Open Shortest Path First (OSPF)

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Screenshot configurations of R1, R2, R3, and R4

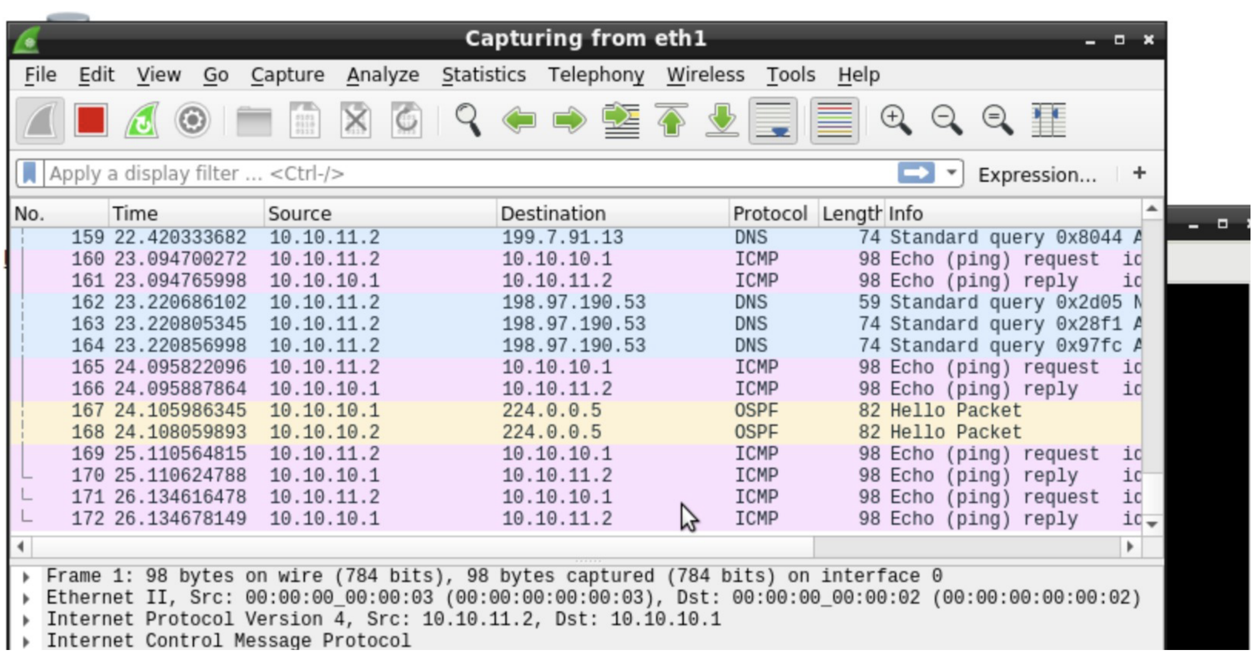
```
root@CN-R1:/home/student# cat /etc/frr/frr.conf
frr version 7.1
frr defaults traditional
hostname CN-R1
log syslog informational
service integrated-vtysh-config
!
interface eth1
 ip address 10.10.10.1/29
!
router ospf
 network 10.10.10.0/29 area 0.0.0.0
!
line vty
!
```

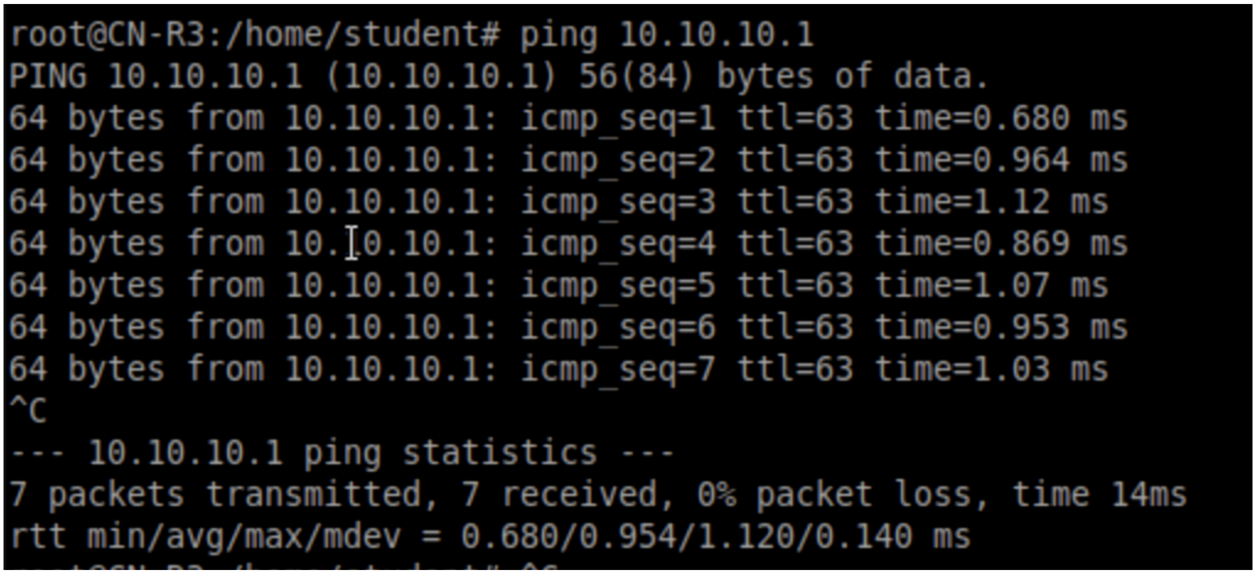
```
hostname CN-R2
log syslog informational
service integrated-vtysh-config
!
ip route 0.0.0.0/0 10.10.10.1
!
interface eth0
 ip address 10.10.10.2/29
!
interface eth1
 ip address 10.10.11.1/30
!
interface eth2
 ip address 10.10.11.5/30
!
router ospf
 network 10.10.10.0/29 area 0.0.0.0
 network 10.10.11.0/30 area 1
 network 10.10.11.4/30 area 1
!
line vty
!
```

```
[sudo] password for student:
root@CN-R3:/home/student# cat /etc/frr/frr.conf
frr version 7.1
frr defaults traditional
hostname CN-R3
log syslog informational
service integrated-vtysh-config
!
ip route 0.0.0.0/0 10.10.11.1
!
interface eth0
 ip address 10.10.11.2/30
!
interface eth1
 ip address 10.10.11.9/30
!
router ospf
 network 10.10.11.0/30 area 1
 network 10.10.11.8/30 area 1
!
line vty
!
```

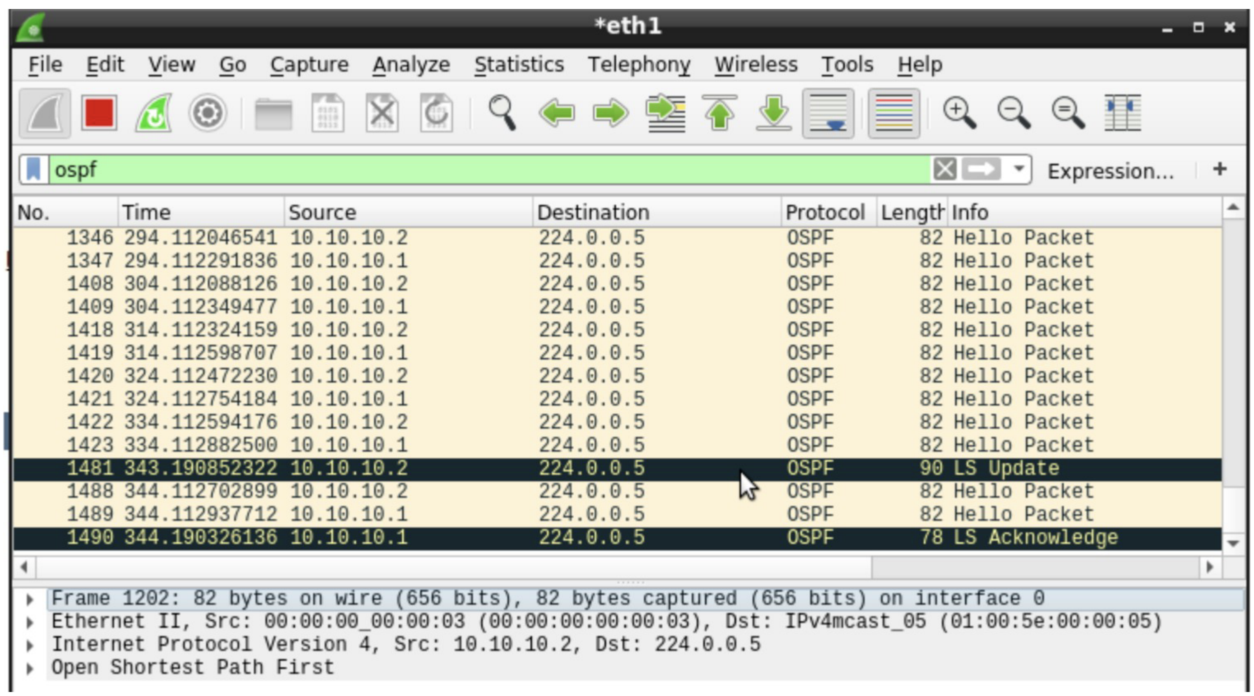
```
frr version 7.1
frr defaults traditional
hostname CN-R4
log syslog informational
service integrated-vtysh-config
!
ip route 0.0.0.0/0 10.10.11.5
!
interface eth0
 ip address 10.10.11.10/30
!
interface eth1
 ip address 10.10.11.6/30
!
interface eth2
 ip address 10.10.11.17/28
!
router ospf
 network 10.10.11.4/30 area 1
 network 10.10.11.8/30 area 1
!
line vty
!
```

ICMP results from R3 to R1





Wireshark screenshots on R1



No.	Time	Source	Destination	Protocol	Length	Info
1346	294.112046541	10.10.10.2	224.0.0.5	OSPF	82	Hello Packet
1347	294.112291836	10.10.10.1	224.0.0.5	OSPF	82	Hello Packet
1408	304.112088126	10.10.10.2	224.0.0.5	OSPF	82	Hello Packet
1409	304.112349477	10.10.10.1	224.0.0.5	OSPF	82	Hello Packet
1418	314.112324159	10.10.10.2	224.0.0.5	OSPF	82	Hello Packet
1419	314.112598707	10.10.10.1	224.0.0.5	OSPF	82	Hello Packet
1420	324.112472230	10.10.10.2	224.0.0.5	OSPF	82	Hello Packet
1421	324.112754184	10.10.10.1	224.0.0.5	OSPF	82	Hello Packet
1422	334.112594176	10.10.10.2	224.0.0.5	OSPF	82	Hello Packet
1423	334.112882500	10.10.10.1	224.0.0.5	OSPF	82	Hello Packet
1481	343.190852322	10.10.10.2	224.0.0.5	OSPF	90	LS Update
1488	344.112702899	10.10.10.2	224.0.0.5	OSPF	82	Hello Packet
1489	344.112937712	10.10.10.1	224.0.0.5	OSPF	82	Hello Packet
1490	344.190326136	10.10.10.1	224.0.0.5	OSPF	78	LS Acknowledge

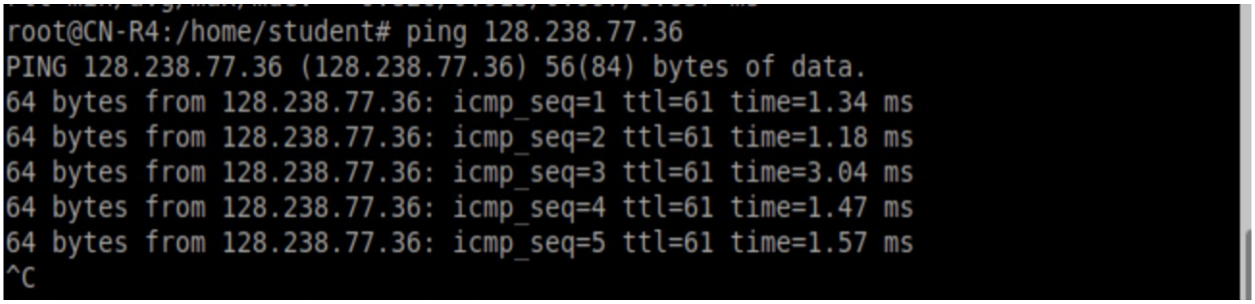
Frame 1202: 82 bytes on wire (656 bits), 82 bytes captured (656 bits) on interface 0
Ethernet II, Src: 00:00:00_00:00:03 (00:00:00:00:00:03), Dst: IPv4mcast_05 (01:00:5e:00:00:05)
Internet Protocol Version 4, Src: 10.10.10.2, Dst: 224.0.0.5
Open Shortest Path First

Screenshots depicting successful ping requests to the SFTP server (128.238.77.36) from R1, R2, R3, and R4

```
root@CN-R1:/home/student# ping 128.238.77.36
PING 128.238.77.36 (128.238.77.36) 56(84) bytes of data.
64 bytes from 128.238.77.36: icmp_seq=1 ttl=63 time=0.797 ms
64 bytes from 128.238.77.36: icmp_seq=2 ttl=63 time=0.616 ms
64 bytes from 128.238.77.36: icmp_seq=3 ttl=63 time=0.643 ms
64 bytes from 128.238.77.36: icmp_seq=4 ttl=63 time=0.656 ms
64 bytes from 128.238.77.36: icmp_seq=5 ttl=63 time=0.617 ms
64 bytes from 128.238.77.36: icmp_seq=6 ttl=63 time=0.563 ms
^C
```

```
root@CN-R2:/home/student# ping 128.238.77.36
PING 128.238.77.36 (128.238.77.36) 56(84) bytes of data.
64 bytes from 128.238.77.36: icmp_seq=1 ttl=62 time=1.19 ms
64 bytes from 128.238.77.36: icmp_seq=2 ttl=62 time=1.20 ms
64 bytes from 128.238.77.36: icmp_seq=3 ttl=62 time=1.14 ms
64 bytes from 128.238.77.36: icmp_seq=4 ttl=62 time=1.07 ms
64 bytes from 128.238.77.36: icmp_seq=5 ttl=62 time=1.12 ms
64 bytes from 128.238.77.36: icmp_seq=6 ttl=62 time=1.17 ms
```

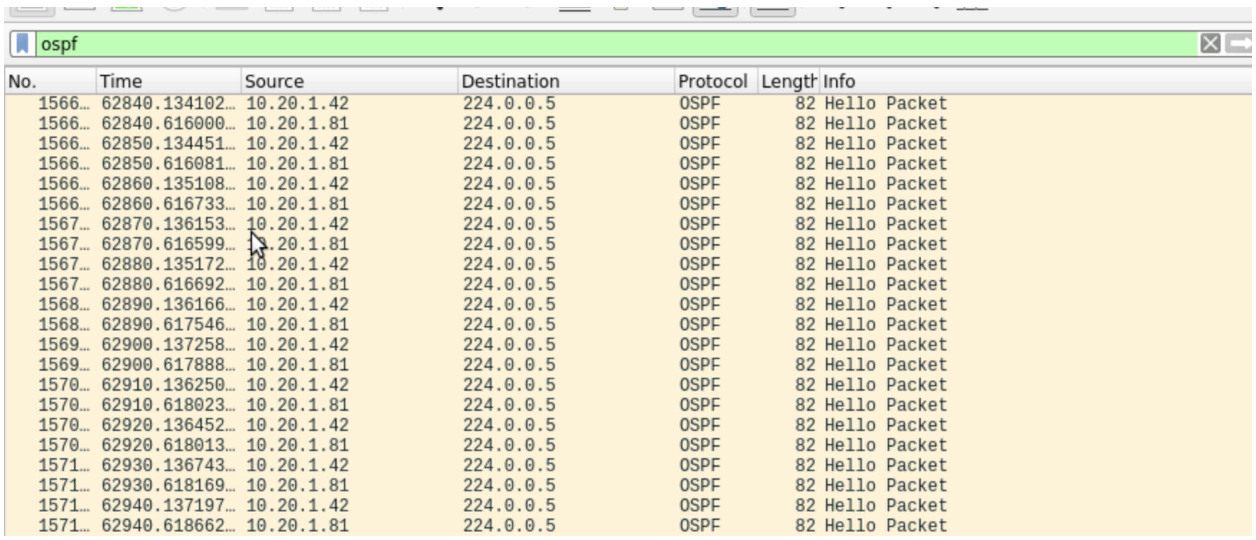
```
root@CN-R3:/home/student# ping 128.238.77.36
PING 128.238.77.36 (128.238.77.36) 56(84) bytes of data.
64 bytes from 128.238.77.36: icmp_seq=1 ttl=61 time=1.36 ms
64 bytes from 128.238.77.36: icmp_seq=2 ttl=61 time=1.52 ms
64 bytes from 128.238.77.36: icmp_seq=3 ttl=61 time=1.75 ms
64 bytes from 128.238.77.36: icmp_seq=4 ttl=61 time=1.63 ms
64 bytes from 128.238.77.36: icmp_seq=5 ttl=61 time=2.20 ms
^C
--- 128.238.77.36 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 12ms
rtt min/avg/max/mdev = 1.362/1.691/2.199/0.283 ms
```



```
root@CN-R4:/home/student# ping 128.238.77.36
PING 128.238.77.36 (128.238.77.36) 56(84) bytes of data.
64 bytes from 128.238.77.36: icmp_seq=1 ttl=61 time=1.34 ms
64 bytes from 128.238.77.36: icmp_seq=2 ttl=61 time=1.18 ms
64 bytes from 128.238.77.36: icmp_seq=3 ttl=61 time=3.04 ms
64 bytes from 128.238.77.36: icmp_seq=4 ttl=61 time=1.47 ms
64 bytes from 128.238.77.36: icmp_seq=5 ttl=61 time=1.57 ms
^C
```

Part 5:

A. Power on all routers and run Wireshark on R1. Apply a filter for OSPF, and look at the Hello Packets. How frequently are these packets sent, and why must they be sent periodically?

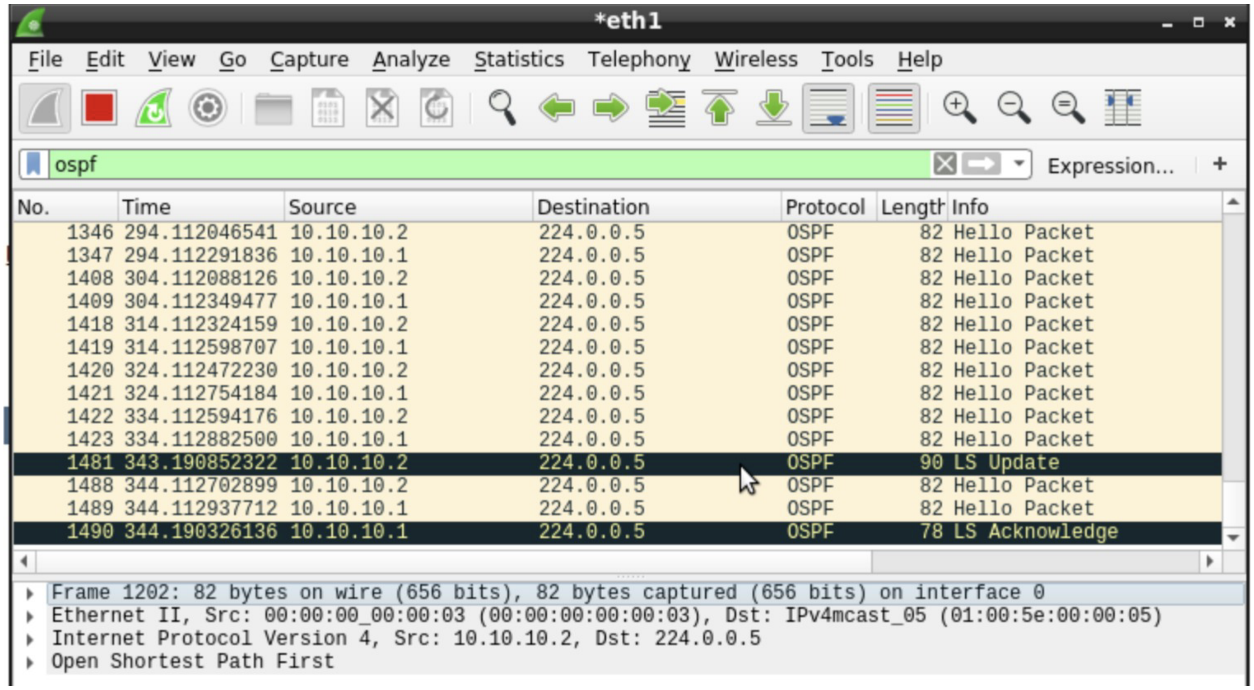


ospf

No.	Time	Source	Destination	Protocol	Length	Info
1566…	62840.134102…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1566…	62840.616000…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1566…	62850.134451…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1566…	62850.616081…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1566…	62860.135108…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1566…	62860.616733…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1567…	62870.136153…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1567…	62870.616599…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1567…	62880.135172…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1567…	62880.616692…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1568…	62890.136166…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1568…	62890.617546…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1569…	62900.137258…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1569…	62900.617888…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1570…	62910.136250…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1570…	62910.618023…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1570…	62920.136452…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1570…	62920.618013…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1571…	62930.136743…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1571…	62930.618169…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet
1571…	62940.137197…	10.20.1.42	224.0.0.5	OSPF	82	Hello Packet
1571…	62940.618662…	10.20.1.81	224.0.0.5	OSPF	82	Hello Packet

Every ten seconds, hello packets are sent out. In the Open Shortest Path First communications protocol, the HELLO packet is a particular data packet (message) that is sent out on a regular basis by a router to create and validate network adjacency connections with other routers. Routers in an OSPF network establish and maintain neighbor connections with other routers in the same OSPF region by sending out OSPF Hello packets on a regular basis. These hello packets perform a number of crucial tasks, such as identifying nearby neighbors, exchanging certain information, and confirming bidirectional connectivity.

B. Continue running Wireshark and turn off R4. You should now see new OSPF packet types captured on R1. Explain why Hello, Link State Update and Link State Acknowledgements use the same Destination IP address.



In an OSPF network, when you disable router R4, R1 will recognize the modification in the network topology and reply with different kinds of OSPF packets. You will probably see additional OSPF packet types in this situation, such as Hello, Link State Update, and Link State Acknowledgment. Since all of these packets are intended for the AllSPFRouters multicast address, they will all utilize the same Destination IP address. This multicast address (224.0.0.5) is where OSPF routers transmit different kinds of OSPF packets for a wide range of purposes. Critical information about changes to the network topology and other important information is securely transmitted to all routers inside the OSPF region by utilizing the same multicast destination address for Hello, LSU, and LSAck packets. By doing this, the OSPF routing database's convergence and consistency across all local routers are maintained.

C. Based on the above steps, explain why we do not see DB Descriptions and LS Requests on R1. Is there a situation in which we get all OSPF packet types on R1?

Usually, we do not see OSPF Link State Request (LS Request) and Database Description (DBD) packets obtained on a router such as R1 during a routine OSPF operation. This is because, during the OSPF neighbor establishment and synchronization phase, there is a specific procedure that takes place between OSPF neighbors that involves the exchange of DBD and LS Request packets. In general, OSPF routers that are in the process of becoming neighbors or that need to synchronize their link-state databases exchange DBD and LS Request packets as part of the OSPF neighbor establishment and synchronization process. These packets are unique to the

OSPF routers taking part in this synchronization and are not frequently observed on any network.