.0.0.255 area 0
00:51:01: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.5.1 on Serial2/0
area 0
Router(config-router)#network 192.168.6.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Router 3:

```
Router>en
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#int fa0/0
Router(config-if)#ip address 192.168.3.3 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int se3/0
Router(config-if)#ip address 192.168.6.2 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial3/0, changed state to up

Router(config-if)#exit
Router(config)#int se2/
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial3/0, changed state to up
0
Router(config-if)#ip address 192.168.4.2 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up
```

```
Router#config ter
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router ospf 1
Router(config-router)#network 192.168.3.0 0.0.255 area 0
                                              ^
% Invalid input detected at '^' marker.

Router(config-router)#network 192.168.3.0 0.0.0.255 area 0
Router(config-router)#network 192.168.4.0 0.0.0.255 area 0
Router(config-router)#network 192.168.4.0 0.0.0.255 area 0
00:52:29: %OSPF-5-ADJCHG: Process 1, Nbr 192.168.5.1 on Serial2/0 fr

Router(config-router)#network 192.168.5.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Show ip ospf neighbor:

```
Router#show ip ospf neighbor


Neighbor ID      Pri    State             Dead Time    Address          Interface
192.168.6.2        0    FULL/  -          00:00:30     192.168.4.2      Serial2/0
192.168.6.1        0    FULL/  -          00:00:35     192.168.5.2      Serial3/0
Router#show ip route ospf
O     192.168.2.0 [110/65] via 192.168.5.2, 00:02:42, Serial3/0
O     192.168.3.0 [110/65] via 192.168.4.2, 00:01:17, Serial2/0
O     192.168.6.0 [110/128] via 192.168.5.2, 00:02:24, Serial3/0

Router#
```

Real Time Packets:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
●	Successful	Laptop0	Laptop2	ICMP		0.000	N	0	(edit)
●	Successful	Laptop3	Laptop5	ICMP		0.000	N	1	(edit)
●	Successful	Laptop1	Laptop4	ICMP		0.000	N	2	(edit)

Simulation:

Fire	Last Status	Source	Destination	Type	Color	Time(sec)	Periodic	Num	Edit
●	Successful	Laptop0	Laptop2	ICMP		0.000	N	0	(edit)
●	Successful	Laptop3	Laptop5	ICMP		0.000	N	1	(edit)
●	Successful	Laptop1	Laptop4	ICMP		0.000	N	2	(edit)