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Учреждение образования
БЕЛОРУССКИЙ ГОСУДАРСТВЕННЫЙ УНИВЕРСИТЕТ
ИНФОРМАТИКИ И РАДИОЭЛЕКТРОНИКИ

Факультет инфокоммуникаций
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Лабораторная работа № 6
«МНОГОУРОВНЕВАЯ OSPF. МЕТОДЫ АУТЕНТИФИКАЦИИ
В ПРОТОКОЛАХ МАРШРУТИЗАЦИИ»

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Цель : изучить принципы деления на области в протоколе OSPF, способы инкапсуляции данных при передачи в глобальной сети, навыками конфигурации маршрутизации в многоуровневой OSPF, перераспределения маршрутов из разных протоколов, аутентификации в PPP.

Ход работы:

2. Router 7 (EIGRP)

```

Router7#
OE2 2001:470:0:503::/124 [110/20]
    via FE80::7, Serial0/3/1
    via FE80::9, Serial0/2/0
OE2 2001:4A00:A519::/59 [110/20]
    via FE80::7, Serial0/3/1
    via FE80::9, Serial0/2/0
OE2 2001:4A00:A519:13::/64 [110/20]
    via FE80::7, Serial0/3/1
    via FE80::9, Serial0/2/0
O 2001:4A00:A519:14::/64 [110/128]
    via FE80::7, Serial0/3/1
C 2001:4A00:A519:15::/64 [0/0]
    via ::, Serial0/3/1
L 2001:4A00:A519:15::2/128 [0/0]
    via ::, Serial0/3/1
C 2001:4A00:A519:16::/64 [0/0]
    via ::, Serial0/2/0
L 2001:4A00:A519:16::1/128 [0/0]
    via ::, Serial0/2/0
O 2001:4A00:A519:17::/64 [110/128]
    via FE80::9, Serial0/2/0
C 2001:4A00:A519:18::/64 [0/0]
    via ::, GigabitEthernet0/0/0
L 2001:4A00:A519:18::1/128 [0/0]
    via ::, GigabitEthernet0/0/0
D 2001:4A00:A519:19::/64 [90/28416]
    via FE80::10, GigabitEthernet0/0/0
OE2 2001:4A00:A519:1A::/64 [110/10]
    via FE80::9, Serial0/2/0
OE2 2001:4A00:A519:1B::/64 [110/20]
    via FE80::9, Serial0/2/0
OE2 2001:4A00:A519:1C::/64 [110/20]
    via FE80::7, Serial0/3/1
OE2 2001:4A00:A519:1D::/64 [110/20]
    via FE80::7, Serial0/3/1
OE2 2001:4A00:A519:1F::/64 [110/20]
    via FE80::7, Serial0/3/1
L FF00::/8 [0/0]
    via ::, Null0
Router7#

```

3. Router 8 (OSPF-10)

```

Router8#
D - EIGRP, EX - EIGRP external
OE2 2001:470:0:503::/124 [110/20]
    via FE80::6, Serial0/3/0
OE2 2001:4A00:A519::/59 [110/20]
    via FE80::6, Serial0/3/0
OE2 2001:4A00:A519:13::/64 [110/20]
    via FE80::6, Serial0/3/0
O 2001:4A00:A519:14::/64 [110/128]
    via FE80::6, Serial0/3/0
O 2001:4A00:A519:15::/64 [110/128]
    via FE80::8, Serial0/2/1
C 2001:4A00:A519:16::/64 [0/0]
    via ::, Serial0/2/1
L 2001:4A00:A519:16::2/128 [0/0]
    via ::, Serial0/2/1
C 2001:4A00:A519:17::/64 [0/0]
    via ::, Serial0/3/0
L 2001:4A00:A519:17::1/128 [0/0]
    via ::, Serial0/3/0
OE2 2001:4A00:A519:18::/64 [110/20]
    via FE80::8, Serial0/2/1
OE2 2001:4A00:A519:19::/64 [110/10000]
    via FE80::8, Serial0/2/1
O 2001:4A00:A519:1A::/64 [110/2]
    via FE80::11, GigabitEthernet0/0/0
C 2001:4A00:A519:1B::/64 [0/0]
    via ::, GigabitEthernet0/0/0
L 2001:4A00:A519:1B::1/128 [0/0]
    via ::, GigabitEthernet0/0/0
OE2 2001:4A00:A519:1C::/64 [110/20]
    via FE80::8, Serial0/2/1
    via FE80::6, Serial0/3/0
OE2 2001:4A00:A519:1D::/64 [110/20]
    via FE80::8, Serial0/2/1
    via FE80::6, Serial0/3/0
OE2 2001:4A00:A519:1F::/64 [110/20]
    via FE80::8, Serial0/2/1
    via FE80::6, Serial0/3/0
L FF00::/8 [0/0]
    via ::, Null0
Router8#

```

4. Router 6 (RIP)

```
ON1 - OSPF NSSA ext 1, ON2 - OSPF NSSA ext 2
D - EIGRP, EX - EIGRP external
OE2 2001:470:0:503::/124 [110/20]
    via FE80::6, Serial0/2/1
OE2 2001:4A00:A519::/59 [110/20]
    via FE80::6, Serial0/2/1
OE2 2001:4A00:A519:13::/64 [110/20]
    via FE80::6, Serial0/2/1
C 2001:4A00:A519:14::/64 [0/0]
    via ::, Serial0/2/1
L 2001:4A00:A519:14::2/128 [0/0]
    via ::, Serial0/2/1
C 2001:4A00:A519:15::/64 [0/0]
    via ::, Serial0/3/0
L 2001:4A00:A519:15::1/128 [0/0]
    via ::, Serial0/3/0
O 2001:4A00:A519:16::/64 [110/128]
    via FE80::8, Serial0/3/0
O 2001:4A00:A519:17::/64 [110/128]
    via FE80::6, Serial0/2/1
OE2 2001:4A00:A519:18::/64 [110/20]
    via FE80::8, Serial0/3/0
OE2 2001:4A00:A519:19::/64 [110/10000]
    via FE80::8, Serial0/3/0
OE2 2001:4A00:A519:1A::/64 [110/10]
    via FE80::8, Serial0/3/0
    via FE80::6, Serial0/2/1
OE2 2001:4A00:A519:1B::/64 [110/20]
    via FE80::8, Serial0/3/0
    via FE80::6, Serial0/2/1
R 2001:4A00:A519:1C::/64 [120/2]
    via FE80::12, GigabitEthernet0/0/0
R 2001:4A00:A519:1D::/64 [120/2]
    via FE80::12, GigabitEthernet0/0/0
C 2001:4A00:A519:1F::/64 [0/0]
    via ::, GigabitEthernet0/0/0
L 2001:4A00:A519:1F::1/128 [0/0]
    via ::, GigabitEthernet0/0/0
L FF00::/8 [0/0]
    via ::, Null0
Router6#
```

5. Router 5

```
ipv6 router ospf 682
router-id 5.5.5.5
default-information originate
log-adjacency-changes
redistribute ospf 672 metric 15 match external 2
redistribute static
redistribute connected
```

Router 5

Router 8

```

C 2001:470:0:503::/124 [0/0]
    via ::, FastEthernet0/0
L 2001:470:0:503::1/128 [0/0]
    via ::, FastEthernet0/0
S 2001:4A00:A519::/59 [1/0]
    via 2001:4A00:A519:13::1
    via FE80::4, GigabitEthernet0/1/0
C 2001:4A00:A519:13::/64 [0/0]
    via ::, GigabitEthernet0/1/0
L 2001:4A00:A519:13::2/128 [0/0]
    via ::, GigabitEthernet0/1/0
C 2001:4A00:A519:14::/64 [0/0]
    via ::, Serial0/2/0
L 2001:4A00:A519:14::1/128 [0/0]
    via ::, Serial0/2/0
O 2001:4A00:A519:15::/64 [110/128]
    via FE80::7, Serial0/2/0
O 2001:4A00:A519:16::/64 [110/128]
    via FE80::9, Serial0/3/1
C 2001:4A00:A519:17::/64 [0/0]
    via ::, Serial0/3/1
L 2001:4A00:A519:17::2/128 [0/0]
    via ::, Serial0/3/1
OE2 2001:4A00:A519:18::/64 [110/20]
    via FE80::7, Serial0/2/0
    via FE80::9, Serial0/3/1
OE2 2001:4A00:A519:19::/64 [110/10000]
    via FE80::7, Serial0/2/0
    via FE80::9, Serial0/3/1
OE2 2001:4A00:A519:1A::/64 [110/10]
    via FE80::9, Serial0/3/1
OE2 2001:4A00:A519:1B::/64 [110/20]
    via FE80::9, Serial0/3/1
OE2 2001:4A00:A519:1C::/64 [110/20]
    via FE80::7, Serial0/2/0
OE2 2001:4A00:A519:1D::/64 [110/20]
    via FE80::7, Serial0/2/0
OE2 2001:4A00:A519:1F::/64 [110/20]
    via FE80::7, Serial0/2/0
L FF00::/8 [0/0]
    via ::, Null0
Router5#

```

```

ip6v6 router ospf 662
router-id 9.9.9.9
default-information originate
log-adjacency-changes
redistribute ospf 682 metric 10
!
ip6v6 router ospf 682
router-id 8.8.8.8
default-information originate
log-adjacency-changes
redistribute ospf 662 metric 10
redistribute connected

```

Router 7

```

ipv6 router ospf 682
 router-id 7.7.7.7
 log-adjacency-changes
 redistribute eigrp 672 metric 10000
 redistribute connected
!
ipv6 router eigrp 672
 eigrp router-id 8.8.8.8
 no shutdown
 redistribute ospf 682 metric 10000 20 255 1 1500
 redistribute connected

```

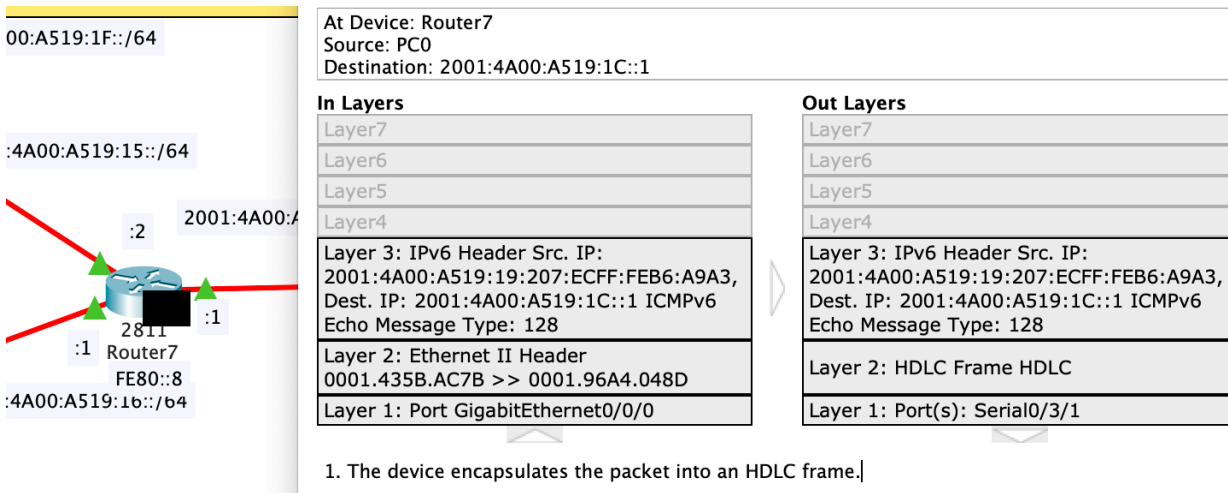
Router 6

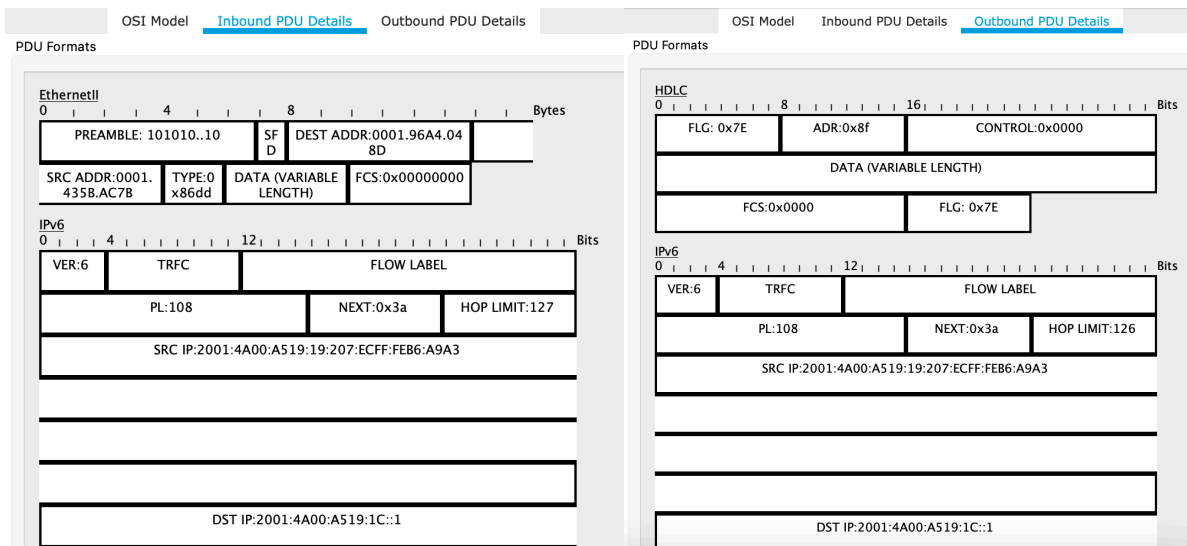
```

ip6v6 router ospf 682
router-id 6.6.6.6
log-adjacency-changes
redistribute rip CELL metric 10
redistribute connected
!
ip6v6 router rip CELL
redistribute ospf 682 metric 10
redistribute connected

```

6.



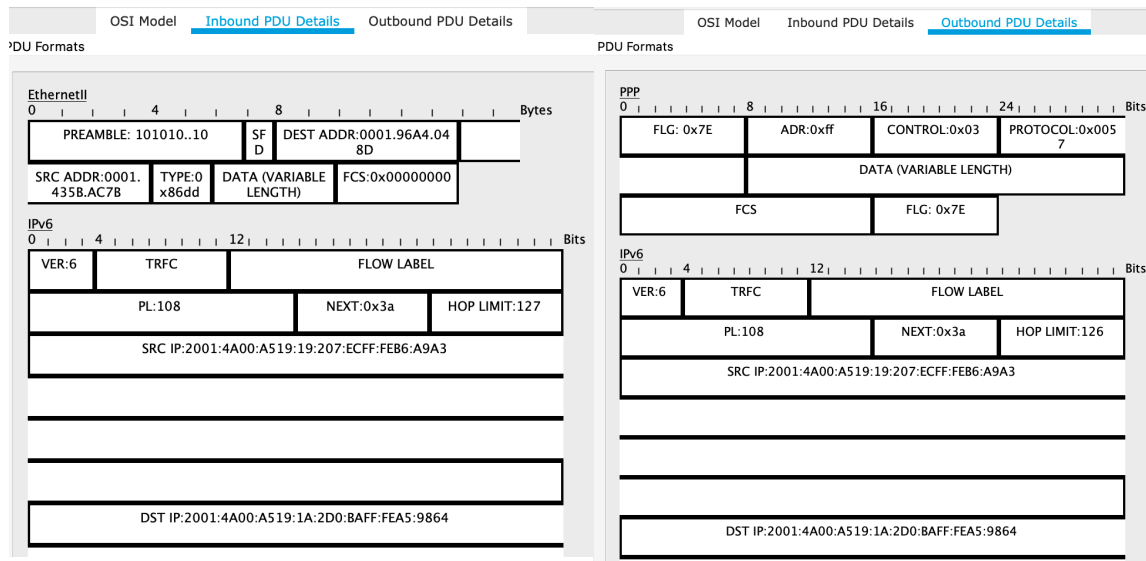
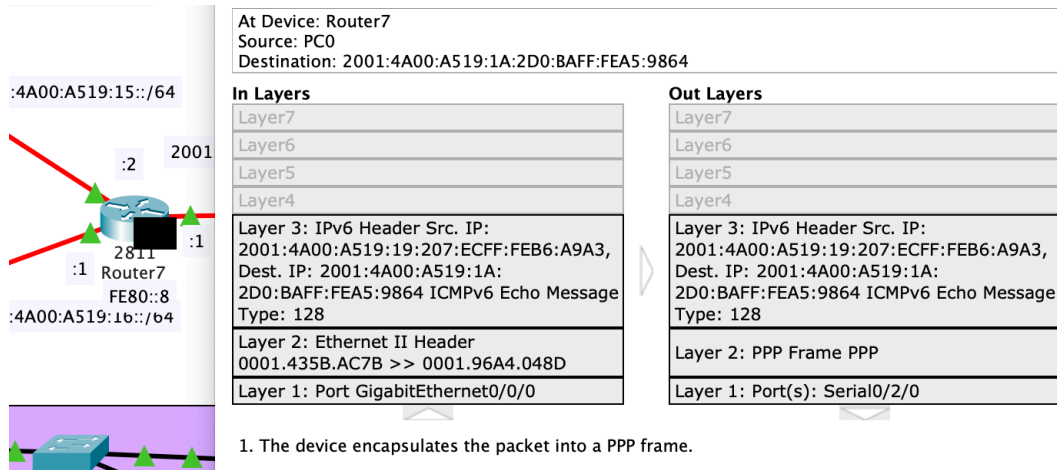


```
Router7#show int serial 0/3/1
Serial0/3/1 is up, line protocol is down (disabled)
Hardware is HD64570
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation HDLC, loopback not set, keepalive set (10 sec)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations 0/0/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 1158 kilobits/sec
5 minute input rate 33 bits/sec, 0 packets/sec
5 minute output rate 26 bits/sec, 0 packets/sec
    56 packets input, 4928 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    30 packets output, 2944 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up
```

7.

```
Router7#sh int serial 0/3/1
Serial0/3/1 is up, line protocol is up (connected)
Hardware is HD64570
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, loopback not set, keepalive set (10 sec)
LCP Open
Open: CDPCP, IPV6CP
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations 0/0/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 1158 kilobits/sec
5 minute input rate 101 bits/sec, 0 packets/sec
5 minute output rate 123 bits/sec, 0 packets/sec
    208 packets input, 15672 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    198 packets output, 14400 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up
```

```
Router6#
Router6#sh int serial 0/3/0
Serial0/3/0 is up, line protocol is up (connected)
Hardware is HD64570
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, loopback not set, keepalive set (10 sec)
LCP Open
Open: CDPCP, IPV6CP
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations 0/0/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
    Available Bandwidth 1158 kilobits/sec
5 minute input rate 117 bits/sec, 0 packets/sec
5 minute output rate 98 bits/sec, 0 packets/sec
    214 packets input, 16173 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    200 packets output, 14964 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up
```



```
Router7(config-if)#
%LINK-5-CHANGED: Interface Serial0/3/1, changed state to up

Serial0/3/1 Using hostname from interface PAP

Serial0/3/1 Using password from interface PAP

Serial0/3/1 PAP: O AUTH-REQ id 17 len 15

Serial0/3/1 PAP: I AUTH-REQ id 17 len 15

Serial0/3/1 PAP: Authenticating peer

Serial0/3/1 PAP: Phase is FORWARDING, Attempting Forward

Serial0/3/1 PAP: Phase is FORWARDING, Attempting Forward

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/1, changed state to up
```

8.

```
Router5#sh int serial 0/2/0
Serial0/2/0 is up, line protocol is up (connected)
Hardware is HD64570
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, loopback not set, keepalive set (10 sec)
LCP Open
Open: CDPCP, IPV6CP
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations   0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
  Available Bandwidth 1158 kilobits/sec
5 minute input rate 136 bits/sec, 0 packets/sec
5 minute output rate 120 bits/sec, 0 packets/sec
  309 packets input, 22540 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  278 packets output, 19956 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up

Router6#sh int serial 0/2/1
Serial0/2/1 is up, line protocol is up (connected)
Hardware is HD64570
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation PPP, loopback not set, keepalive set (10 sec)
LCP Open
Open: CDPCP, IPV6CP
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
  Conversations   0/0/256 (active/max active/max total)
  Reserved Conversations 0/0 (allocated/max allocated)
  Available Bandwidth 1158 kilobits/sec
5 minute input rate 126 bits/sec, 0 packets/sec
5 minute output rate 128 bits/sec, 0 packets/sec
  316 packets input, 23524 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
  0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
  300 packets output, 21776 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out
    0 carrier transitions
DCD=up DSR=up DTR=up RTS=up CTS=up

Router5(config-if)#
%LINK-5-CHANGED: Interface Serial0/2/0, changed state to up

Serial0/2/0 IPCP: O CONFREQ [Closed] id 1 len 10

Serial0/2/0 IPCP: I CONFREQ [Closed] id 1 len 10

Serial0/2/0 IPCP: O CONFACK [Closed] id 1 len 10

Serial0/2/0 IPCP: I CONFACK [Closed] id 1 len 10

Serial0/2/0 IPCP: O CONFREQ [Closed] id 1 len 10

Serial0/2/0 IPCP: I CONFREQ [REQsent] id 1 len 10

Serial0/2/0 IPCP: O CONFACK [REQsent] id 1 len 10

Serial0/2/0 IPCP: I CONFACK [REQsent] id 1 len 10

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/2/0, changed state to up
```

Вывод: В ходе выполнения данной лабораторной работы было рассмотрено, что для обеспечения большей эффективности маршрутизации и масштабируемости сетей протокол OSPF поддерживает иерархическую маршрутизацию с разделением на области. Протокол OSPF с одной областью чаще используется в небольших сетях, где сеть соединений маршрутизаторов не является сложной, и стоимости маршрутов быстро вычисляются. Многоуровневая OSPF – это разделение области OSPF на более мелкие области. Основная область называется областью магистральной, все остальные области должны соединяться с областью магистральной. Перед передачей данных по последовательному интерфейсу использовались протоколы инкапсуляции: HDLC и PPP - использует протокол инкапсуляции HDLC, но также имеет встроенные механизмы безопасности, такие как PAP и CHAP, которые также были рассмотрены.

