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- Route-map (Policy-based routing)
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-
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-
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-

	in/out				
RIP	Import		Network, Redistribute	Route-map - () ↘ .	RIP
				Prefix-list - () ↘ .	
	Export	,		Route-map - () ↗ .	
				Prefix-list - () ↗ .	
OSPF	Import		Network, Redistribute	Route-map - () ↘ .	OSPF
				Prefix-list - () ↘ .	
	Export	OSPF		Route-map - () ↗ .	
				Prefix-list - () ↗ . <i>OSPF: E2, E1</i>	
IS-IS	Import		Network, Redistribute	Route-map - () ↘ .	IS-IS
				Prefix-list - () ↘ .	
	Export	IS-IS		Route-map - () ↗ .	
				Prefix-list - () ↗ .	
iBGP	Import		Network, Redistribute	Route-map - () ↘ .	address-family, peer-group, neighbor
				Prefix-list - () ↘ .	
	Export	, RIB BGP		Route-map - () ↗ .	
				Prefix-list - () ↗ .	
eBGP	Import			Route-map - () ↘ .	
				Prefix-list - () ↘ .	

	Export	route-map prefix-list	Route-map - () ., .
			Prefix-list - () ., .

— , .

:

```
esr(config)# ip route [ vrf <VRF> ] <SUBNET> { <NEXTHOP> | interface <IF> | tunnel <TUN> | wan load-balance rule
<RULE> [ <METRIC> ] | blackhole | unreachable | prohibit } [ <METRIC> ] [ track <TRACK-ID> ] [ bfd ]
```

- <VRF> – VRF, 31 ;
- <SUBNET> – , :
 - AAA.BBB.CCC.DDD – IP-, [0..255];
 - AAA.BBB.CCC.DDD/NN – IP-, AAA-DDD [0..255] NN [1..32].
- <NEXTHOP> – IP- AAA.BBB.CCC.DDD, [0..255];
- <IF> – IP-, , ;
- <TUN> – , , ;
- <RULE> – wan, [1..50];
- blackhole – ;
- unreachable – , ICMP Destination unreachable (Host unreachable, code 1);
- prohibit – , ICMP Destination unreachable (Communication administratively prohibited, code 13);
- bfd – next-hop.

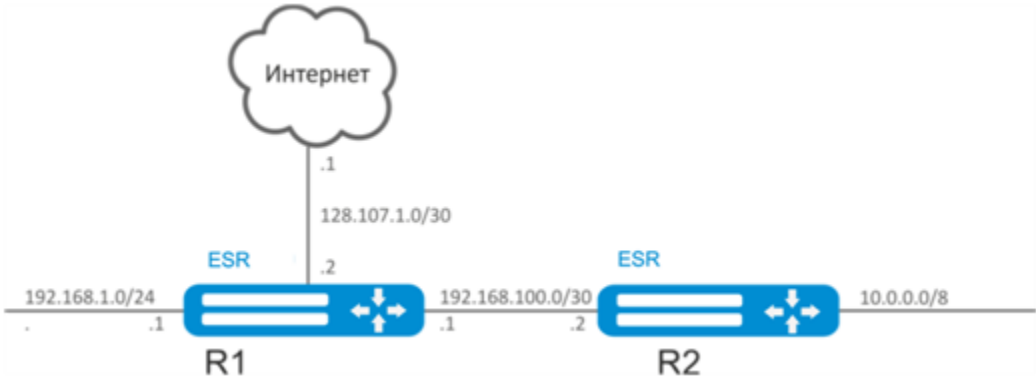
IPv6- :

```
ipv6 route [ vrf <VRF> ] <SUBNET> { <NEXTHOP> [ resolve ] | interface <IF> | wan load-balance rule <RULE> |
blackhole | unreachable | prohibit } [ <METRIC> ] [ bfd ]
```

- <VRF> – VRF, 31 ;
- <SUBNET> – , :
 - X:X:X:X – IPv6-, [0..FFFF];
 - X:X:X:X/EE – IPv6-, X [0..FFFF] EE [1..128].
- <NEXTHOP> – IPv6-, X:X:X:X:X, [0..FFFF];
- resolve – IPv6- . , ;
- <IF> – IP-, , ;
- blackhole – ;
- unreachable – , ICMP Destination unreachable (Host unreachable, code 1);
- prohibit – , ICMP Destination unreachable (Communication administratively prohibited, code 13);
- [METRIC] – , [0..255].
- bfd – next-hop.

:

Internet 192.168.1.0/24 10.0.0.0/8, . R1 Internet. LAN, Internet WAN.



:

R1:

```
esr# hostname R1
```

gi1/0/1 192.168.1.1/24 «LAN». R1 192.168.1.0/24:

```
esr(config)# interface gi1/0/1
esr(config-if-gi)# security-zone LAN
esr(config-if-gi)# ip address 192.168.1.1/24
esr(config-if-gi)# exit
```

gi1/0/2 192.168.100.1/30 «LAN». R1 R2 :

```
esr(config)# interface gi1/0/2
esr(config-if-gi)# security-zone LAN
esr(config-if-gi)# ip address 192.168.100.1/30
esr(config-if-gi)# exit
```

gi1/0/3 128.107.1.2/30 «WAN». R1 Internet:

```
esr(config)# interface gi1/0/3
esr(config-if-gi)# security-zone WAN
esr(config-if-gi)# ip address 128.107.1.2/30
esr(config-if-gi)# exit
```

10.0.0.0/8, R2 (192.168.100.2):

```
esr(config)# ip route 10.0.0.0/8 192.168.100.2
```

Internet, nexthop (128.107.1.1):

```
esr(config)# ip route 0.0.0.0/0 128.107.1.1
```

R2:

```
esr# hostname R2
```

gi1/0/1 10.0.0.1/8 «LAN». R2 10.0.0.0/8:

```
esr(config)# interface gi1/0/1
esr(config-if-gi)# security-zone LAN
esr(config-if-gi)# ip address 10.0.0.1/8
esr(config-if-gi)# exit
```

gi1/0/2 192.168.100.2/30 «LAN». R2 R1 :

```
esr(config)# interface gi1/0/2
esr(config-if-gi)# security-zone LAN
esr(config-if-gi)# ip address 192.168.100.2/30
esr(config-if-gi)# exit
```

, nexthop IP- gi1/0/2 R1 (192.168.100.1):

```
esr(config)# ip route 0.0.0.0/0 192.168.100.1
```

:

```
esr# show ip route
```

RIP

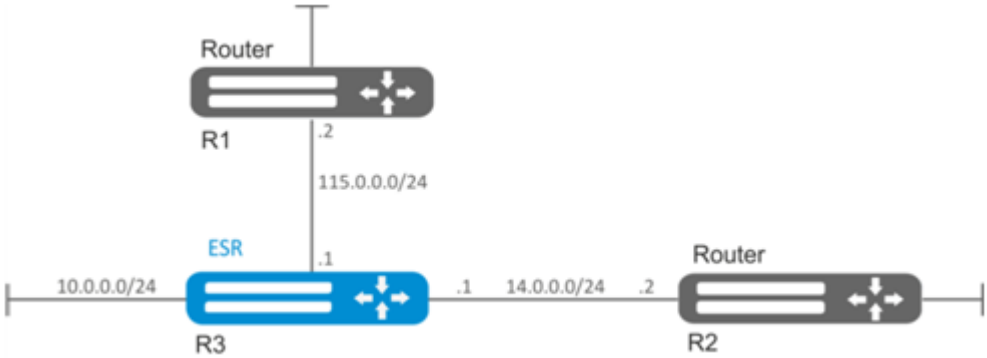
RIP — , . (hop), RIP, 15. RIP- 30. RIP 3- TCP/IP, UDP- 520.

1	RIP (.).	esr(config)# ip protocols rip preference <VALUE>	<VALUE> – , [1..255]. : RIP (100).
2	RIP (.).	esr(config)# ip protocols rip max-routes <VALUE>	<VALUE> – RIP , [1..10000]; : 10000.
3	IP-, IP-.	esr(config)# ip prefix-list <NAME>	<NAME> – , 31 .
4	(permit) (deny) .	esr(config-pl)# permit {object-group <OBJ-GROUP-NETWORK-NAME> <ADDR/LEN> <IPV6-ADDR/LEN> } [{ eq <LEN> le <LEN> ge <LEN> [le <LEN>] }] esr(config-pl)# deny {object-group <OBJ-GROUP-NETWORK-NAME> <ADDR/LEN> <IPV6-ADDR/LEN> } [{ eq <LEN> le <LEN> ge <LEN> [le <LEN>] }]	<OBJ-GROUP-NETWORK-NAME> – IP -, 31 ; <LEN> – , [1..32] IP- ; <ul style="list-style-type: none">• eq – ;• le – ;• ge – ;• default - route – .
5	RIP-.	esr(config)# router rip esr(config-rip)#	
6	RIP-.	esr(config-rip)# enable	
7	RIP (.).	esr(config-rip)# authentication algorithm { cleartext md5 }	<ul style="list-style-type: none">• cleartext – , ;• md5 – md5.
8	(.).	esr(config-rip)# authentication key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> – , 8 16 ; <ENCRYPTED-TEXT> – 8 16 (16 32) (0xYYYY...) (YYYY...).
9	md5 (.).	esr(config-rip)# authentication key-chain <KEYCHAIN>	<KEYCHAIN> – , 16 .
10	//bridge, (.).	esr(config-rip)# passive-interface {<IF> <TUN> }	<IF> – ; <TUN> – .
11	, (.).	esr(config-rip)# timers update <TIME>	<TIME> – , [1..65535]. : 180 .
12	(.).	esr(config-rip)# timers invalid <TIME>	<TIME> – , [1..65535]. : 180 .
13	, (.).	esr(config-rip)# timers flush <TIME>	<TIME> – , [1..65535]. : «timersinvalid + 60» : 240 .
14	.	esr(config-rip)# network <ADDR/LEN>	<ADDR/LEN> – , : AAA.BBB.CCC.DDD/EE – IP- , AAA-DDD [0..255] EE [1..32].

15	(.).	esr(config-rip)# prefix-list <PREFIX-LIST-NAME> { in out }	<PREFIX-LIST-NAME>- , 31 . <ul style="list-style-type: none">• in - ;• out - .
16	, (.).	esr(config-rip)# redistribute static [route-map <NAME>]	<NAME>- , , 31 .
		esr(config-rip)# redistribute connected [route-map <NAME>]	<NAME>- , , 31 .
		esr(config-rip)# redistribute ospf <ID><ROUTE-TYPE> [route-map <NAME>]	<ID>- , [1..65535]; <ROUTE-TYPE>- : <ul style="list-style-type: none">• intra - area - OSPF- ;• inter - area - OSPF- ;• external 1 - OSPF- 1;• external 2 - OSPF- 2; <NAME>- , OSPF-, 31 .
		esr(config-rip)# redistribute bgp <AS> [route-map <NAME>]	<AS>- , [1..4294967295]; <NAME>- , BGP-, 31 .
17	// .	esr(config)# interface <IF-TYPE><IF-NUM>	<IF-TYPE> ; <IF-NUM>- F/S/P - F- (1), S - (0), P - .
		esr(config)# tunnel <TUN-TYPE><TUN-NUM>	<TUN-TYPE> ; <TUN-NUM> .
		esr(config)# bridge <BR-NUM>	<BR-NUM>- bridge.
18	RIP- (.).	esr(config-if-gi)# ip rip metric <VALUE>	<VALUE>- , [0..32767]. : 5.
19	RIP (.).	esr(config-if-gi)# ip rip mode <MODE>	<MODE>- : <ul style="list-style-type: none">• multicast - ;• broadcast - ;• unicast - unicast- . : multicast.
20	IP- unicast- (.).	esr(config-if-gi)# ip rip neighbor <ADDR>	<ADDR>- IP-, AAA.BBB.CCC.DDD, [0..255].
21	(.).	esr(config-if-gi)# ip rip summary-address <ADDR/LEN>	<ADDR/LEN>- IP- , AAA.BBB.CCC.DDD/EE, AAA - DDD [0..255] EE [1..32].

RIP

RIP . 115.0.0.0/24, 14.0.0.0/24, 10.0.0.0/24. 25 .



IP- , .

RIP:

```
esr(config)# router rip
```

, : 115.0.0.0/24, 14.0.0.0/24 10.0.0.0/24:

```
esr(config-rip)# network 115.0.0.0/24
esr(config-rip)# network 14.0.0.0/24
esr(config-rip)# network 10.0.0.0/24
```

:

```
esr(config-rip)# redistribute static
```

, :

```
esr(config-rip)# timers update 25
```

:

```
esr(config-rip)# enable
```

RIP :

```
esr# show ip rip
```



RIP, firewall UDP- 520.

OSPF

OSPF — , (link-state technology) .

1	OSPF ().	esr(config)# ip protocols ospf preference <VALUE>	<VALUE> – , [1..255]. : 150.
		esr(config-vrf)# ip protocols ospf preference <VALUE>	
2	OSPF ().	esr(config)# ip protocols ospf max-routes <VALUE>	<VALUE> – OSPF , : <ul style="list-style-type: none">• ESR-1000/1200/1500/1700 [1..500000];• ESR-20/21/100/200 [1..300000];• ESR-10/12V(F)/14VF [1..30000] : <ul style="list-style-type: none">• ESR-1000/1200/1500/1700 – (500000);• ESR-20/21/100/200 – (300000);• ESR-10/12V(F)/14VF – (30000). VRF: 0
		esr(config)# ipv6 protocols ospf max-routes <VALUE>	
3	OSPF ().	esr(config)# router ospf log-adjacency-changes	
		esr(config)# ipv6 router ospf log-adjacency-changes	
4	IP-, IP-.	esr(config)# ip prefix-list <NAME>	<NAME> – , 31 .

		esr(config)# ipv6 prefix-list <NAME>	
5	(permit) (deny) .	esr(config-pl)# permit [{ object-group <OBJ-GROUP-NETWORK-NAME> <ADDR/LEN> <IPV6-ADDR/LEN> }] [{ eq <LEN> le <LEN> ge <LEN> le <LEN> }]] esr(config-pl)# deny [{ object-group <OBJ-GROUP-NETWORK-NAME> <ADDR/LEN> <IPV6-ADDR/LEN> }] [{ eq <LEN> le <LEN> ge <LEN> le <LEN> }]]	<OBJ-GROUP-NETWORK-NAME> – IPv4/IPv6-, 31; <ADDR> – IP-, AAA.BBB.CCC.DDD, [0..255]; <LEN> – , [1..32] IP-; • eq – ; • le – ; • ge – ;
6	OSPF- OSPF-.	esr(config)# router ospf <ID> [vrf <VRF>] esr(config)# ipv6 router ospf <ID> [vrf <VRF>]	<ID> – , [1..65535] <VRF> – VRF, 31, .
7	OSPF-.	esr(config-ospf)# router-id <ID> esr(config-ipv6-ospf)# router-id <ID>	<ID> – , AAA.BBB.CCC.DDD, [0..255].
8	OSPF.	esr(config-ospf)# preference <VALUE> esr(config-ipv6-ospf)# preference <VALUE>	<VALUE> – OSPF, [1..255]. : 10.
9	RFC 1583 (.).	esr(config-ospf)# compatible rfc1583 esr(config-ipv6-ospf)# compatible rfc1583	
11	(.).	esr(config-ospf)# prefix-list <PREFIX-LIST-NAME> { in out } esr(config-ipv6-ospf)# prefix-list <PREFIX-LIST-NAME> { in out }	<PREFIX-LIST-NAME> – , 31. • in – ; • out – .
12	, (.).	esr(config-ospf)# redistribute static [route-map <NAME>] esr(config-ipv6-ospf)# redistribute static [route-map <NAME>] esr(config-ospf)# redistribute connected [route-map <NAME>] esr(config-ipv6-ospf)# redistribute connected [route-map <NAME>] esr(config-ospf)# redistribute rip [route-map <NAME>] esr(config-ospf)# redistribute bgp <AS> [route-map <NAME>] esr(config-ipv6-ospf)# redistribute bgp <AS> [route-map <NAME>]	<NAME> – , , 31. <NAME> – , , 31. <NAME> – , RIP-, 31. <AS> – , [1..4294967295]; <NAME> – , BGP-, 31.
13	OSPF-.	esr(config-ospf)# enable esr(config-ipv6-ospf)# enable	
14	OSPF- .	esr(config-ospf)# area <AREA_ID> esr(config-ipv6-ospf)# area <AREA_ID>	<AREA_ID> – , AAA.BBB.CCC.DDD, [0..255].
15	.	esr(config-ospf-area)# network <ADDR/LEN> esr(config-ipv6-ospf-area)# network <IPV6-ADDR/LEN>	<ADDR/LEN> – , : AAA.BBB.CCC.DDD/EE – IP-, AAA-DDD [0..255] EE [1..32]. <IPV6-ADDR/LEN> – IPv6-, X:X:X:X::X/EE, X [0..FFFF] EE [1..128].
16		esr(config-ospf-area)# area-type <TYPE> [no-summary] 	<TYPE> – : • stub – stub (); no-summary – «stub» «totallystubby» ().

		esr(config-ipv6-ospf-area)# area-type <TYPE> [no-summary]	<ul style="list-style-type: none"> • nssa – nssa (NSSA); no-summary – nssa totallynssa ().
17	NSSA- LSA. NSSA-	esr(config-ospf-area)# default-information-originate esr(config-ipv6-ospf-area)# default-information-originate	
18	.	esr(config-ospf-area)# summary-address <ADDR/LEN> { advertise not-advertise } esr(config-ipv6-ospf-area)# summary-address <IPV6-ADDR/LEN> { advertise not-advertise }	<ADDR/LEN> – IP- , AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32]; <ul style="list-style-type: none"> • advertise – ; • not - advertise – , , . <IPV6-ADDR/LEN> – IPv6- , X:X:X:X::X/EE, X [0..FFFF] EE [1..128]; <ul style="list-style-type: none"> • advertise – , , ; • not-advertise – .
19	OSPF-.	esr(config-ospf-area)# enable esr(config-ipv6-ospf-area)# enable	
20	, .	esr(config-ospf-area)# virtual-link <ID> esr(config-ipv6-ospf-area)# virtual-link <ID>	<ID> – , , AAA.BBB.CCC.DDD, [0..255].
21	, , , (, DatabaseDescription LinkStateRequest).	esr(config-ospf- vlink)# retransmit-interval <TIME> esr(config-ipv6-ospf- vlink)# retransmit-interval <TIME>	<TIME> – , [1..65535]. : 5 .
22	, hello-.	esr(config-ospf- vlink)# hello-interval <TIME> esr(config-ipv6-ospf- vlink)# hello-interval <TIME>	<TIME> – , [1..65535]. : 10 .
23	, . «hello-interval».	esr(config-ospf- vlink)# dead-interval <TIME> esr(config-ipv6-ospf- vlink)# dead-interval <TIME>	<TIME> – , [1..65535]. : 40 .
24	, DR	esr(config-ospf- vlink)# wait-interval <TIME> esr(config-ipv6-ospf- vlink)# wait-interval <TIME>	<TIME> – , [1..65535]. : 40
25		esr(config-ospf- vlink)# authentication algorithm <ALGORITHM>	<ALGORITHM> – : <ul style="list-style-type: none"> • cleartext – , (RIP OSPF-VLINK); • md 5 – md5.
26	.	esr(config-ospf- vlink)# authentication key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> – , 8 16 . <ENCRYPTED-TEXT> – 8 16 (16 32) (0xYYYY...) (YYYY...).
27	md5.	esr(config-ospf- vlink)# authentication key chain <KEYCHAIN>	<KEYCHAIN> – , 16 .
28	.	esr(config-ospf- vlink)# enable	
29	// .	esr(config)# interface <IF-TYPE><IF-NUM> esr(config)# tunnel <TUN-TYPE><TUN-NUM> esr(config)# bridge <BR-NUM>	<IF-TYPE> ; <IF-NUM> – F/S/P – F- (1), S – (0), P – . <TUN-TYPE> ; <TUN-NUM> . <BR-NUM> – bridge.

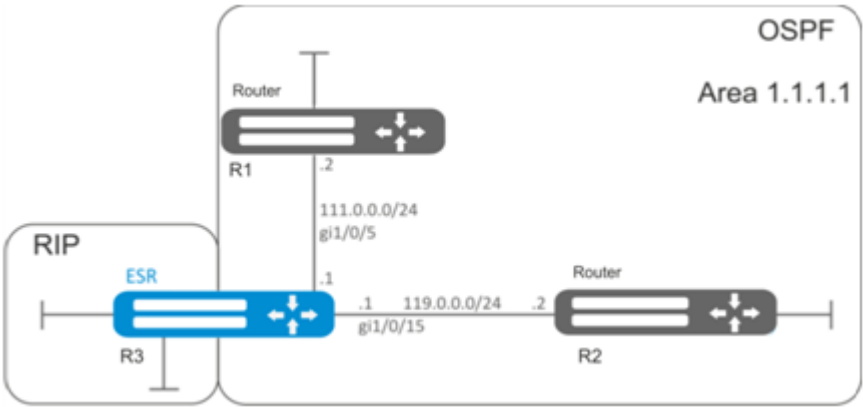
30	// OSPF-.	esr(config-if-gi)# ip ospf instance <ID>	<ID> – , [1..65535].
		esr(config-if-gi)# ipv6 ospf instance <ID>	
31	OSPF-.	esr(config-if-gi)# ip ospf area <AREA_ID>	<AREA_ID> – , AAA.BBB.CCC.DDD, [0..255].
		esr(config-if-gi)# ipv6 ospf area <AREA_ID>	
32	OSPF .	esr(config-if-gi)# ip ospf	
		esr(config-if-gi)# ipv6 ospf	
33	, OSPF- MTU Database Description-.	esr(config-if-gi)# ip ospf mtu-ignore	
		esr(config-if-gi)# ipv6 ospf mtu-ignore	
34	OSPF.	esr(config-if-gi)# ip ospf authentication algorithm <ALGORITHM>	<ALGORITHM> – : <ul style="list-style-type: none"> • cleartext – , ; • md 5 – md5.
35	OSPF- .	esr(config-if-gi)# ip ospf authentication key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> – , 8 16 ; <ENCRYPTED-TEXT> – 8 16 (16 32) (0xYYYY...) (YYYY...).
36	md5 .	esr(config-if-gi)# ip ospf authentication key-chain <KEYCHAIN>	<KEYCHAIN> – , 16 .
37	, DR .	esr(config-if-gi)# ip ospf wait-interval <TIME>	<TIME> – , [1..65535]. : 40 .
		esr(config-if-gi)# ipv6 ospf wait-interval <TIME>	
38	, , (DatabaseDescription LinkStateRequest).	esr(config-if-gi)# ip ospf retransmit-interval <TIME>	<TIME> – , [1..65535]. : 5 .
		esr(config-if-gi)# ipv6 ospf retransmit-interval <TIME>	
39	, hello-.	esr(config-if-gi)# ip ospf hello-interval <TIME>	<TIME> – , [1..65535]. : 10 .
		esr(config-if-gi)# ipv6 ospf hello-interval <TIME>	
40	, . hello-interval.	esr(config-if-gi)# ip dead-interval <TIME>	<TIME> – , [1..65535]. : 40 .
		esr(config-if-gi)# ipv6 dead-interval <TIME>	
41	, NBMA-, HELLO-, .	esr(config-if-gi)# ip poll-interval <TIME>	<TIME> – , [1 .. 65535]. : 120 .
		esr(config-if-gi)# ipv6 poll-interval <TIME>	
42	IP- NMBA P2MP (Point-to-MultiPoint) .	esr(config-if-gi)# ip ospf neighbor <IP> [eligible]	<IP> – IP-, AAA.BBB.CCC.DDD, [0..255]. eligible – , DR NBMA-. .
		esr(config-if-gi)# ip ospf neighbor <IP> [eligible]	<IPV6-ADDR> – IPv6-, X:X:X::X, [0..FFFF]; eligible – , DR NBMA-. .
43	OSPF .	esr(config-if-gi)# ip ospf network <TYPE>	<TYPE> – : <ul style="list-style-type: none"> • broadcast – ; • non - broadcast – NBMA; • point - to - multipoint – -; • point-to-multipoint non-broadcast – NBMA-; • point - to - point – -. : broadcast.
		esr(config-if-gi)# ipv6 ospf network <TYPE>	
44	, DR BDR.	esr(config-if-gi)# ip ospf priority <VALUE>	<VALUE> – , [1..65535]. : 120.

		esr(config-if-gi)# ipv6 ospf priority <VALUE>	
45		esr(config-if-gi)# ip ospf cost <VALUE>	<VALUE> – , [0..32767]. : 150.
		esr(config-if-gi)# ipv6 ospf cost <VALUE>	
47	BFD OSPF	esr(config-if-gi)# ip ospf bfd-enable	
		esr(config-if-gi)# ipv6 ospf bfd-enable	

OSPF

:

OSPF . 1.1.1.1 , RIP.



:

IP- , .

OSPF- 10 OSPF:

```

esr(config)# router ospf 10

```

```

esr(config-ospf)# area 1.1.1.1
esr(config-ospf-area)# enable
esr(config-ospf-area)# exit

```

RIP:

```

esr(config-ospf)# redistribute rip

```

OSPF-:

```

esr(config-ospf)# enable
esr(config-ospf)# exit

```

gi1/0/5 gi1/0/15. OSPF- . OSPF:

```

esr(config)# interface gigabitethernet 1/0/5
esr(config-if-gi)# ip ospf instance 10
esr(config-if-gi)# ip ospf area 1.1.1.1
esr(config-if-gi)# ip ospf
esr(config-if-gi)# exit

```

```

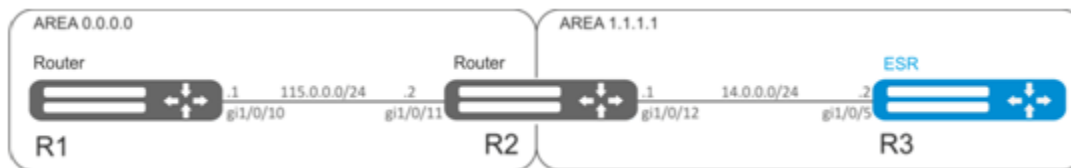
esr(config)# interface gigabitethernet 1/0/15
esr(config-if-gi)# ip ospf instance 10
esr(config-if-gi)# ip ospf area 1.1.1.1
esr(config-if-gi)# ip ospf
esr(config-if-gi)# exit
esr(config)# exit

```

OSPF stub area

:

1.1.1.1, . . , RIP.



:

OSPF IP- , .

. 1.1.1.1 :

```

esr(config-ospf-area)# area-type stub

```

R3 RIP:

```

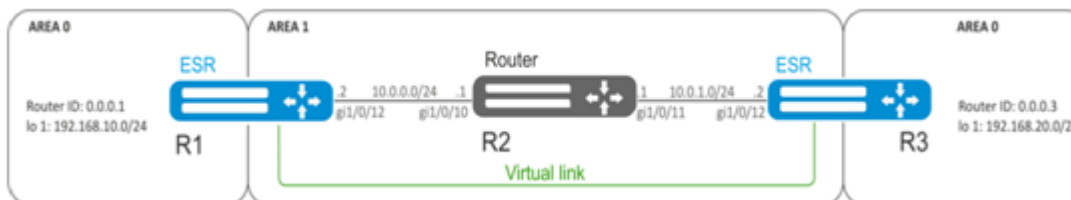
esr(config-ospf)# redistribute rip

```

Virtual link

:

virtual link.



:

Virtual link — , . (Area Border Router, ABR).

OSPF IP- , .

R1 1.1.1.1:

```
esr(config-ospf)# area 1.1.1.1
```

virtual link 0.0.0.3 :

```
esr(config-ospf-area)# virtual-link 0.0.0.3
esr(config-ospf-vlink)# enable
```

R3 1.1.1.1:

```
esr(config-ospf)# area 1.1.1.1
```

virtual link 0.0.0.1 :

```
esr(config-ospf-area)# virtual-link 0.0.0.1
esr(config-ospf-vlink)# enable
```

R1:

```
esr# show ip route
C    * 10.0.0.0/24      [0/0]   dev gil/0/12,          [direct 00:49:34]
O    * 10.0.1.0/24      [150/20] via 10.0.0.1 on gil/0/12, [ospf1 00:49:53] (0.0.0.3)
O    * 192.168.20.0/24  [150/30] via 10.0.0.1 on gil/0/12, [ospf1 00:50:15] (0.0.0.3)
C    * 192.168.10.0/24  [0/0]   dev lo1,              [direct 21:32:01]
```

R3:

```
esr# show ip route
O    * 10.0.0.0/24      [150/20] via 10.0.1.1 on gil/0/12, [ospf1 14:38:35] (0.0.0.2)
C    * 10.0.1.0/24      [0/0]   dev gil/0/12,          [direct 14:35:34]
C    * 192.168.20.0/24  [0/0]   dev lo1,              [direct 14:32:58]
O    * 192.168.10.0/24  [150/30] via 10.0.1.1 on gil/0/12, [ospf1 14:39:54] (0.0.0.1)
```

OSPF , R1, R3, .

:

```
esr# show ip ospf neighbors 10
```

OSPF :

```
esr# show ip ospf 10
```



firewall OSPF (89).

BGP

BGP (), , . , . , .



BGP- firewall TCP- 179.

1	BGP ().	esr(config)# ip protocols bgp preference <VALUE>	<VALUE> – , [1..255]. : BGP (170).
2	BGP ().	esr(config)# ip protocols bgp max-routes <VALUE>	<VALUE> – BGP , : ESR-1700 [1..5000000]; ESR-1000/1200/1500 [1..3000000]; ESR-20/21/100/200 [1..2000000]; ESR-10/12V(F)/14VF [1..800000]. : ESR-1700 (5000000); ESR-1000/1200/1500 (3000000); ESR-20/21/100/200 (2000000); ESR-10/12V/12VF/14VF (800000). VRF: 0.
		esr(config)# ipv6 protocols bgp max-routes <VALUE>	
		esr(config-vrf)# ip protocols bgp max-routes <VALUE>	
		esr(config-vrf)# ipv6 protocols bgp max-routes <VALUE>	
3	BGP ().	esr(config)# router bgp log-neighbor-changes	
		esr(config)# ipv6 router bgp log-neighbor-changes	
4	ECMP .	esr(config)# router bgp maximum-paths <VALUE>	<VALUE> – , [1..16].
3	.(eBGP)		
3.1.1	route-map , IP-.	esr(config)# route-map <NAME>	<NAME> – , 31 .
3.1.2		(config-route-map)# rule <ORDER>	<ORDER> – , [1 .. 10000].
3.1.3	, .	esr(config-route-map-rule)#match ip address { <ADDR/LEN> object-group <OBJ-GRP-NETNAME> } [{ eq <LEN> le <LEN> ge <LEN 1> [le <LEN 2>] }]	<ADDR/LEN> – IP- , : AAA.BBB.CCC.DDD/EE – IP- , AAA-DDD [0..255] EE [1..32]; <IPV6-ADDR/LEN> – IPv6- , : X:X:X:X:X/EE, X [0..FFFF] EE [1..128]; <OBJ-GRP-NETNAME> – IP-, 31 *; <LEN>, <LEN 1>, <LEN 2> – , [1..32] IP- IPv4 [1..128] IPv6; eq – ; le – ; ge – ; ge <LEN 1> le <LEN 2> – <LEN> <LEN1>. * object-group, .
		esr(config-route-map-rule)#match ipv6 address { <IPV6-ADDR/LEN> object-group <OBJ-GRP-NETNAME> } [{ eq <LEN> le <LEN> ge <LEN 1> [le <LEN 2>] }]	
3.1.4	(permit) (deny) .	esr(config-route-map-rule)# action {deny permit}	
3.2.1	- IP-, IP-.	esr(config)# ip prefix-list <NAME>	<NAME> – , 31 .
		esr(config)# ipv6 prefix-list <NAME>	
3.2.2	(permit) (deny) .	esr(config-pl)# permit { <ADDR/LEN> object-group <OBJ-GRP-NETNAME> } [{ eq <LEN> le <LEN> ge <LEN 1> [le <LEN 2>] }]	<ADDR/LEN> – IP- , : AAA.BBB.CCC.DDD/EE – IP- , AAA-DDD [0..255] EE [1..32]; <IPV6-ADDR/LEN> – IPv6- , : X:X:X:X:X/EE, X [0..FFFF] EE [1..128];

		<pre> esr(config-pl)# deny { <ADDR/LEN> object-group <OBJ-GRP-NETNAME> } [{ { eq <LEN> le <LEN> ge <LEN 1> [le <LEN 2>] } }] esr(config-ipv6-pl)# permit { <IPV6-ADDR/LEN> object-group <OBJ-GRP-NETNAME> } [{ { eq <LEN> le <LEN> ge <LEN 1> [le <LEN 2>] } }] esr(config-ipv6-pl)# deny { <IPV6-ADDR/LEN> object-group <OBJ-GRP-NETNAME> } [{ { eq <LEN> le <LEN> ge <LEN 1> [le <LEN 2>] } }] </pre>	<p><OBJ-GRP-NETNAME> – IP-, 31 *;</p> <p><LEN>, <LEN 1>, <LEN 2> – , [1..32] IP- IPv4 [1..128] IPv6;</p> <p>eq – ;</p> <p>le – ;</p> <p>ge – ;</p> <p>ge <LEN 1> le <LEN 2> – <LEN> <LEN1>.</p> <p>* object-group, .</p>
4	BGP- BGP-.	esr(config)# router bgp <AS>	<AS> – , [1..4294967295].
5	.	esr(config-bgp)# router-id <ID>	<ID> – , AAA.BBB.CCC.DDD, [0..255].
6	Route-Reflector, BGP-.()	esr(config-bgp)# cluster-id <ID>	<ID> – Route-Reflector, AAA.BBB.CCC.DDD, [0..255].
7	, FIB.()	esr(config-bgp)# default-information-originate	
8	, .()	esr(config-bgp-af)# timers keepalive <TIME>	<p><TIME> – , [1..65535].</p> <p>: 60 .</p>
9	, .()	esr(config-bgp-af)# timers holdtime <TIME>	<p><TIME> – , [1..65535].</p> <p>: 180 .</p>
10	, , ()	esr(config-bgp-af)# timers error-wait <TIME1> <TIME2>	<p><TIME1> – , [1..65535];</p> <p><TIME2> – , [1..65535].</p>
11	().	esr(config-bgp)# authentication algorithm <ALGORITHM>	<p><ALGORITHM> – :</p> <p>md5 – md5.</p> <p>:</p>
12	.("authentication algorithm")	esr(config-bgp)# authentication key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<p><CLEAR-TEXT> – , 8 16;</p> <p><ENCRYPTED-TEXT> – 8 16 (16 32) (0xYYYY...) (YYYY...).</p>
13	BGP-.	esr(config-bgp)# enable	
14	.	esr(config-bgp)# address-family { ipv4 ipv6 } unicast	<p>– ipv4 – IPv4;</p> <p>– ipv6 – IPv6;</p>
15	BGP ().	<pre> esr(config-bgp-af)# redistribute static [route-map <NAME>] esr(config-bgp-af)# redistribute connected [route-map <NAME>] esr(config-bgp-af)# redistribute rip [route-map <NAME>] esr(config-bgp-af)# redistribute ospf <ID> <ROUTE-TYPE 1> [<ROUTE-TYPE 2>] [<ROUTE-TYPE 3>] [<ROUTE-TYPE 4>] [route-map <NAME>] esr(config-bgp-af)# redistribute bgp <AS> [route-map <NAME>] </pre>	<p><NAME> – , , 31 .</p> <p><NAME> – , , 31 .</p> <p><NAME> – , RIP-, 31 .</p> <p><ID> – , {1..65535};</p> <p><ROUTE-TYPE> – :</p> <p>- intra - area – OSPF- ;</p> <p>- inter - area – OSPF- ;</p> <p>- external 1 – OSPF- 1;</p> <p>- external 2 – OSPF- 2;</p> <p><NAME> – , OSPF-, 31 .</p> <p><AS> – , [1..4294967295];</p> <p><NAME> – , BGP-, 31 .</p>

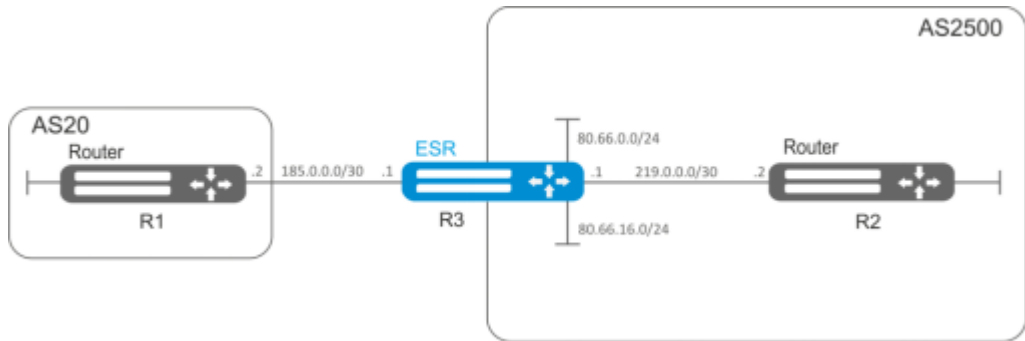
16	.	esr(config-bgp-af)# network <ADDR/LEN>	<ADDR/LEN> – , : AAA.BBB.CCC.DDD/EE – IP- , AAA-DDD [0..255] EE [1..32]; X:X:X:X/EE – IPv6- , X [0..FFFF] EE [1..128].
17	BGP	esr(config-bgp-af)# exit	
18	BGP- BGP-.	esr(config-bgp)# neighbor <ADDR> <IPv6-ADDR>	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255]; <IPv6-ADDR> – IPv6- , X:X:X:X, [0..FFFF].
19	().	esr(config-bgp-neighbor)# description <DESCRIPTION>	<DESCRIPTION> – , 255 .
20	, . ()	esr(config-bgp-neighbor)# timers keepalive <TIME>	<TIME> – , [1.65535]. : 60 .
21	, ().	esr(config-bgp- neighbor)# timers holdtime <TIME>	<TIME> – , [1.65535]. : 180 .
22	, , ().	esr(config-bgp-af)# timers error-wait <TIME1> <TIME2>	<TIME1> – , [1.65535]; <TIME2> – , [1.65535]. : 60 300
23	BGP-.	esr(config-bgp-neighbor)# remote-as <AS>	<AS> – , [1..4294967295].
24	, ()	esr(config-bgp-neighbor)# ebgp-multihop <NUM>	<NUM> – EBGp (TTL).
25	, BGP- Route-Reflector .()	esr(config-bgp-neighbor)# route-reflector-client	
26	IP/IPv6-, IP/IPv6- BGP.()	esr(config-bgp-neighbor)# update-source { <ADDR> <IPv6-ADDR> }	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255]; <IPv6-ADDR> – IPv6- , X:X:X:X, [0..FFFF].
27	, BGP-, AS Path .()	esr(config-bgp-neighbor)# allow-local-as <NUMBER>	<NUMBER> – AS Path, , [1..10].
28	BFD- BGP-. (, update-source)	esr(config-bgp-neighbor)# bfd-enable	
29	.()	esr(config-bgp-neighbor)# authentication algorithm <ALGORITHM>	<ALGORITHM> – : md5 – md5.
30	.()	esr(config-bgp-neighbor)# authentication key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> – , 8 16; <ENCRYPTED-TEXT> – 8 16 (16 32) (0xYYYY...) (YYYY...).
31		esr(config-bgp-neighbor)# enable	
32	.	esr(config-bgp-neighbor)# address-family { ipv4 ipv6 vpnv4 } unicast	– ipv4 – IPv4; – ipv6 – IPv6; – vpnv4 – VPNv4;
33	- (eBGP).	esr(config-bgp-neighbor-af)# prefix-list <PREFIX-LIST-NAME> { in out }	<PREFIX-LIST-NAME> – , 31 . in – ; out – .
34	, BGP- .(, vpnv4)	esr(config-bgp-neighbor-af)# default-originate	
35	, BGP- next-hop IP- . (, vpnv4)	esr(config-bgp-neighbor-af)# next-hop-self	
36	, .()	esr(config-bgp-neighbor-af)# preference <VALUE>	<VALUE> – , [1..255]. : 170.

37	, BGP- AS Path (RFC 6996). (, vpnv4)	esr(config-bgp-neighbor-af)# remove-private-as [{ all nearest replace }]	all - AS AS-path; nearest - AS AS-path AS; replace - AS BGP. : all.
38		esr(config-bgp-neighbor-af)# enable	

, iBGP, bgp bgp neighbor . bgp peer-group, , bgp neighbor bgp peer-group.

:

BGP- R3 :



- : 80.66.0.0/24, 80.66.16.0/24;
- , ;
- AS 2500;
- - 219.0.0.0/30, IP- 219.0.0.1, IP- 219.0.0.2, AS2500;
- - 185.0.0.0/30, IP- 185.0.0.1, IP- 185.0.0.2, AS20

:

:

```

esr-R3(config)# interface gigabitethernet 1/0/1
esr-R3(config-if-gi)# ip address 185.0.0.1/30
esr-R3(config-if-gi)# exit
esr-R3(config)# interface gigabitethernet 1/0/2
esr-R3(config-if-gi)# ip address 219.0.0.1/30
esr-R3(config-if-gi)# exit
esr-R3(config)# interface gigabitethernet 1/0/3
esr-R3(config-if-gi)# ip address 80.66.0.1/24
esr-R3(config-if-gi)# exit
esr-R3(config)# interface gigabitethernet 1/0/4
esr-R3(config-if-gi)# ip address 80.66.16.1/24
esr-R3(config-if-gi)# exit

```

firewall BGP- WAN


```
esr-R3(config)# object-group service og_bgp
esr-R3(config-object-group-service)# port-range 179
esr-R3(config-object-group-service)# exit
esr-R3(config)# security zone wan
esr-R3(config-zone)# exit
esr-R3(config)# security zone-pair wan self
esr-R3(config-zone-pair)# rule 100
esr-R3(config-zone-pair-rule)# match protocol tcp
esr-R3(config-zone-pair-rule)# match destination-port og_bgp
esr-R3(config-zone-pair-rule)# action permit
esr-R3(config-zone-pair-rule)# enable
esr-R3(config-zone-pair-rule)# exit
esr-R3(config-zone-pair)# exit
```

```
esr-R3(config)# interface gigabitethernet 1/0/1
esr-R3(config-if-gi)# security-zone wan
esr-R3(config-if-gi)# exit
esr-R3(config)# interface gigabitethernet 1/0/2
esr-R3(config-if-gi)# security-zone wan
esr-R3(config-if-gi)# exit
```

route-map, AS

```
esr-R3(config)# route-map bgp-general
esr-R3(config-route-map)# rule 1
esr-R3(config-route-map-rule)# match ip address 80.66.0.0/24
esr-R3(config-route-map-rule)# match ip address 80.66.16.0/24
esr-R3(config-route-map-rule)# action permit
esr-R3(config-route-map-rule)# exit
esr-R3(config-route-map)# exit
```

BGP AS 2500 :

```
esr(config)# router bgp 2500
```

, :

```
esr-R3(config-bgp)# address-family ipv4 unicast
esr-R3(config-bgp-af)# redistribute connected
esr-R3(config-bgp-af)# exit
```

R2 iBGP

```
esr-R3(config-bgp)# neighbor 219.0.0.2
esr-R3(config-bgp-neighbor)# remote-as 2500
esr-R3(config-bgp-neighbor)# enable
```

ipv4-

```
esr-R3(config-bgp-neighbor)# address-family ipv4 unicast
esr-R3(config-bgp-neighbor-af)# enable
esr-R3(config-bgp-neighbor-af)# exit
esr-R3(config-bgp-neighbor)# exit
```

R1 eBGP

```

esr-R3(config-bgp)# neighbor 185.0.0.2
esr-R3(config-bgp-neighbor)# remote-as 20
esr-R3(config-bgp-neighbor)# enable

```

ipv4-, route-map

```

esr-R3(config-bgp-neighbor)# address-family ipv4 unicast
esr-R3(config-bgp-neighbor-af)# route-map bgp-general out
esr-R3(config-bgp-neighbor-af)# enable
esr-R3(config-bgp-neighbor-af)# exit
esr-R3(config-bgp-neighbor)# exit

```

```

esr-R3(config-bgp)# enable
esr-R3(config-bgp)# exit

```

BGP- :

```

esr# show ip bgp 2500 neighbors

```

BGP :

```

esr# show ip bgp

```

BFD

BFD (Bidirectional Forwarding Detection) — , , 50 . BFD ,.. (BFD- -).

1	BFD OSPF	esr(config-if-gi)# ip ospf bfd-enable	
2	BFD BGP neighbor	esr(config-bgp-neighbor)# bfd-enable	
3	, BFD- . ()	esr(config)# ip bfd idle-tx-interval <TIMEOUT>	<TIMEOUT>- , BFD- , [200..65535] ESR-1000/1200/1500/1700 [300..65535] ESR-10/12V(F)/14VF/20/21/100/200 1
4	BFD- ()	esr(config)# ip bfd log-adjacency-changes	
5	, BFD- . ()	esr(config)# ip bfd min-rx-interval <TIMEOUT>	<TIMEOUT>- , BFD- , [200..65535] ESR-1000/1200/1500/1700 [300..65535] ESR-10/12V(F) /14VF/20/21/100/200 : • 300 ESR-10/12V(F)/14VF/20/21/100/200 • 200 ESR-1000/1200/1500/1700
6	, BFD- . ()	esr(config)# ip bfd min-tx-interval <TIMEOUT>	<TIMEOUT>- , BFD- , [200..65535] ESR-1000/1200/1500/1700 [300..65535] ESR-10/12V(F)/14VF/20/21/100/200 : • 300 ESR-10/12V(F)/14VF/20/21/100/200 • 200 ESR-1000/1200/1500/1700
7	, BFD- .	esr(config)# ip bfd multiplier <COUNT>	<COUNT>- , , [1..100]. :5

8	BFD IP-.	esr(config)# ip bfd neighbor <ADDR> [{ interface <IF> tunnel <TUN> }] [local-address <ADDR> [multihop]] [vrf <VRF>]	<ADDR> – IP-, AAA.BBB.CCC.DDD, [0..255]; <IF> – ; <TUN> – ; <VRF> – VRF, 31; multihop – TTL=255, BFD .
9	BFD- , BFD- , BFD- ()	esr(config)# ip bfd passive	
10	, BFD- . ()	esr(config-if-gi)# ip bfd idle-tx-interval <TIMEOUT>	<TIMEOUT> – , BFD- , [200..65535] ESR-1000/1200/1500/1700 [300..65535] ESR-10/12V(F)/14VF/20/21/100/200. : 1
11	, BFD- . ()	esr(config-if-gi)# ip bfd min-rx-interval <TIMEOUT>	<TIMEOUT> – , BFD- , [200..65535] ESR-1000/1200/1500/1700 [300..65535] ESR-10/12V(F)/14VF/20/21/100/200 : • 300 ESR-10/12V(F)/14VF/20/21/100/200 • 200 ESR-1000/1200/1500/1700
12	, BFD- . ()	esr(config-if-gi)# ip bfd min-tx-interval <TIMEOUT>	<TIMEOUT> – , BFD- , [200..65535] ESR-1000/1200/1500/1700 [300..65535] ESR-10/12V(F)/14VF/20/21/100/200 : • 300 ESR-10/12V(F)/14VF/20/21/100/200 • 200 ESR-1000/1200/1500/1700
13	, BFD- . ()	esr(config-if-gi)# ip bfd multiplier <COUNT>	<COUNT> – , , [1..100]. : 5
14	BFD- , BFD- , BFD- ()	esr(config-if-gi)# ip bfd passive	

BFD c BGP

:

eBGP ESR R1 R2 BFD.



:

1. R1
Gi1/0/1:

```
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# ip firewall disable
esr(config-if-gi)# ip address 10.0.0.1/24
```

eBGP BFD:

```

esr(config)# router bgp 100
esr(config-bgp)# address-family ipv4
esr(config-bgp-af)# neighbor 10.0.0.2
esr(config-bgp-neighbor)# remote-as 200
esr(config-bgp-neighbor)# update-source 10.0.0.1
esr(config-bgp-neighbor)# bfd-enable
esr(config-bgp-neighbor)# enable
esr(config-bgp-neighbor)# ex
esr(config-bgp-af)# enable
esr(config-bgp-af)# exit

```

2. R2

Gi1/0/1:

```

esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# ip firewall disable
esr(config-if-gi)# ip address 10.0.0.2/24

```

eBGP BFD:

```

esr(config)# router bgp 200
esr(config-bgp)# address-family ipv4
esr(config-bgp-af)# neighbor 10.0.0.1
esr(config-bgp-neighbor)# remote-as 100
esr(config-bgp-neighbor)# update-source 10.0.0.2
esr(config-bgp-neighbor)# bfd-enable
esr(config-bgp-neighbor)# enable
esr(config-bgp-neighbor)# ex
esr(config-bgp-af)# enable
esr(config-bgp-af)# exit

```

PBR

Route-map BGP

Route-map , , (MED, AS-PATH, community, LocalPreference) .

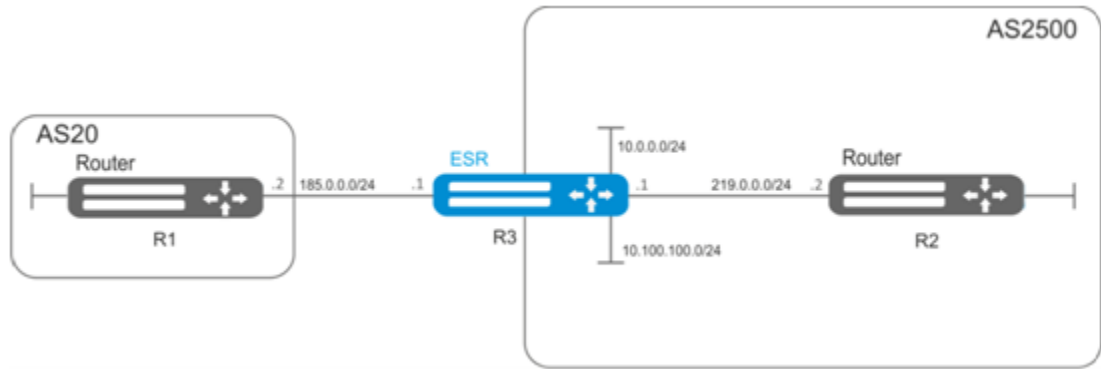
Route-map (ACL).

1	IP-.	esr(config)# route-map <NAME>	<NAME> – , 31 .
2	.	esr(config-route-map)# rule <ORDER>	<ORDER> – , [1 .. 10000].
3	, .	esr(config-route-map-rule)# action <ACT>	<ACT> – : <ul style="list-style-type: none"> • permit – ; • deny – .
4	BGPAS-Path , (.).	esr(config-route-map-rule)# match as-path [begin end contain] <AS-PATH>	<AS-PATH> – , AS,AS,AS, [1..4294967295]. : <ul style="list-style-type: none"> • begin – AS; • end – AS; • contain – AS.
5	BGPCommunity, (.).	esr(config-route-map-rule)# match community <COMMUNITY-LIST>	<COMMUNITY-LIST> – community, AS:N,AS:N, [1..4294967295]. 64 community.

6	BGP Extended Community, ().	esr(config-route-map-rule)# match extcommunity <EXTCOMMUNITY-LIST>	<EXTCOMMUNITY-LIST> – extcommunity, KIND:AS:N, KIND:AS:N, KIND – extcommunity: <ul style="list-style-type: none"> • rt (Route Target); • ro (Route Origin); N – extcommunity, [1..65535].
7	IP-, ().	esr(config-route-map-rule)# match ip address object-group <OBJ-GROUP- NETWORK -NAME> esr(config-route-map-rule)# match ipv6 address object-group <OBJ-GROUP- NETWORK -NAME>	<OBJ-GROUP-NETWORK-NAME> – IP-, , 31 .
8	IP-, BGP Next-Hop ().	esr(config-route-map-rule)# match ip next-hop object-group <OBJ-GROUP- NETWORK -NAME> esr(config-route-map-rule)# match ipv6 next-hop object-group <OBJ-GROUP- NETWORK -NAME>	<OBJ-GROUP-NETWORK-NAME> – IP-, , 31 .
9	, IP-, , ().	esr(config-route-map-rule)# match ip route-source object-group <OBJ-GROUP- NETWORK -NAME> esr(config-route-map-rule)# match ipv6 route-source object-group <OBJ-GROUP- NETWORK -NAME>	<OBJ-GROUP-NETWORK-NAME> – IP-, , 31 .
10	ACL, .	esr(config-route-map-rule)# match access-group <NAME>	<NAME> – , 31 .
11	BGP MED ().	esr(config-route-map-rule)# match metric bgp <METRIC>	<METRIC> – BGP MED, [0..4294967295].
12	OSPF Metric, .	esr(config-route-map-rule)# match metric ospf <TYPE> <METRIC>	<TYPE> – OSPF Metric, type-1 type-2; <METRIC> – OSPF Metric, [0..65535].
13	RIP Metric, .	esr(config-route-map-rule)# match metric rip <METRIC>	<METRIC> – RIP Metric, [0..16].
14	OSPF Tag, .	esr(config-route-map-rule)# match tag ospf <TAG>	<TAG> – OSPF Tag, [0..4294967295].
15	RIP Tag, .	esr(config-route-map-rule)# match tag rip <TAG>	<RIP> – RIP Tag, [0..65535].
16	BGP AS-Path, AS-Path ().	esr(config-route-map-rule)# action set as-path prepend <AS-PATH> {track <TRACK-ID>}	<AS-PATH> – , . AS,AS,AS, [1..4294967295]. <TRACK-ID> – vrrp-tracking, . [1..60].
17	BGP Community, ()	esr(config-route-map-rule)# action set community {COMMUNITY-LIST} no-advertise no-export }	<COMMUNITY-LIST> – community, AS:N,AS:N, [1..65535]; <ul style="list-style-type: none"> • no - advertise – , community, BGP-; • no - export – , community, eBGP-, .
18	BGP ExtCommunity, ().	esr(config-route-map-rule)# action set extcommunity <EXTCOMMUNITY-LIST>	<EXTCOMMUNITY-LIST> – extcommunity, KIND:AS:N, KIND:AS:N, KIND – extcommunity: <ul style="list-style-type: none"> • rt (Route Target); • ro (Route Origin); N – extcommunity, [1..65535].
19	BGP Next-Hop, ().	esr(config-route-map-rule)# action set ip bgp-next-hop <ADDR> esr(config-route-map-rule)# action set ipv6 bgp-next-hop <IPV6-ADDR>	<ADDR> – IP-, AAA.BBB.CCC.DDD, [0..255]. <IPV6-ADDR> – IPv6-, X:X:X:X::X, [0..FFFF].

20	Next-Hop, , BGP (.).	esr(config-route-map-rule)# action set ip next-hop {<NEXTHOP> blackhole unreachable prohibit}	<NEXTHOP> – IP- AAA.BBB.CCC.DDD, [0..255]; <ul style="list-style-type: none"> • blackhole – ; • unreachable – , ICMP Destination unreachable (Host unreachable, code 1); • prohibit – , ICMP Destination unreachable (Communication administratively prohibited code 13).
		esr(config-route-map-rule)# action set ipv6 next-hop <IPV6-NEXTHOP>	<IPV6-NEXTHOP> – IPv6- , X:X:X::X, [0..FFFF].
21	BGP Local Preference, (.).	esr(config-route-map-rule)# action set local- preference <PREFERENCE>	<PREFERENCE> – BGP Local Preference, [0..255].
22	BGP Origin, (.).	esr(config-route-map-rule)# action set origin <ORIGIN>	<ORIGIN> – BGP Origin: <ul style="list-style-type: none"> • egp – EGP; • igp – AS; • incomplete – .
23	BGP MED, (.).	esr(config-route-map-rule)# action set metric bgp <METRIC>	<METRIC> – BGP MED, [0..4294967295].
24	.	esr(config-bgp-neighbor)# route-map <NAME><DIRECTION>	<NAME> – ; <DIRECTION> – : <ul style="list-style-type: none"> • in – ; • out – .
		esr(config-ipv6-bgp-neighbor)# route-map <NAME><DIRECTION>	

1. Route-map BGP



:
ommunity , AS 20:
:

- BGP c AS 2500 ESR;
- AS20.

:

:

```
esr# configure
esr(config)# route-map from-as20
```

1:

```
esr(config-route-map)# rule 1
```

AS PATH AS 20, community 20:2020 :

```
esr(config-route-map-rule)# match as-path contain 20
esr(config-route-map-rule)# action set community 20:2020
esr(config-route-map-rule)# exit
esr(config-route-map)# exit
```

BGP AS 2500 :

```
esr(config)# router bgp 2500
esr(config-bgp)# address-family ipv4
esr(config-bgp-af)# neighbor 185.0.0.2
```

:

```
esr(config-bgp-neighbor)# route-map from-as20 in
```

2. Route-map BGP

:

(community 2500:25) MED, 240, EGP:

:

BGP c AS 2500 ESR

:

:

```
esr(config)# route-map to-as20
```

:

```
esr(config-route-map)# rule 1
```

community 2500:25, MED 240 Origin EGP:

```
esr(config-route-map-rule)# match community 2500:25
esr(config-route-map-rule)# action set metric bgp 240
esr(config-route-map-rule)# action set origin egp
esr(config-route-map-rule)# exit
esr(config-route-map)# exit
```

BGP AS 2500 :

```
esr(config)# router bgp 2500
esr(config-bgp)# address-family ipv4
esr(config-bgp-af)# neighbor 185.0.0.2
```

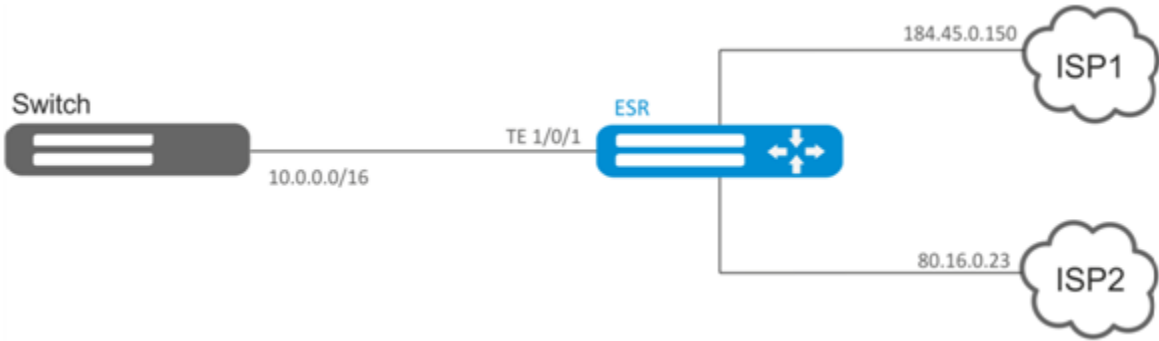
:

```
esr(config-bgp-neighbor)# route-map to-as20 out
esr(config-bgp-neighbor)# exit
esr(config-bgp)# exit
esr(config)# exit
```

Route-map (Policy-based routing)

1	C IP-.	esr(config)# route-map <NAME>	<NAME>- , 31 .
2		esr(c onfig-route-map)# rule <ORDER>	<ORDER>- , [1 .. 10000].
3	, .	esr(config-route-map-rule)# action <ACT>	<ACT>- : <ul style="list-style-type: none">• permit - ;• deny - .
4	ACL, ().	esr(config-route-map-rule)# match ip access-group <NAME>	<NAME>- , 31 .
5	Next-Hop , (ACL) ().	esr(config-route-map-rule)# action set ip next-hop verify-availability <NEXTHOP><METRIC>	<NEXTHOP>- IP- AAA.BBB.CCC.DDD, [0..255]; <METRIC>- , [0..255].
6	(ACL).	esr(config-if-gi)# ip policy route-map <NAME>	<NAME>- , 31 .

Route-map (Policy-based routing)



:

.

IP- .
10.0.20.0/24 ISP1 (184.45.0.150), 10.0.30.0/24 – ISP2 (80.16.0.23). (ISP), .

:

ACL:


```
esr# configure
esr(config)# ip access-list extended sub20
esr(config-acl)# rule 1
esr(config-acl-rule)# match source-address 10.0.20.0 255.255.255.0
esr(config-acl-rule)# match destination-address any
esr(config-acl-rule)# match protocol any
esr(config-acl-rule)# action permit
esr(config-acl-rule)# enable
esr(config-acl-rule)# exit
esr(config-acl)# exit
esr(config)# ip access-list extended sub30
esr(config-acl)# rule 1
esr(config-acl-rule)# match source-address 10.0.30.0 255.255.255.0
esr(config-acl-rule)# match destination-address any
esr(config-acl-rule)# match protocol any
esr(config-acl-rule)# action permit
esr(config-acl-rule)# enable
esr(config-acl-rule)# exit
esr(config-acl)# exit
```

:

```
esr(config)# route-map PBR
```

1:

```
esr(config-route-map)# rule 1
```

(ACL) :

```
esr(config-route-map-rule)# match ip access-group sub20
```

next-hop sub20:

```
esr(config-route-map-rule)# action set ip next-hop verify-availability 184.45.0.150 10
esr(config-route-map-rule)# action set ip next-hop verify-availability 80.16.0.23 30
esr(config-route-map-rule)# exit
esr(config-route-map)# exit
```

1 10.0.20.0/24 184.45.0.150, - 80.16.0.23. - 10 30.

2:

```
esr(config-route-map)# rule 2
```

(ACL) :

```
esr(config-route-map-rule)# match ip access-group sub30
```

nexthop sub30 :

```
esr(config-route-map-rule)# action set ip next-hop verify-availability 80.16.0.23 10
esr(config-route-map-rule)# action set ip next-hop verify-availability 184.45.0.150 30
esr(config-route-map-rule)# exit
esr(config-route-map)# exit
```

2 10.0.30.0/24 80.16.0.23, - 184.45.0.150. .

TE 1/0/1:

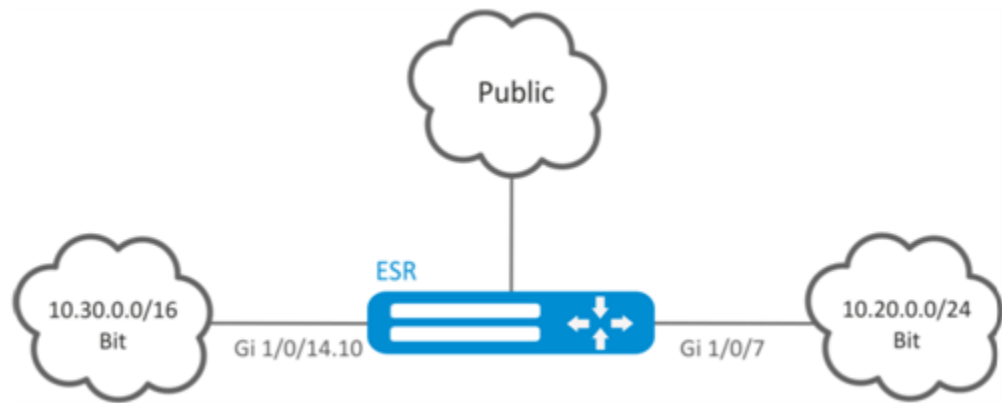
```
esr(config)# interface tengigabitethernet 1/0/1
```

:

```
esr(config-if-te)# ip policy route-map PBR
```

VRF Lite

VRF (Virtual Routing and Forwarding) – , , ().



1	VRF VRF.	esr(config)# ip vrf <VRF>	<VRF> – VRF, 31 .
2	VRF.	esr(config-vrf)# description <DESCRIPTION>	<DESCRIPTION> – VRF, 255 .
3	VRF IPv4/IPv6 ().	esr(config-vrf)# ip protocols <PROTOCOL> max-routes <VALUE>	<PROTOCOL> – , : ospf, bgp; <VALUE> – , :
		esr(config-vrf)#ipv6 protocols <PROTOCOL> max-routes <VALUE>	OSPF ESR-1000/1200/1500/1700 [1..500000], ESR-20/21/100/200 [1..300000], ESR-10/12V(F)/14VF [1..300000] BGP ESR-1000/1200/1500/1700 [1..2800000], ESR-20/21/100/200 [1..1500000], ESR-10/12V(F)/14VF [1..800000]. : 0
4	(Static/OSPF/BGP/IS-IS) VRF (). , OSPF BGP.		
5	/,, DNAT/SNAT,DAS-SNMPv3 VRF ().	esr(config-snat-ruleset)# ip vrf forwarding <VRF>	<VRF> – VRF, 31 .
6	LT- VRF ().		. LT-

:

ESR 2, .

:

VRF:

```
esr(config)# ip vrf bit
esr(config-vrf)# exit
```

:

```
esr(config)# security zone vrf-sec
esr(config-zone)# ip vrf forwarding bit
esr(config-zone)# exit
```

TCP/UDP-:

```
esr(config)# security zone-pair vrf-sec vrf-sec
esr(config-zone-pair)# rule 1
esr(config-zone-rule)# match source-address any
esr(config-zone-rule)# match destination-address any
esr(config-zone-rule)# match protocol udp
esr(config-zone-rule)# match source-port any
esr(config-zone-rule)# match destination-port any
esr(config-zone-rule)# action permit
esr(config-zone-rule)# enable
esr(config-zone-rule)# exit
esr(config-zone-pair)# rule 2
esr(config-zone-rule)# match source-address any
esr(config-zone-rule)# match destination-address any
esr(config-zone-rule)# match protocol tcp
esr(config-zone-rule)# match source-port any
esr(config-zone-rule)# match destination-port any
esr(config-zone-rule)# action permit
esr(config-zone-rule)# enable
esr(config-zone-rule)# exit
```

, IP-, :

```
esr(config)# interface gigabitethernet 1/0/7
esr(config-if-gi)# ip vrf forwarding bit
esr(config-if-gi)# ip address 10.20.0.1/24
esr(config-if-gi)# security-zone vrf-sec
esr(config-if-gi)# exit
esr(config)# interface gigabitethernet 1/0/14.10
esr(config-subif)# ip vrf forwarding bit
esr(config-subif)# ip address 10.30.0.1/16
esr(config-subif)# security-zone vrf-sec
esr(config-subif)# exit
esr(config)# exit
```

, VRF, :

```
esr# show ip vrf
```

VRF :

```
esr# show ip route vrf bit
```

MultiWAN

MultiWAN , .

1	, MultiWAN: ip-security-zone.		
2	WAN ().	esr(config)# ip route <SUBNET> wan load-balance rule <ID> [<METRIC>]	<ID> – .2. [METRIC] – , [0..255].
3	WAN .	esr(config)# wan load-balance rule <ID>	<ID> – , [1..50].
4	, , MultiWAN.	esr(config-wan-rule)# outbound { interface <IF> tunnel <TUN> } [WEIGHT]	<IF> – ; <TUN> – ; [WEIGHT] – , [1..255]. 2, 2 , . . 1.
5	().	esr(config-wan-rule)# description <DESCRIPTION>	<DESCRIPTION> – wan, 255 .
6	().	esr(config-wan-rule)# failover	
7	wan .	esr(config-wan-rule)# enable	
8	IP- .	esr(config)# wan load-balance target-list <NAME>	<NAME> – , 31 .
9	.	esr(config-target-list)# target <ID>	<ID> – , [1..50]. «all», .
10	target ().	esr(config-wan-target)# description <DESCRIPTION>	<DESCRIPTION> – target, 255 .
11	ICMP ().	esr(config-wan-target)# resp-time <TIME>	<TIME> – , [1..30].
12	IP- .	esr(config-wan-target)# ip address <ADDR>	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255].
		esr(config-wan-target)# ipv6 address <IPV6-ADDR>	<IPV6-ADDR> – IPv6- , X:X:X:X::X, [0..FFFF].
13	.	esr(config-wan-target)# enable	
14-17 / MultiWAN			
14	WAN IPv4/IPv6 .	esr(config-if-gi)# wan load-balance enable	
		esr(config-if-gi)# ipv6 wan load-balance enable	
15	, , , ().	esr(config-if-gi)# wan load-balance failure-count <VALUE>	<VALUE> – , [1..10].
		esr(config-if-gi)# ipv6 wan load-balance failure-count <VALUE>	1.
16	, , , ().	esr(config-if-gi)# wan load-balance success-count <VALUE>	<VALUE> – , [1..10].
		esr(config-if-gi)# ipv6 wan load-balance success-count <VALUE>	1.
17	IP- , , MultiWAN.	esr(config-if-gi)# wan load-balance nexthop { <IP> dhcp enable tunnel enable }	<IP> – IP- (), AAA.BBB.CCC.DDD, [0..255]. dhcp enable – IP- DHCP-, DHCP-. tunnel enable – nexthop – p-t-p . ppp.
		esr(config-if-gi)# ipv6 wan load-balance nexthop { <IPV6> }	<IPV6> – IPv6- (), X:X:X:X::X, [0..FFFF].
18	IP- . () / (check-all) , .	esr(config-if-gi)# wan load-balance target-list { check-all <NAME> }	<NAME> – target (.7).
		esr(config-if-gi)# ipv6 wan load-balance target-list { check-all <NAME> }	check-all – target .
19	WAN.	esr(config)# ip route <SUBNET> wan load-balance rule <ID> [<METRIC>]	<ID> – .2. [METRIC] – , [0..255].

```
esr(config)# ipv6 route <SUBNET> wan load-balance rule <ID>
[<METRIC>]
```

:

(108.16.0.1/28) .



:

:

- te1/0/1 te1/0/2;
- IP- te1/0/1 te1/0/2.

:

:

```
esr(config)# ip route 108.16.0.0/28 wan load-balance rule 1
```

WAN:

```
sr(config)# wan load-balance rule 1
```

:

```
sr(config-wan-rule)# outbound interface tengigabitethernet 1/0/2
sr(config-wan-rule)# outbound interface tengigabitethernet 1/0/1
```

:

```
sr(config-wan-rule)# enable
sr(config-wan-rule)# exit
```

:

```
sr(config)# wan load-balance target-list google
```

:

```
esr(config-target-list)# target 1
```

, :

```
sr(config-wan-target)# ip address 8.8.8.8
sr(config-wan-target)# enable
sr(config-wan-target)# exit
```

. te1/0/1 nexthop:

```
sr(config)# interface tengigabitethernet 1/0/1
sr(config-if)# wan load-balance nexthop 203.0.0.1
```

te1/0/1 :

```
sr(config-if)# wan load-balance target-list google
```

te1/0/1 WAN- :

```
sr(config-if)# wan load-balance enable
sr(config-if)# exit
```

te1/0/2 nexthop:

```
sr(config)# interface tengigabitethernet 1/0/2
sr(config-if)# wan load-balance nexthop 65.6.0.1
```

te1/0/2 :

```
sr(config-if)# wan load-balance target-list google
```

te1/0/2 WAN- :

```
sr(config-if)# wan load-balance enable
sr(config-if)# exit
```

:

WAN:

```
sr(config)# wan load-balance rule 1
```

MultiWAN , . :

```
sr(config-wan-rule)# failover
```

IS-IS

IS-IS - , ISO, (link-state). , , . IS-IS OSI, .

1	C IS-IS .	esr(config)# router isis <ID> [vrf <VRF>]	<ID> – , [1..65535]; <VRF> – VRF, 31 .
2	NET .	esr(config-isis)# net {<NET>}	<NET> – NET , : ff[.ffff.ffff.ffff.ffff.ffff].ffff.ffff.00.

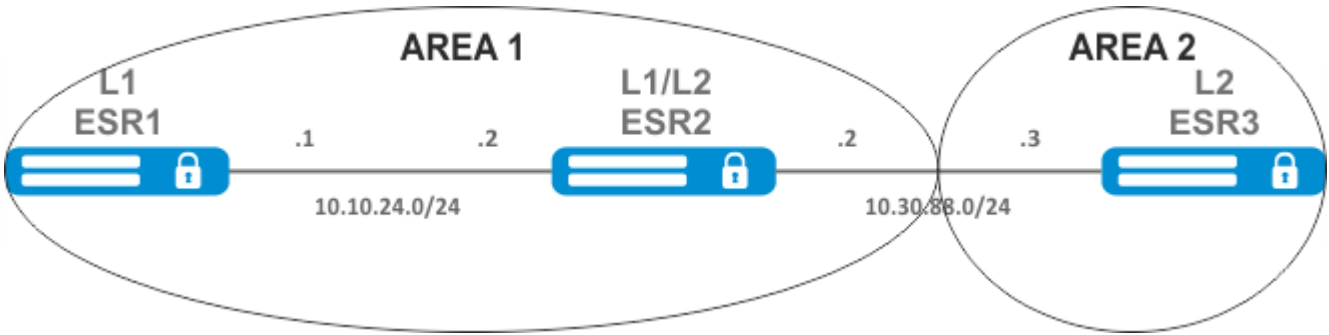
3	IS-IS .	esr(config-isis)# enable	
4	L2 ().	esr(config-isis)# authentication domain algorithm <ALGORITHM>	<ALGORITHM> - : - cleartext - , ; - md5 - md5.
5	L2 ().	esr(config-isis)# authentication domain key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> - , 8; <ENCRYPTED-TEXT> - 8 (16) (0xYYYY...) (YYYY...).
6	().	esr(config-isis)# authentication domain key chain <KEYCHAIN>	<KEYCHAIN> - , 16 .
7	L1 ().	esr(config-isis)# authentication area algorithm <ALGORITHM>	<ALGORITHM> - : - cleartext - , ; - md5 - md5.
8	L1 ().	esr(config-isis)# authentication area key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> - , 8; <ENCRYPTED-TEXT> - 8 (16) (0xYYYY...) (YYYY...).
9	().	esr(config-isis)# authentication area key chain <KEYCHAIN>	<KEYCHAIN> - , 16 .
10	LSP ().	esr(config-isis)# hostname dynamic	
11	IS-IS ().	esr(config-isis)# is-type {<LEVEL>}	<LEVEL> - IS-IS: - level-1 - 1; - level-1-2 - 1, 2; - level-2 - 2 .
12	, IS-IS ().	esr(config-isis)# metric-style { narrow wide transition } [<LEVEL>]	narrow — TLV () ; wide — TLV () ; transition — TLV () ; <LEVEL> — IS-IS: - level-1 - 1; - level-2 - 2 .
13	IS-IS ().	esr(config-isis)# preference {<VALUE>}	<VALUE> - [1..255].
14	IS-IS IPv4/IPv6 ().	esr(config-isis)# address-family { ipv4 ipv6 }	ipv4 - IPv4; ipv6 - IPv6.
15	LSP ().	esr(config-isis)# lsp-refresh-interval { min max } <TIME> [<LEVEL>]	min — /; max — /; <TIME> — , [1..65535]; <LEVEL> — IS-IS: - level-1 - 1; - level-2 - 2 .
16	LSP ().	esr(config-isis)# max-lsp-lifetime <TIME> [<LEVEL>]	<TIME> - , [1..65535]; <LEVEL> - IS-IS: - level-1 - 1; - level-2 - 2 .
17	SPF ().	esr(config-isis)# spf-timeout <TIME> [<LEVEL>]	<TIME> — , [1..10000]; <LEVEL> — IS-IS: - level-1 - 1; - level-2 - 2 .

18	, ().	esr(config-isis)# redistribute bgp <AS> [route-map <NAME>] [is-type <LEVEL>]	<AS>- , [1..4294967295]; <NAME>- , , 31 ;
		esr(config-isis)# redistribute ipv6 bgp <AS> [route-map <NAME>] [is-type <LEVEL>]	<LEVEL> — IS-IS: - level-1 — 1 ; - level-2 — 2 .
		esr(config-isis)# redistribute ospf <ID> <ROUTE-TYPE> [route-map <NAME>] [is-type <LEVEL>]	<ID>- , [1..65535]; <ROUTE-TYPE>- - :
		esr(config-isis)# redistribute ipv6 ospf <ID> <ROUTE-TYPE> [route-map <NAME>] [is-type <LEVEL>]	- intra-area — OSPF- ; - inter-area — OSPF- ; - external1 — OSPF- 1; - external2 — OSPF- 2; <NAME>- , OSPF-, 31 ; <LEVEL> — IS-IS: - level-1 — 1 ; - level-2 — 2 .
		esr(config-isis)# redistribute isis <ID> <ROUTE-TYPE> [route-map <NAME>] [is-type <LEVEL>]	<ID>- , [1..65535]; <ROUTE-TYPE>- - : - level-1 — 1 ; - level-2 — 1 ; - inter-area — IS-IS- ; <NAME>- , IS-IS-, 31 ; <LEVEL> — IS-IS: - level-1 — 1 ; - level-2 — 2 .
		esr(config-isis)# redistribute rip [route-map <NAME>] [is-type <LEVEL>]	<NAME>- , RIP-, 31 ; <LEVEL> — IS-IS: - level-1 — 1 ; - level-2 — 2 .
		esr(config-isis)# redistribute static [route-map <NAME>] [is-type <LEVEL>]	<NAME>- , , 31 ; <LEVEL> — IS-IS: - level-1 — 1 ; - level-2 — 2 .
		esr(config-isis)# redistribute connected [route-map <NAME>] [is-type <LEVEL>]	<NAME>- , , 31 ; <LEVEL> — IS-IS: - level-1 — 1 ; - level-2 — 2 .
19	().	esr(config-isis)# prefix-list { ipv6 <LIST_NAME> <LIST_NAME> } {in out}	<LIST-NAME>- , 31 . in - ; out - .

20	(.).	esr(config-isis)# route-map <NAME> {in out}	<NAME>- , , 31 .
21	IS-IS .	esr(config-if-gi)# isis instance <ID>	<ID>- , [1..65535].
22	IS-IS .	esr(config-if-gi)# isis enable	
23	TLV#8 hello (.).	esr(config-if-gi)# isis hello-padding	
24	DIS (.).	esr(config-if-gi)# isis priority <VALUE> [<LEVEL>]	<VALUE>- , [0..127]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
25	a (.).	esr(config-if-gi)# isis metric <VALUE> [<LEVEL>]	<VALUE>- , [1..16777215]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
26	IS-IS (.).	esr(config-if-gi)# isis circuit-type {<LEVEL>}	<LEVEL>- IS-IS: - level-1 - 1 ; - level-1-2 - 1, 2 ; - level-2 - 2 .
27	hello (.).	esr(config-if-gi)# isis hello-interval <TIME> [<LEVEL>]	<TIME>- , [1..65535]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
28	Hold Time (.).	esr(config-if-gi)# isis hello-multiplier <VALUE> [<LEVEL>]	<VALUE>- , [3..1000]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
29	point-to-point IS-IS (.).	esr(config-if-gi)# isis network point-to-point	
30	CSNP (.).	esr(config-if-gi)# isis csnp-interval <TIME> [<LEVEL>]	<TIME>- , [1..65535]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
31	PSNP (.).	esr(config-if-gi)# isis psnp-interval <TIME> [<LEVEL>]	<TIME>- , [1..65535]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
32	LSP Broadcast (.).	esr(config-if-gi)# isis lsp-interval <TIME> [<LEVEL>]	<TIME>- , [1-10000]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .
33	LSP PtP (.).	esr(config-if-gi)# isis lsp-retransmit-interval <TIME> [<LEVEL>]	<TIME>- , [1..65535]; <LEVEL>- IS-IS: - level-1 - 1 ; - level-2 - 2 .

34	hello ().	esr(config-if-gi)# isis authentication algorithm <ALGORITHM> [<LEVEL>]	<ALGORITHM> - : - cleartext - , ; - md5 - md5; <LEVEL> - IS-IS: - level-1 - 1; - level-2 - 2.
35	hello ().	esr(config-if-gi)# isis authentication key ascii-text { <CLEAR-TEXT> encrypted <ENCRYPTED-TEXT> } [<LEVEL>]	<CLEAR-TEXT> - , 8; <ENCRYPTED-TEXT> - 8 (16) (0xYYYY...) (YYYY...); <LEVEL> - IS-IS: - level-1 - 1; - level-2 - 2.
36	hello ().	esr(config-if-gi)# isis authentication key chain <KEYCHAIN> [<LEVEL>]	<KEYCHAIN> - , 16; <LEVEL> - IS-IS: - level-1 - 1; - level-2 - 2.

:
IS-IS . ESR1 L1-only, ESR2 - L1/L2, ESR3 - L2-only, area.



:
IP- , .
ESR1. IS-IS 1 :

```
ESR1(config)# router isis 1
```

, :

```
ESR1(config-isis)# net 49.0001.1111.1111.1111.00
```

IS-IS:

```
ESR1(config-isis)# is-type level-1
```

:

```
ESR1(config-isis)# metric-style narrow level-1
```

IS-IS

```
ESR1(config-isis)# enable
```

. IS-IS, :

```
ESR1(config-if-gi)# isis instance 1
ESR1(config-if-gi)# isis enable
```

ESR2:

```
ESR2(config)# router isis 2
```

, ESR1, :

```
ESR2(config-isis)# net 49.0001.2222.2222.2222.00
```

, IS-IS:

```
ESR2(config-isis)# metric-style narrow level-1
ESR2(config-isis)# metric-style wide level-2
ESR2(config-isis)# enable
```

. .

```
ESR2(config-if-gi)# isis instance 2
ESR2(config-if-gi)# isis enable
```

ESR3:

```
ESR3(config)# router isis 3
ESR3(config-isis)# net 49.0002.3333.3333.3333.00
ESR3(config-isis)# is-type level-2
ESR3(config-isis)# metric-style wide level-2
ESR3(config-isis)# enable
ESR3(config-if-gi)# isis instance 3
ESR3(config-if-gi)# isis enable
```

show isis neighbors. ESR2:

```
ESR2# show isis neighbors
IS-IS 2
IS-IS Level 1 Neighbors
System ID      Hostname      Interface      State      Holdtime  SNPA
1111.1111.1111  ESR1          gi1/0/2        Up          25        a8f9.4baa.1d42
IS-IS Level 2 Neighbors
System ID      Hostname      Interface      State      Holdtime  SNPA
3333.3333.3333  ESR3          gi1/0/1        Up          8         a8f9.4bab.813a
```