GRE-

GRE (. Generic Routing Encapsulation —) — . — OSI IP-. GRE VPN 3- OSI. ESR GRE-, . .

1	L3-, GRE-.		
2	GRE- .	`esr(config)# tunnel gre <INDEX>`	<INDEX> – : • ESR-10/12V(F)/14VF – [1..10]; • ESR-20/21/100/200 – [1..250]; • ESR-1000/1200/1500/1700 – [1..500].
3	VRF, GRE- ( ).	`esr(config-gre )# ip vrf forwarding <VRF>`	<VRF> – VRF, 31 .
4	( ).	`esr(config-gre)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
5	IP- .	`esr(config-gre)# local address <ADDR>`	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255].
		`esr(config-gre)# local interface <IF>`	<IF> – , IP- .
6	IP- .	`esr(config-gre)# remote address <ADDR>`	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255].
7	GRE .	`esr(config-gre)# mode <MODE>`	<MODE> – GRE : • **ip** – IP- GRE; • **ethernet** – Ethernet- GRE. : ip
8	IP- (ip).	`esr(config-gre)# ip address <ADDR/LEN>`	<ADDR/LEN> – IP- AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32]. 8 IP- . IPv4- . IP-.
9	GRE- (ethernet).	`esr(config-gre)# bridge-group <BRIDGE-ID>`	<BRIDGE-ID> – , : • ESR-10/12V(F)/14VF – [1..50]; • ESR-20/21/100/200 – [1..250]; • ESR-1000/1200/1500/1700 – [1..500]
10	GRE- firewall (. Firewall).	`esr(config-gre)# security-zone<NAME>`	<NAME> – , 12 .

		esr(config-gre)# ip firewall disable	
11	MTU (MaximumTransmitionUnit) ( ). MTU 1500 "system jumbo-frames"	esr(config-gre)# mtu <MTU>	<MTU> – MTU, : • ESR-10/12V(F)/14VF – [1280..9600]; • ESR-20/21 – [1280..9500]; • ESR-100/200/1000/1200/1500/1700 [1280..10000]. : 1500.
12	TTL ( ).	esr(config-gre)# ttl <TTL>	<TTL> – TTL, [1..255]. : .
13	DSCP IP- ( ).	esr(config-gre)# dscp <DSCP>	<DSCP> – DSCP, [0..63]. : .
14	(Key) GRE (RFC 2890) . . ( ).	esr(config-gre)# key <KEY>	<KEY> – KEY, [1..2000000]. : .
15	GRE- . . ( )	esr(config-gre)# local checksum	
16	GRE-. . ( )	esr(config-gre)# remote checksum	
17	( )	esr(config-gre)# keepalive enable	
18	keepalive ( )	esr(config-gre)# keepalive timeout <TIME>	<TIME> – , [1..32767]. : 10
19	( )	esr(config-gre)# keepalive retries <VALUE>	<VALUE> – , [1..255]. : 5
20	IP- keepalive (ethernet)	esr(config-gre)# keepalive dst-address <ADDR>	<ADDR> – IP- GRE-.
21	, ( )	esr(config-gre)# load-average <TIME>	<TIME> – , [5..150]. : 5
22	snmp-trap / .	esr(config-gre)# snmp init-trap	
23	IP- DHCP GRE- keepalive ( )	esr(config-gre)# keepalive dhcp dependent-interface <IF>	<IF> – / , IP- DHCP
24	GRE- IP- /, keepalive dhcp dependent-interface ( )	esr(config-gre)# keepalive dhcp link-timeout <SEC>	<SEC> – GRE- IP- DHCP
25	MSS (Maximum segment size) TCP- ( ).	esr(config-gre)# ip tcp adjust-mss <MSS>	<MSS> – MSS, [500..1460]. : 1460
26	( ).	esr(config-gre)# history statistics	
27	.	esr(config-gre)# enable	

GRE- :

- QoS (. QoS);
- proxy (. HTTP/HTTPS-);
- (. Netflow sFlow);
- (.);
- BRAS (. BRAS (Broadband Remote Access Server));

IP-GRE-

:

L3-VPN IP-, GRE.

- IP- 115.0.0.1;
- IP- 114.0.0.10;
- IP- 25.0.0.1/24.

:

WAN GRE , , WAN.

GRE 10:

```
esr(config)# tunnel gre 10
```

(IP- , WAN):

```
esr(config-gre)# local address 115.0.0.1
esr(config-gre)# remote address 114.0.0.10
```

IP- 25.0.0.1/24:

```
esr(config-gre)# ip address 25.0.0.1/24
```

, , firewall. :

```
esr(config-gre)# security-zone untrusted
```

:

```
esr(config-gre)# enable
esr(config-gre)# exit
```

. GRE:

```
esr(config)# ip route 172.16.0.0/16 tunnel gre 10
```

, GRE- .

GRE- :

- GRE :

  ```
  esr(config-gre)# local checksum
  ```

- GRE :

  ```
  esr(config-gre)# remote checksum
  ```

- :

  ```
  esr(config-gre)# key 15808
  ```

- DSCP, MTU, TTL:

```
esr(config-gre)# dscp 44
esr(config-gre)# mtu 1426
esr(config-gre)# ttl 18
```

- keepalive:

```
esr(config-gre)# keepalive enable
esr(config-gre)# keepalive timeout <TIME>
esr(config-gre)# keepalive retries <VALUE>
```

:

```
esr# show tunnels status gre 10
```

:

```
esr# show tunnels counters gre 10
```

:

```
esr# show tunnels configuration gre 10
```

IPv4-over-IPv4 .

firewall GRE(47).

DMVPN

DMVPN (*Dynamic Multipoint Virtual Private Network*) – , . . DMVPN Hub-and-Spoke, VPN Spoke-to-Spoke Spoke-to-Hub . , , Hub.

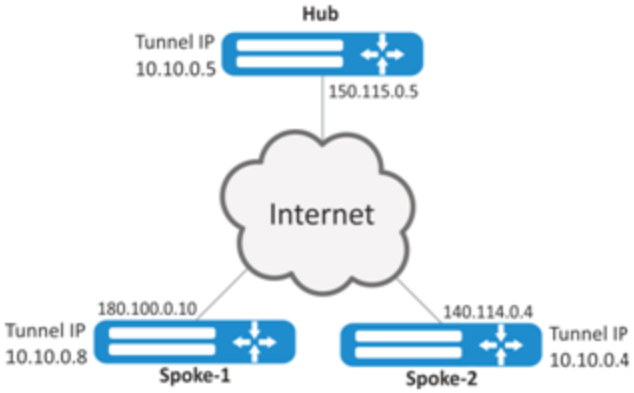
, (NHC) IPsec- () (NBMA) NHRP- (NHS). NHC, , . , c .

1	“” IP-, .		
2	IPsec- GRE-.		. Policy-based IPsec VPN.
2	GRE- .	`esr(config)# tunnel gre <INDEX>`	<INDEX> – .
3	GRE- multipoint.	`esr(config-gre )# multipoint`	
4	NHRP ( ).	`esr(config-gre)# ip nhrp authentication <WORD>`	<WORD> – , [1..8] , [0-9a-fA-F].
5	, NHS ( ).	`esr(config-gre)# ip nhrp holding-time <TIME>`	<TIME> – , , [1..65535]. : 7200
6	«()» NHRP .	`esr(config-gre)# ip nhrp nhs <ADDR> [ no-registration ]`	<ADDR/LEN> – , AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32]; • **no - registration** — NHRP .
7	«» «» NBMA .	`esr(config-gre)# ip nhrp map <ADDR> <ADDR>`	<ADDR> – IP- AAA.BBB.CCC.DDD, [0..255].

8	.	`esr(config-gre)# ip nhrp multicast { dynamic | nhs | <ADDR> }`	• **dynamic** — , ; • **nhs** — ; <ADDR> — , AAA.BBB.CCC.DDD, [0..255].
9	NHRP Traffic Indication . NHS ( ).	`esr(config-gre)# ip nhrp redirect`	
10	. NHC( ).	`esr(config-gre)# ip nhrp shortcut`	
11	IPsec-VPN mGRE ( ).	`esr(config-gre)# ip nhrp ipsec <WORD> { static | dynamic }`	<WORD> – VPN, 31 ; • **static** — , NHS; • **dynamic** — , NHC.
12	NHRP.	`esr(config-gre)# ip nhrp enable`	
13	IP- .		
- GRE- (. GRE-)			

:

DMVPN , mGRE-, NHRP (Next Hop Resolution Protocol), (BGP), Ipsec. HUB . HUB – DMVPN c (NHS), – DMPVN (NHC).



Hub IP- — 150.115.0.5;

Spoke-1 IP- — 180.100.0.10;

Spoke-2 IP- — 140.114.0.4.

IPsec VPN:

IKE:

- -: 2;
- : AES128;
- : SHA1.

IPsec:

- : AES128;
- : SHA1.

:

1. Hub
   GRE:

```
esr# configure
esr(config)# tunnel gre 5
```

   IP- , ISP:

```
esr(config-gre)# local address 150.115.0.5
```

MTU:

```
esr(config-gre)# mtu 1416
```

ttl:

```
esr(config-gre)# ttl 16
```

IP- GRE :

```
esr(config-gre)# ip address 10.10.0.5/24
```

GRE- mutipoint :

```
esr(config-gre)# multipoint
```

NHRP. :

```
esr(config-gre)# ip nhrp multicast dynamic
```

Hub. BGP:

```
esr(config)# router bgp 65005
esr(config-bgp)# address-family ipv4
esr(config-bgp-af)# neighbor 10.10.0.8
esr(config-bgp-neighbor)# remote-as 65008
esr(config-bgp-neighbor)# enable
esr(config-bgp-neighbor)# exit
esr(config-bgp-af)# neighbor 10.10.0.4
esr(config-bgp-neighbor)# remote-as 65004
esr(config-bgp-neighbor)# enable
esr(config-bgp-neighbor)# exit
esr(config-bgp-af)# enable
```

IPsec Hub:

```
esr(config)# security ike proposal IKEPROP
esr(config-ike-proposal)# encryption algorithm aes128
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# exit
```

```
esr(config)# security ike policy IKEPOLICY
esr(config-ike-policy)# pre-shared-key ascii-text encrypted 8CB5107EA7005AFF
esr(config-ike-policy)# proposal IKEPROP
esr(config-ike-policy)# exit
```

```
esr(config)# security ike gateway IKEGW
esr(config-ike-gw)# ike-policy IKEPOLICY
esr(config-ike-gw)# local address 150.115.0.5
esr(config-ike-gw)# local network 150.115.0.5/32 protocol gre
esr(config-ike-gw)# remote address any
esr(config-ike-gw)# remote network any
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# exit
```

```
esr(config)# security ipsec proposal IPSECPROP
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

```
esr(config)# security ipsec policy IPSECPOLICY
esr(config-ipsec-policy)# proposal IPSECPROP
esr(config-ipsec-policy)# exit
```

```
esr(config)# security ipsec vpn IPSECVPN
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel route
esr(config-ipsec-vpn)# ike gateway IKEGW
esr(config-ipsec-vpn)# ike ipsec-policy IPSECPOLICY
esr(config-ipsec-vpn)# enable
```

IPsec GRE , :

```
esr(config-gre)# ip nhrp ipsec IPSECVPN dynamic
```

NHRP :

```
esr(config-gre)# ip nhrp enable
esr(config-gre)# enable
```

2. Spoke

   DMVPN :

```
esr# configure
esr(config-gre)# tunnel gre 8
esr(config-gre)# mtu 1416
esr(config-gre)# ttl 16
esr(config-gre)# multipoint
esr(config-gre)# local address 180.100.0.10
esr(config-gre)# ip address 10.10.0.8/24
```

   :

```
esr(config-gre)# ip nhrp holding-time 300
```

   NHS:

```
esr(config-gre)# ip nhrp nhs 10.10.0.5/24
```

   – :

```
esr(config-gre)# ip nhrp map 10.10.0.5 150.115.0.5
```

NHRP :

```
esr(config)# ip nhrp multicast nhs
```

BGP spoke:

```
esr(config)# router bgp 65008
esr(config-bgp)# address-family ipv4
esr(config-bgp-af)# neighbor 10.10.0.5
esr(config-bgp-neighbor)# remote-as 65005
esr(config-bgp-neighbor)# enable
esr(config-bgp-neighbor)# exit
esr(config-bgp-af)# enable
```

IPsec. IKE NHS, . A IKE NHC – any:

```
esr(config)# security ike proposal IKEPROP
esr(config-ike-proposal)# encryption algorithm aes128
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# exit
```

```
esr(config)# security ike policy IKEPOLICY
esr(config-ike-policy)# pre-shared-key ascii-text encrypted 8CB5107EA7005AFF
esr(config-ike-policy)# proposal IKEPROP
esr(config-ike-policy)# exit
```

```
esr(config)# security ike gateway IKEGW_HUB
esr(config-ike-gw)# ike-policy IKEPOLICY
esr(config-ike-gw)# local address 180.100.0.10
esr(config-ike-gw)# local network 180.100.0.10/32 protocol gre
esr(config-ike-gw)# remote address 150.115.0.5
esr(config-ike-gw)# remote network 150.115.0.5/32 protocol gre
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# exit
```

```
esr(config)# security ike gateway IKEGW_SPOKE
esr(config-ike-gw)# ike-policy IKEPOLICY
esr(config-ike-gw)# local address 180.100.0.10
esr(config-ike-gw)# local network 180.100.0.10/32 protocol gre
esr(config-ike-gw)# remote address any
esr(config-ike-gw)# remote network any
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# exit
```

```
esr(config)# security ipsec proposal IPSECPROP
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

```
esr(config)# security ipsec policy IPSECPOLICY
esr(config-ipsec-policy)# proposal IPSECPROP
esr(config-ipsec-policy)# exit
```

```
esr(config)# security ipsec vpn IPSECVPN_HUB
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel route
esr(config-ipsec-vpn)# ike gateway IKEGW_HUB
esr(config-ipsec-vpn)# ike ipsec-policy IPSECPOLICY
esr(config-ipsec-vpn)# enable
```

```
esr(config)# security ipsec vpn IPSECVPN_SPOKE
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel route
esr(config-ipsec-vpn)# ike gateway IKEGW_SPOKE
esr(config-ipsec-vpn)# ike ipsec-policy IPSECPOLICY
esr(config-ipsec-vpn)# enable
```

IPsec GRE , :

```
esr(config-gre)# ip nhrp ipsec IPSECVPN_HUB static
esr(config-gre)# ip nhrp ipsec IPSECVPN_SPOKE dynamic
```

NHRP :

```
esr(config-gre)# ip nhrp enable
esr(config-gre)# enable
```

NHRP :

```
esr# show ip nhrp
```

NHRP :

```
esr# clear ip nhrp
```

L2TPv3-

L2TPv3 (Layer 2 Tunneling Protocol Version 3) – 2- OSI IP-. IP UDP. L2TPv3 MPLS P2P L2VPN (VLL) VPN L2. ESR L2TPv3-, .
.

1	L3-, L2TPv3-.		
2	L2TPv3- .	`esr(config)# tunnel l2tpv3 <INDEX>`	<INDEX> – : • ESR-10/12V(F)/14VF – [1..10]; • ESR-20/21/100/200 – [1..250]; • ESR-1000/1200/1500/1700 – [1..500].
3	( ).	`esr(config-l2tpv3)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
4	IP- .	`esr(config-l2tpv3)# local address <ADDR>`	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255].
5	IP- .	`esr(config-l2tpv3)# remote address <ADDR>`	<ADDR> – IP- , AAA.BBB.CCC.DDD, [0..255].
6	L2TPv3.	`esr(config-l2tpv3)# protocol <TYPE>`	<TYPE> – , : • **ip** - IP-; • **udp** UDP-.

7	.	`esr(config-l2tpv3)# local session-id <SESSION-ID>`	<SESSION-ID> – , [1..200000].
8	.	`esr(config-l2tpv3)# remote session-id <SESSION-ID>`	<SESSION-ID> – , [1..200000].
9	UDP- (UDP).	`esr(config-l2tpv3)# local port <UDP>`	<UDP> – UDP- [1..65535].
10	UDP- (UDP).	`esr(config-l2tpv3)# remote port <UDP>`	<UDP> – UDP- [1..65535].
11	L2TPV3- .	`esr(config-l2tpv3)# bridge-group <BRIDGE-ID>`	<BRIDGE-ID> – , : • ESR-10/12V(F)/14VF – [1..50]; • ESR-20/21/100/200 – [1..250]; • ESR-1000/1200/1500/1700 – [1..500]
12	.	`esr(config-l2tpv3)# enable`	
13	MTU (MaximumTransmitionUnit) ( ). MTU 1500 "system jumbo-frames"	`esr(config-l2tpv3)# mtu <MTU>`	<MTU> – MTU, : • ESR-10/12V(F)/14VF – [1280..9600]; • ESR-20/21 – [1280..9500]; • ESR-100/200/1000/1200/1500/1700 [1280..10000]. : 1500.
14	cookie ( ).	`esr(config-l2tpv3)# local cookie <COOKIE>`	<COOKIE> – COOKIE, .
15	cookie ( ).	`esr(config-l2tpv3)# remote cookie <COOKIE>`	<COOKIE> – COOKIE, .
16	, ( ).	`esr(config-l2tpv3)# load-average <TIME>`	<TIME> – , [5..150]. : 5.
17	( ).	`esr(config-subif)# history statistics`	

L2TPv3- :

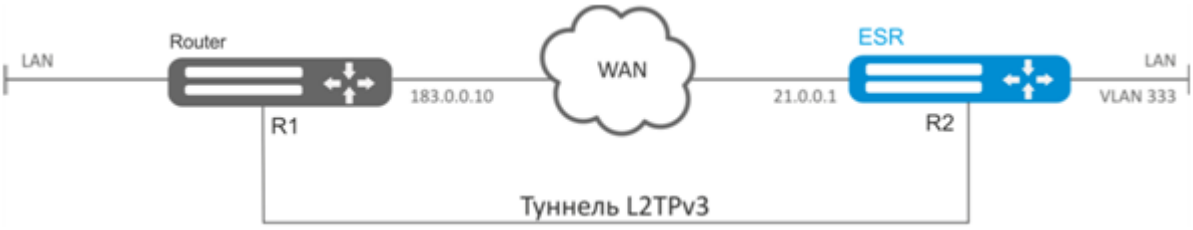
- QoS (. QoS);
- BRAS (. BRAS (Broadband Remote Access Server)).

L2TPv3-

:

L2 VPN IP-, L2TPv3.

- UDP, 519;
- IP- 21.0.0.1;
- IP- 183.0.0.10;
- 2, 3;
- 100, 200;
- bridge 333.



:

L2TPv3 333:

```
esr# configure
esr(config)# tunnel l2tpv3 333
```

(IP- , WAN):

```
esr(config-l2tpv3)# local address 21.0.0.1
esr(config-l2tpv3)# remote address 183.0.0.10
```

UDP-:

```
esr(config-l2tpv3)# protocol udp
esr(config-l2tpv3)# local port 519
esr(config-l2tpv3)# remote port 519
```

:

```
esr(config-l2tpv3)# local session-id 100
esr(config-l2tpv3)# remote session-id 200
```

L2TPv3- , (bridge VLAN L2TPv3-):

```
esr(config-l2tpv3)# bridge-group 333
```

:

```
esr(config-l2tpv3)# enable
esr(config-l2tpv3)# exit
```

- , , VLAN id 333:

```
esr(config)# interface gi 1/0/2.333
```

- , (PPP E1):

```
esr(config-subif)# bridge-group 333
esr(config-subif)# exit
```

, L2TPv3 .

. IP- 183.0.0.10. IP- 21.0.0.1. 519. 200, 100. , .

:

```
esr# show tunnels status l2tpv3 333
```

:

```
esr# show tunnels counters l2tpv3 333
```

:

```
esr# show tunnels configuration l2tpv3 333
```

⚠ firewall UDP 519 519.

IPsec VPN

IPsec – , IP- . (), IP-, .

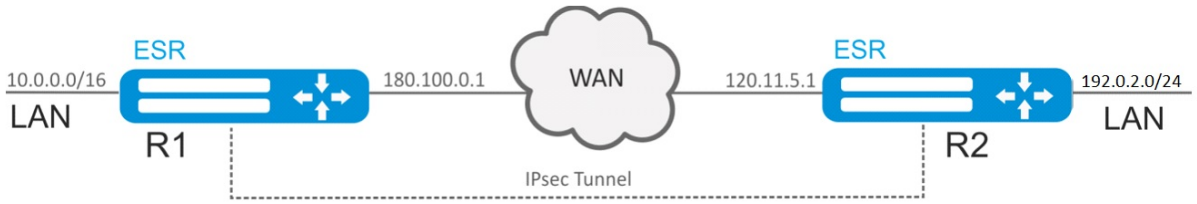
Route-based IPsec VPN

1	VTI- .	`esr(config)# tunnel vti <TUN>`	<TUN> – .
2	IP- VTI-.	`esr(config-vti)#local address <ADDR>`	<ADDR> – IP- .
3	IP- VTI-.	`esr(config-vti)#remote address <ADDR>`	<ADDR> – IP- .
4	IP- VTI-	`esr(config-vti)# ip address <ADDR/LEN>`	<ADDR/LEN> – IP- AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32].
5	VTI- firewall VTI-.	`esr(config-vti)# security-zone<NAME>` `esr(config-vti)# ip firewall disable`	<NAME> – , 12 .
6	.	`esr(config-vti)#enable`	
7	IKE- .	`esr(config)# security ike proposal <NAME>`	<NAME> – IKE, 31 .
8	IKE- ( ).	`esr(config-ike- proposal)# description<DESCRIPTION>`	<DESCRIPTION> – , 255 .
9	IKE. ( )	`esr(config-ike- proposal)# authentication algorithm <ALGORITHM>`	<ALGORITHM> – , : md5, sha1, sha2-256, sha2384, sha2-512. : sha1
10	IKE. ( )	`esr(config-ike- proposal)# encryption algorithm <ALGORITHM>`	<ALGORITHM> – , : des, 3des, blowfish128, blowfish192, blowfish256, aes128, aes192, aes256, aes128ctr, aes192ctr, aes256ctr, camellia128, camellia192, camellia256. : 3des
11	-. ( )	`esr(config-ike- proposal)# dh-group <DH-GROUP>`	<DH-GROUP> – -, [1, 2, 5, 14, 15, 16, 17, 18]. : 1
12	IKE. ( )	`esr(config-ike- proposal)# authentication method <METHOD>`	<METHOD> – . : • **pre - shared - key** – , ; • **rsa - public - key** – , RSA-. : pre-shared-key
13	ike- .	`esr(config)# security ike policy <NAME>`	<NAME> – IKE, 31 .
14	IKE ( ).	`esr(config-ike- proposal)# lifetime seconds <SEC>`	<SEC> – , [4 ..86400] . : 3600
15	IKE- IKE-.	`esr(config-ike-policy)# proposal <NAME>`	<NAME> – IKE, 31 .
16	. (, pre-shared-key)	`esr(config-ike-policy)# pre-shared-key ascii-text<TEXT>`	<TEXT> – [1..64] ASCII .
17	IKE- .	`esr(config)# security ike gateway <NAME>`	<NAME> – IKE, 31 .
18	IKE- IKE-.	`esr(config-ike-gw)# ike-policy <NAME>`	<NAME> – IKE, 31 .
19	IKE ( ).	`esr(config-ike-gw)# version <VERSION>`	<version> – IKE-: v1-only v2-only. : v1-only

20	– route-based.	`esr(config-ike-gw)# mode route-based`	
21	DPD ( ).	`esr(config-ike-gw)# dead-peer-detection action <MODE>`	<MODE> – DPD: • **restart** – ; • **clear** – ; • **hold** – ; • **none** – , . : none
22	DPD ( ).	`esr(config-ike-gw)# dead-peer-detection interval <SEC>`	<SEC> – DPD, [1..180] . : 2
23	DPD ( ).	`esr(config-ike-gw)# dead-peer-detection timeout <SEC>`	<SEC> – DPD, [1..180] . : 30
24	VTI- IKE-.	`esr(config-ike-gw)# bind-interface vti <VTI>`	<VTI> – VTI.
25	IPsec-.	`esr(config)# security ipsec proposal <NAME>`	<NAME> – IPsec, 31 .
26	IPsec. ( )	`esr(config-ipsec- proposal)# authentication algorithm <ALGORITHM>`	<ALGORITHM> – , : md5, sha1, sha2-256, sha2384, sha2-512. : sha1
27	IPsec. ( )	`esr(config-ipsec- proposal)# encryption algorithm <ALGORITHM>`	<ALGORITHM> – , : des, 3des, blowfish128, blowfish192, blowfish256, aes128, aes192, aes256, aes128ctr, aes192ctr, aes256ctr, camellia128, camellia192, camellia256. : 3des
28	IPsec ( ).	`esr(config-ipsec- proposal)# protocol <PROTOCOL>`	<PROTOCOL> – , : esp
29	IPsec- .	`esr(config)# security ipsec policy <NAME>`	<NAME> – IPsec, 31 .
30	IPsec- IPsec-	`esr(config-ipsec-policy)# proposal <NAME>`	<NAME> – IPsec, 31 .
31	IPsec- ( ).	`esr(config-ipsec- policy)# lifetime { seconds <SEC> | packets <PACKETS> | kilobytes <KB> }`	<SEC> – IPsec-, . [1140..86400] . <PACKETS> – , IPsec-. [4..86400]. <KB> – , IPsec-. [4..86400] . : 28800
32	IPsec VPN .	`esr(config)# security ipsec vpn <NAME>`	<NAME> – VPN, 31 .
33	, VPN.	`esr(config-ipsec-vpn)# mode <MODE>`	<MODE> – VPN.
34	IPsec- IPsec-VPN.	`esr(config-ipsec-vpn)# ike ipsec-policy <NAME>`	<NAME> – IPsec-, 31 .
35	DSCP IP- IKE- ( ).	`esr(config-ipsec-vpn)# ike dscp <DSCP>`	DSCP> – DSCP, [0..63]. : 63
36	VPN.	`esr(config-ipsec-vpn)# ike establish-tunnel <MODE>`	<MODE> – VPN: • **by - request** – ; • **route** – , ; • **immediate** – .
37	IKE- IPsec-VPN.	`esr(config-ipsec-vpn)# ike gateway <NAME>`	<NAME> – IKE-, 31 .
38	, , SA ( ).	`esr(config-ipsec-vpn)# ike idle-time <TIME>`	<TIME> – , [4..86400].

39	IKE- , ( ).	`esr(config-ipsec-vpn)# ike rekey disable`	
40	IKE- ( ).	`esr(config-ipsec-vpn)# ike rekey margin { seconds <SEC> | packets <PACKETS> | kilobytes <KB> }`	<SEC> – , (lifetimeseconds, . 22.2.13). [4..86400]. <PACKETS> – , (lifetimepackets). [4..86400] <KB> – , (lifetimekilobytes). [4..86400] : • – 540 . • – .
41	margin seconds, margin packets, margin kilobytes ( ).	`esr(config-ipsec-vpn)# ike rekey randomization <VALUE>`	<VALUE> – , [1..100]. : 100%
42	IPsec-VPN ( ).	`esr(config-ipsec-vpn)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
43	IPsec VPN.	`esr(config-ipsec-vpn)# enable`	

Route-based IPsec VPN



:

IPsec- R1 R2.

- R1 IP- – 120.11.5.1;
- R2 IP- – 180.100.0.1;

IKE:

- -: 2;
- : AES 128 bit;
- : MD5.

IP sec:

- : AES 128 bit;
- : MD5.

:

1. R1
   :

```
esr# configure
esr(config)# interface gi 1/0/1
esr(config-if-gi)# ip address 180.100.0.1/24
esr(config-if-gi)# security-zone untrusted
esr(config-if-gi)# exit
```

VTI. VTI IPsec-. IP- , WAN:

```
esr(config)# tunnel vti 1
esr(config-vti)# local address 180.100.0.1
esr(config-vti)# remote address 120.11.5.1
esr(config-vti)# enable
esr(config-vti)# exit
```

ISAKMP:

```
esr(config)# object-group service ISAKMP
esr(config-object-group-service)# port-range 500
esr(config-object-group-service)# exit
```

LAN-. , IPsec-, VTI-:

```
esr(config)# ip route 192.0.2.0/24 tunnel vti 1
```

IKE. - 2, AES 128 bit, MD5. IKE-:

```
esr(config)# security ike proposal ike_prop1
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# authentication algorithm md5
esr(config-ike-proposal)# encryption algorithm aes128
esr(config-ike-proposal)# exit
```

IKE. IKE, :

```
esr(config)# security ike policy ike_pol1
esr(config-ike-policy)# pre-shared-key hexadecimal 123FFF
esr(config-ike-policy)# proposal ike_prop1
esr(config-ike-policy)# exit
```

IKE. VTI-, , :

```
esr(config)# security ike gateway ike_gw1
esr(config-ike-gw)# ike-policy ike_pol1
esr(config-ike-gw)# mode route-based
esr(config-ike-gw)# bind-interface vti 1
esr(config-ike-gw)# version v2-only
esr(config-ike-gw)# exit
```

IPsec-. AES 128 bit, MD5. IPsec-:

```
esr(config)# security ipsec proposal ipsec_prop1
esr(config-ipsec-proposal)# authentication algorithm md5
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

IPsec-. IPsec-, .

```
esr(config)# security ipsec policy ipsec_pol1
esr(config-ipsec-policy)# proposal ipsec_prop1
esr(config-ipsec-policy)# exit
```

IPsec VPN. VPN IKE-, IP sec-, . *enable.*

```
esr(config)# security ipsec vpn ipsec1
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel route
esr(config-ipsec-vpn)# ike gateway ike_gw1
esr(config-ipsec-vpn)# ike ipsec-policy ipsec_pol1
esr(config-ipsec-vpn)# enable
esr(config-ipsec-vpn)# exit
esr(config)# exit
```

2. R2

:

```
esr# configure
esr(config)# interface gi 1/0/1
esr(config-if)# ip address 120.11.5.1/24
esr(config-if)# security-zone untrusted
esr(config-if)# exit
```

VTI. VTI IPsec-. IP- , WAN:

```
esr(config)# tunnel vti 1
esr(config-vti)# remote address 180.100.0.1
esr(config-vti)# local address 120.11.5.1
esr(config-vti)# enable
esr(config-vti)# exit
```

ISAKMP:

```
esr(config)# object-group service ISAKMP
esr(config-object-group-service)# port-range 500
esr(config-object-group-service)# exit
```

LAN-. , IPsec-, VTI-:

```
esr(config)# ip route 10.0.0.0/16 tunnel vti 1
```

IKE. - 2, AES 128 bit, MD5. IKE-:

```
esr(config)# security ike proposal ike_prop1
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# authentication algorithm md5
esr(config-ike-proposal)# encryption algorithm aes128
esr(config-ike-proposal)# exit
esr(config)#
```

IKE. IKE, :

```
esr(config)# security ike policy ike_pol1
esr(config-ike-policy)# pre-shared-key hexadecimal 123FFF
esr(config-ike-policy)# proposal ike_prop1
esr(config-ike-policy)# exit
```

IKE. VTI-, , :

```
esr(config)# security ike gateway ike_gw1
esr(config-ike-gw)# ike-policy ike_pol1
esr(config-ike-gw)# mode route-based
esr(config-ike-gw)# bind-interface vti 1
esr(config-ike-gw)# version v2-only
esr(config-ike-gw)# exit
```

IPsec-. AES 128 bit, MD5. IPsec-:

```
esr(config)# security ipsec proposal ipsec_prop1
esr(config-ipsec-proposal)# authentication algorithm md5
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

IPsec-. IPsec-, .

```
esr(config)# security ipsec policy ipsec_pol1
esr(config-ipsec-policy)# proposal ipsec_prop1
esr(config-ipsec-policy)# exit
```

IPsec VPN. VPN IKE-, IP sec-, . *enable.*

```
esr(config)# security ipsec vpn ipsec1
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel route
esr(config-ipsec-vpn)# ike gateway ike_gw1
esr(config-ipsec-vpn)# ike ipsec-policy ipsec_pol1
esr(config-ipsec-vpn)# enable
esr(config-ipsec-vpn)# exit
esr(config)# exit
```

:

```
esr# show security ipsec vpn status ipsec1
```

:

```
esr# show security ipsec vpn configuration ipsec1
```

firewall ESP ISAKMP (UDP- 500).

Policy-based IPsec VPN

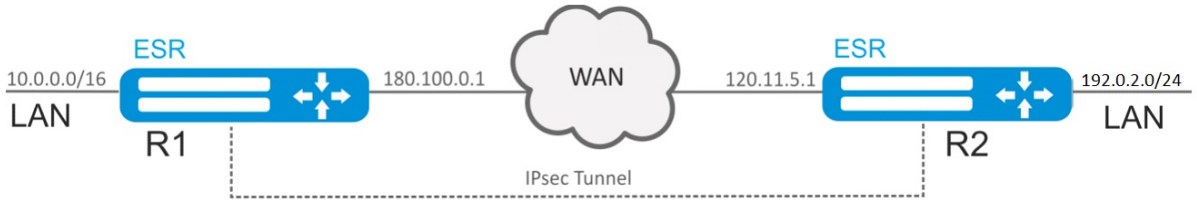
1	IKE- .	`esr(config)# security ike proposal <NAME>`	<NAME> – IKE, 31 .
2	( ).	`esr(config-ike- proposal)# description<DESCRIPTION>`	<DESCRIPTION> – , 255 .
3	IKE.	`esr(config-ike- proposal)# authentication algorithm <ALGORITHM>`	<ALGORITHM> – , : md5, sha1, sha2-256, sha2384, sha2-512.
4	IKE.	`esr(config-ike- proposal)# encryption algorithm <ALGORITHM>`	<ALGORITHM> – , : des, 3des, blowfish128, blowfish192, blowfish256, aes128, aes192, aes256, aes128ctr, aes192ctr, aes256ctr, camellia128, camellia192, camellia256.
5	-.	`esr(config-ike- proposal)# dh-group <DH-GROUP>`	<DH-GROUP> – -, [1, 2, 5, 14, 15, 16, 17, 18].
6	.	`esr(config-ike- proposal)# authentication method <METHOD>`	<METHOD> – . : • **pre - shared - key** – , ; • **rsa - public - key** – , RSA-.
7	IKE .	`esr(config)# security ike policy <NAME>`	<NAME> – IKE, 31 .
8	IKE ( ).	`esr(config-ike- proposal)# lifetime seconds <SEC>`	<SEC> – , [4 ..86400] .
9	.	`esr(config-ike-policy)# proposal <NAME>`	<NAME> – IKE, 31 .

10	.	esr(config-ike-policy)#pre-shared-key ascii-text<TEXT>	<TEXT> – [1..64] ASCII .
11	IKE .	esr(config)# security ike gateway <NAME>	<NAME> – IKE, 31 .
12	IKE.	esr(config-ike-gw)# ike-policy <NAME>	<NAME> – IKE, 31 .
13	IKE ( ).	esr(config-ike-gw)# version <VERSION>	<version> – IKE-: **v1-only v2-only**.
14	.	esr(config-ike-gw)#mode<MODE>	<MODE> – , : • **policy - based** – ; • **route - based** – , .
15	DPD ( ).	esr(config-ike-gw)# dead-peer-detection action <MODE>	<MODE> – DPD: • **restart** – ; • **clear** – ; • **hold** – ; • **none** – , .
16	DPD ( ).	esr(config-ike-gw)#dead-peer-detection interval <SEC>	<SEC> – DPD, [1..180] .
17	DPD ( ).	esr(config-ike-gw)# dead-peer-detection timeout <SEC>	<SEC> – DPD, [1..180] .
18	IKE ( ).	esr(config-ike-gw)# version <VERSION>	<version> – IKE-: **v1-only v2-only**.
19	IP .	esr(config-ike-gw)# local network <ADDR/LEN> [protocol { <TYPE> | <ID> } [port <PORT>]]	<ADDR/LEN> – IP- . AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32]; <TYPE> – , : esp, icmp, ah, eigrp, ospf, igmp, ipip, tcp, pim, udp, vrrp, rdp, l2tp, gre; <ID> – IP-, [0x00-0xFF]; <PORT> – TCP/UDP , [1..65535].
20	IP- IPsec-.	esr(config-ike-gw)#local address <ADDR>	<ADDR> – IP- .
21	IP- IPsec-.	esr(config-ike-gw)#remote address <ADDR>	<ADDR> – IP- .
22	IP- , IP- .	esr(config-ike-gw)# remote network <ADDR/LEN> [protocol { <TYPE> | <ID> } [port <PORT>]]	<ADDR/LEN> – IP- . AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32]; <TYPE> – , : esp, icmp, ah, eigrp, ospf, igmp, ipip, tcp, pim, udp, vrrp, rdp, l2tp, gre; <ID> – IP-, [0x00-0xFF]; <PORT> – TCP/UDP , [1..65535].
23	IPsec.	esr(config)# security ipsec proposal <NAME>	<NAME> – IPsec, 31 .
24	IPsec.	esr(config-ipsec- proposal)# authentication algorithm <ALGORITHM>	<ALGORITHM> – , : md5, sha1, sha2-256, sha2384, sha2-512.
26	IPsec.	esr(config-ipsec- proposal)# encryption algorithm <ALGORITHM>	<ALGORITHM> – , : des, 3des, blowfish128, blowfish192, blowfish256, aes128, aes192, aes256, aes128ctr, aes192ctr, aes256ctr, camellia128, camellia192, camellia256.
26	( ).	esr(config-ipsec- proposal) #protocol <PROTOCOL>	<PROTOCOL> – ,
27	IPsec	esr(config)# security ipsec policy <NAME>	<NAME> – IPsec, 31 .
28		esr(config-ipsec-policy)# proposal <NAME>	<NAME> – IPsec, 31 .

29	IPsec ( ).	`esr(config-ipsec- policy)# lifetime { seconds <SEC> | packets <PACKETS> | kilobytes <KB> }`	<SEC> – IPsec-, . [1140..86400] . <PACKETS> – , IPsec-. [4..86400]. <KB> – , IPsec-. [4..86400] .
30	IPsec VPN .	`esr(config)# security ipsecvpn <NAME>`	<NAME> – VPN, 31 .
31	, VPN.	`esr(config-ipsec-vpn)# mode <MODE>`	<MODE> – VPN.
32	IPsec VPN.	`esr(config-ipsec-vpn)#ike ipsec-policy <NAME>`	<NAME> – IPsec-, 31 .
33	DSCP IP- IKE- ( ).	`esr(config-ipsec-vpn)#ike dscp <DSCP>`	DSCP> – DSCP, [0..63].
34	VPN.	`esr(config-ipsec-vpn)#ike establish-tunnel <MODE>`	<MODE> – VPN: • **by - request** – ; • **route** – , ; • **immediate** – .
35	IKE- VPN.	`esr(config-ipsec-vpn)# ike gateway <NAME>`	<NAME> – IKE-, 31 .
36	, , SA ( ).	`esr(config-ipsec-vpn)# ike idle-time <TIME>`	<TIME> – , [4..86400].
37	IKE , ( ).	`esr(config-ipsec-vpn)#ike rekey disable`	
38	IKE ( ).	`esr(config-ipsec-vpn)# Ike rekey margin { seconds <SEC> | packets <PACKETS> | kilobytes <KB> }`	<SEC> – , (lifetimeseconds) . [4..86400]. <PACKETS> – , (lifetimepackets). [4..86400]. <KB> – , (lifetimekilobytes). [4..86400]
39	marginseconds, marginpackets, marginkilobytes ( ).	`esr(config-ipsec-vpn)# ike rekey randomization <VALUE>`	<VALUE> – , [1..100].
40	VPN ( ).	`esr(config-ipsec-vpn)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
41	IPsec VPN.	`esr(config-ipsec-vpn)# enable`	

Policy-based IPsec VPN

:



IPsec- R1 R2.

R1 IP- – 120.11.5.1;

R2 IP- – 180.100.0.1;

IKE:

- -: 2;
- : AES 128 bit;
- : MD5.

IPsec:

- : AES 128 bit;
- : MD5.

:

1. R1

   :

```
esr# configure
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# ip address 120.11.5.1/24
esr(config-if-gi)# security-zone untrusted
esr(config-if-gi)# exit
```

   ISAKMP:

```
esr(config)# object-group service ISAKMP
esr(config-object-group-service)# port-range 500
esr(config-object-group-service)# exit
```

   IKE. - 2, AES 128 bit, MD5. IKE-:

```
esr(config)# security ike proposal ike_prop1
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# authentication algorithm md5
esr(config-ike-proposal)# encryption algorithm aes128
esr(config-ike-proposal)# exit
```

   IKE. IKE, :

```
esr(config)# security ike policy ike_pol1
esr(config-ike-policy)# pre-shared-key hexadecimal 123FFF
esr(config-ike-policy)# proposal ike_prop1
esr(config-ike-policy)# exit
```

   IKE. VTI-, , :

```
esr(config)# security ike gateway ike_gw1
esr(config-ike-gw)# ike-policy ike_pol1
esr(config-ike-gw)# local address 180.100.0.1
esr(config-ike-gw)# local network 10.0.0.0/16
esr(config-ike-gw)# remote address 120.11.5.1
esr(config-ike-gw)# remote network 192.0.2.0/24
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# exit
```

   IPsec-. AES 128 bit, MD5. IPsec-:

```
esr(config)# security ipsec proposal ipsec_prop1
esr(config-ipsec-proposal)# authentication algorithm md5
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

   IPsec-. IPsec-, .

```
esr(config)# security ipsec policy ipsec_pol1
esr(config-ipsec-policy)# proposal ipsec_prop1
esr(config-ipsec-policy)# exit
```

   IPsec VPN. VPN IKE-, IP sec-, . *enable.*

```
esr(config)# security ipsec vpn ipsec1
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel immediate
esr(config-ipsec-vpn)# ike gateway ike_gw1
esr(config-ipsec-vpn)# ike ipsec-policy ipsec_pol1
esr(config-ipsec-vpn)# enable
esr(config-ipsec-vpn)# exit
esr(config)# exit
```

2. R2
   :

```
esr# configure
esr(config)# interface gi 1/0/1
esr(config-if)# ip address 120.11.5.1/24
esr(config-if)# security-zone untrusted
esr(config-if)# exit
```

ISAKMP:

```
esr(config)# object-group service ISAKMP
esr(config-addr-set)# port-range 500
esr(config-addr-set)# exit
```

IKE. - 2, AES 128 bit, MD5. IKE-:

```
esr(config)# security ike proposal ike_prop1
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# authentication algorithm md5
esr(config-ike-proposal)# encryption algorithm aes128
esr(config-ike-proposal)# exit
esr(config)#
```

IKE. IKE, :

```
esr(config)# security ike policy ike_pol1
esr(config-ike-policy)# pre-shared-key hexadecimal 123FFF
esr(config-ike-policy)# proposal ike_prop1
esr(config-ike-policy)# exit
```

IKE. VTI-, , :

```
esr(config)# security ike gateway ike_gw1
esr(config-ike-gw)# ike-policy ike_pol1
esr(config-ike-gw)# remote address 180.100.0.1
esr(config-ike-gw)# remote network 10.0.0.0/16
esr(config-ike-gw)# local address 120.11.5.1
esr(config-ike-gw)# local network 192.0.2.0/24
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# exit
```

IPsec-. AES 128 bit, MD5. IPsec-:

```
esr(config)# security ipsec proposal ipsec_prop1
esr(config-ipsec-proposal)# authentication algorithm md5
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

IPsec-. IPsec-, .

```
esr(config)# security ipsec policy ipsec_pol1
esr(config-ipsec-policy)# proposal ipsec_prop1
esr(config-ipsec-policy)# exit
```

IPsec VPN. VPN IKE-, IP sec-, . *enable.*

```
esr(config)# security ipsec vpn ipsec1
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel immediate
esr(config-ipsec-vpn)# ike gateway ike_gw1
esr(config-ipsec-vpn)# ike ipsec-policy ipsec_pol1
esr(config-ipsec-vpn)# enable
esr(config-ipsec-vpn)# exit
esr(config)# exit
```

:

```
esr# show security ipsec vpn status ipsec1
```

:

```
esr# show security ipsec vpn configuration ipsec1
```


firewall ESP ISAKMP (UDP- 500).

Remote Access IPsec VPN

Remote Access IPsec VPN – VPN-, IPsec VPN , .

RA IPsec VPN IPsec – Extended Authentication (XAUTH), - IPsec VPN.

1	IKE- .	`esr(config)# security ike proposal <NAME>`	<NAME> – IKE, 31 .
2	( ).	`esr(config-ike- proposal)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
3	IKE ( ).	`esr(config-ike- proposal)# authentication algorithm <ALGORITHM>`	<ALGORITHM> – , : md5, sha1, sha2-256, sha2384, sha2-512. : sha1
4	IP- VTI- ( ).	`esr(config-vti)# ip address <ADDR/LEN>`	<ADDR/LEN> – IP- AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..31].
5	- ( ).	`esr(config-ike- proposal)# dh-group <DH-GROUP>`	<DH-GROUP> – -, [1, 2, 5, 14, 15, 16, 17, 18]. : 1
6	IKE .	`esr(config)# security ike policy <NAME>`	<NAME> – IKE, 31 .
7	.	`esr(config-ike- policy)# authentication method <METHOD>`	<METHOD> – . : • **xauth - psk - key** – , - .
8	( ).	`esr(config-ike- policy)# authentication mode client`	
9	IKE ( ).	`esr(config-ike- policy)# lifetime seconds <SEC>`	<SEC> – , [4 ..86400] . : 3600

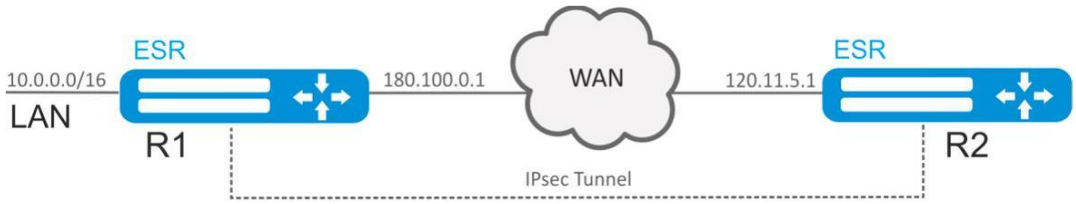
10	.	esr(config-ike-policy)# proposal <NAME>	<NAME> – IKE, 31 .
11	.	esr(config-ike-policy)#pre-shared-key ascii-text <TEXT>	<TEXT> – [1..64] ASCII .
12	.	esr(config)# access profile <NAME>	<NAME> – , 31 .
13	.	esr(config-access-profile)# user <LOGIN>	<LOGIN> – , 31 .
14	.	esr(config-profile)# password ascii-text <TEXT>	<TEXT> – [8..32] ASCII .
15	( ).	esr(config)# address-assignment pool <NAME>	<NAME> – , 31 .
16	, IP ( ).	esr(config-pool)# ip prefix <ADDR/LEN>	<ADDR/LEN> – .
17	IKE .	esr(config)# security ike gateway <NAME>	<NAME> – IKE, 31 .
18	IKE.	esr(config-ike-gw)# ike-policy <NAME>	<NAME> – IKE, 31 .
19	.	esr(config-ike-gw)# mode <MODE>	<MODE> – , : • **policy - based** – .
20	DPD ( ).	esr(config-ike-gw)# dead-peer-detection action <MODE>	<MODE> – DPD: • **restart** – ; • **clear** – ; • **hold** – ; • **none** – , . : none
21	DPD ( ).	esr(config-ike-gw)#dead-peer-detection interval <SEC>	<SEC> – DPD, [1..180] . : 2
22	DPD ( ).	esr(config-ike-gw)# dead-peer-detection timeout <SEC>	<SEC> – DPD, [1..180] . : 30
23	IKE ( ).	esr(config-ike-gw)# version <VERSION>	<VERSION> – IKE-: **v1-only** **v2-only**. : v1-only
24	IP ( ).	esr(config-ike-gw)# local network <ADDR/LEN> [protocol { <TYPE> | <ID> } [port <PORT>]]	<ADDR/LEN> – IP- . AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32]; <TYPE> – , : esp, icmp, ah, eigrp, ospf, igmp, ipip, tcp, pim, udp, vrrp, rdp, l2tp, gre; <ID> – IP-, [0x00-0xFF]; <PORT> – TCP/UDP , [1..65535].
25	IP- IPsec-.	esr(config-ike-gw)#local address <ADDR>	<ADDR> – IP- .
26	IP- IPsec-.	esr(config-ike-gw)#remote address [any | <ADDR/LEN> [protocol { <TYPE> | <ID> } [port <PORT>]]	Any – – , ; <ADDR/LEN> – IP- , .
27	IP- ( ).	esr(config-ike-gw)# remote network dynamic pool <NAME>	<NAME> – , 31 .
28	( ).	esr(config-ike-gw)# remote network dynamic client	
29	XAUTH ( ).	esr(config-ike-gw)# xauth access-profile <NAME>	<NAME> – , 31 .

30	XAUTH ( ).	esr(config-ike-gw)# xauth access-profile <NAME> client <LOGIN>	<NAME> – , 31; <LOGIN> – , 31 .
31	IP IPsec VPN ( ).	esr(config-ike-gw)# assign-interface loopback <INDEX>	<INDEX> – , [1..65535].
32	IPsec.	esr(config)# security ipsec proposal <NAME>	<NAME> – IPsec, 31 .
33	IPsec ( ).	esr(config-ipsec-proposal)# authentication algorithm <ALGORITHM>	<ALGORITHM> – , : md5, sha1, sha2-256, sha2384, sha2-512. : sha1
34	IPsec ( ).	esr(config-ipsec-proposal)# encryption algorithm <ALGORITHM>	<ALGORITHM> – , : des, 3des, blowfish128, blowfish192, blowfish256, aes128, aes192, aes256, aes128ctr, aes192ctr, aes256ctr, camellia128, camellia192, camellia256. : 3des
35	( ).	esr(config-ipsec- proposal) #protocol <PROTOCOL>	<PROTOCOL> – , .
36	IPsec	esr(config)# security ipsec policy <NAME>	<NAME> – IPsec, 31 .
37		esr(config-ipsec-policy)# proposal <NAME>	<NAME> – IPsec, 31 .
38	IPsec ( ).	esr(config-ipsec-policy)# lifetime { seconds <SEC> | packets <PACKETS> | kilobytes <KB> }	<SEC> – IPsec-, . [1140..86400] . : 540 <PACKETS> – , IPsec-. [4..86400]. : . <KB> – , IPsec-. [4..86400] . : .
39	IPsec VPN .	esr(config)# security ipsec vpn <NAME>	<NAME> – VPN, 31 .
40	, VPN.	esr(config-ipsec-vpn)# mode <MODE>	<MODE> – VPN, : ike, manual.
41	IPsec VPN.	esr(config-ipsec-vpn)#ike ipsec-policy <NAME>	<NAME> – IPsec-, 31 .
42	DSCP IP- IKE- ( ).	esr(config-ipsec-vpn)#ike dscp <DSCP>	DSCP> – DSCP, [0..63]. : 63
43	VPN.	esr(config-ipsec-vpn)#ike establish-tunnel <MODE>	<MODE> – VPN: • **by - request** – , ; • **route** – , , ; • **immediate** – , .
44	IKE- VPN.	esr(config-ipsec-vpn)# ike gateway <NAME>	<NAME> – IKE-, 31 .
45	, , SA ( ).	esr(config-ipsec-vpn)# ike idle-time <TIME>	<TIME> – , [4..86400]. : 0
46	IKE , ( ).	esr(config-ipsec-vpn)#ike rekey disable	: .

47	IKE ( ).	`esr(config-ipsec-vpn)# Ike rekey margin { seconds <SEC> | packets <PACKETS> | kilobytes <KB> }`	<SEC> – , (lifetimeseconds) . [4..86400]. : 540 <PACKETS> – , (lifetimepackets). [4..86400]. : . <KB> – , (lifetimekilobytes). [4..86400] : .
48	marginseconds, marginpackets, marginkilobytes ( ).	`esr(config-ipsec-vpn)# ike rekey randomization <VALUE>`	<VALUE> – , [1..100]. : 100
49	VPN ( ).	`esr(config-ipsec-vpn)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
50	IPsec VPN.	`esr(config-ipsec-vpn)# enable`	
51	- XAUTH / ( ) ( ).	`esr(config-ipsec-vpn)# security ike session uniqueids <MODE>`	<MODE> – -, : • no - XAUTH , XAUTH "INITIAL_CONTACT", IP-. , XAUTH . XAUTH IP-. • never - XAUTH . XAUTH IP-. "INITIAL_CONTACT" . • replace - XAUTH . XAUTH IP-. • keep - XAUTH . XAUTH .

Remote Access IPsec VPN

:



Remote Access IPsec VPN R1 R2 IPsec - XAUTH. IPsec VPN R1, R2 IPsec VPN.

R2 IP- – 120.11.5.1;

R1 IP- – 180.100.0.1;

IPsec VPN:

- 192.0.2.0/24
- LAN 10.0.0.0/16

IKE:

- -: 2;
- : 3DES;
- : SHA1.

IPsec:

- : 3DES;
- : SHA1.

XAUTH:

- : client1;
- : password123.

:

1. R1
   :

```
esr# configure
esr(config)# security zone untrusted
esr(config-zone)# exit
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# security-zone untrusted
esr(config-if-gi)# ip address 180.100.0.1/24
esr(config-if-gi)# exit
```

ISAKMP:

```
esr(config)# object-group service ISAKMP
esr(config-object-group-service)# port-range 500,4500
esr(config-object-group-service)# exit
```

IKE. - 2, 3 DES, SHA1. IKE-:

```
esr(config)# security ike proposal IKEPROP
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# authentication algorithm sha1
esr(config-ike-proposal)# encryption algorithm 3des
esr(config-ike-proposal)# exit
```

IKE. IKE, , XAUTH :

```
esr(config)# security ike policy IKEPOLICY
esr(config-ike-policy)# pre-shared-key hexadecimal 123FFF
esr(config-ike-policy)# authentication method xauth-psk-key
esr(config-ike-policy)# proposal IKEPROP
esr(config-ike-policy)# exit
```

IPsec VPN:

```
esr(config)# access profile XAUTH
esr(config-access-profile)# user client1
esr(config-profile)# password ascii-text password123
esr(config-profile)# exit
esr(config-access-profile)# exit
```

, IP IPsec VPN:

```
esr-1000(config)# address-assignment pool CLIENT_POOL
esr-1000(config-pool)# ip prefix 192.0.2.0/24
esr-1000(config-pool)# exit
```

IKE. IKE, , , XAUTH:

```
esr(config)# security ike gateway IKEGW
esr(config-ike-gw)# ike-policy IKEPOLICY
esr(config-ike-gw)# local address 180.100.0.1
esr(config-ike-gw)# local network 10.0.0.0/16
esr(config-ike-gw)# remote address any
esr(config-ike-gw)# remote network dynamic pool CLIENT_POOL
esr(config-ike-gw)# dead-peer-detection action clear
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# xauth access-profile XAUTH
esr(config-ike-gw)# exit
```

IPsec-. 3DES, SHA1. IPsec-:

```
esr(config)# security ipsec proposal IPSECPROP
esr(config-ipsec-proposal)# authentication algorithm sha1
esr(config-ipsec-proposal)# encryption algorithm 3des
esr(config-ipsec-proposal)# exit
```

IPsec-. IPsec-, .

```
esr(config)# security ipsec policy IPSECPOLICY
esr(config-ipsec-policy)# proposal IPSECPROP
esr(config-ipsec-policy)# exit
```

IPsec VPN. VPN IKE-, IP sec-, IPsec – *by-request*. *enable.*

```
esr(config)# security ipsec IPSECVPN
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel by-request
esr(config-ipsec-vpn)# ike gateway IKEGW
esr(config-ipsec-vpn)# ike ipsec-policy IPSECPOLICY
esr(config-ipsec-vpn)# enable
esr(config-ipsec-vpn)# exit
```

esp udp 500, 4500 firewall IPsec VPN:

```
esr(config)# security zone-pair untrusted self
esr(config-zone-pair)# rule 1
esr(config-zone-pair-rule)# action permit
esr(config-zone-pair-rule)# match protocol udp
esr(config-zone-pair-rule)# match destination-port ISAKMP
esr(config-zone-pair-rule)# enable
esr(config-zone-pair-rule)# exit
esr(config-zone-pair)#   rule 2
esr(config-zone-pair-rule)# action permit
esr(config-zone-pair-rule)# match protocol esp
esr(config-zone-pair-rule)# enable
esr(config-zone-pair-rule)# exit
esr(config-zone-pair)# end
```

2. R2
   :

```
esr# configure
esr(config)# interface gi 1/0/1
esr(config-if)# ip address 120.11.5.1/24
esr(config-if)# security-zone untrusted
esr(config-if)# exit
```

ISAKMP:

```
esr(config)# object-group service ISAKMP
esr(config-addr-set)# port-range 500,4500
esr(config-addr-set)# exit
```

IKE. - 2, 3 DES, SHA1. IKE-:

```
esr(config)# security ike proposal IKEPROP
esr(config-ike-proposal)# dh-group 2
esr(config-ike-proposal)# authentication algorithm sha1
esr(config-ike-proposal)# encryption algorithm 3des
esr(config-ike-proposal)# exit
```

IKE. IKE, , , XAUTH – :

```
esr(config)# security ike policy IKEPOLICY
esr(config-ike-policy)# pre-shared-key hexadecimal 123FFF
esr(config-ike-policy)# authentication method xauth-psk-key
esr(config-ike-policy)# authentication mode client
esr(config-ike-policy)# proposal IKEPROP
esr(config-ike-policy)# exit
```

:

```
esr(config)# access profile XAUTH
esr(config-access-profile)# user client1
esr(config-profile)# password ascii-text password123
esr(config-profile)# exit
esr(config-access-profile)# exit
```

loopback IP , IPsec VPN :

```
esr(config)# interface loopback 8
esr(config-loopback)# exit
```

IKE. , , , XAUTH :

```
esr(config)# security ike gateway IKEGW
esr(config-ike-gw)# ike-policy IKEPOLICY
esr(config-ike-gw)# assign-interface loopback 8
esr(config-ike-gw)# local address 120.11.5.1
esr(config-ike-gw)# remote address 180.100.0.1
esr(config-ike-gw)# remote network dynamic client
esr(config-ike-gw)# mode policy-based
esr(config-ike-gw)# xauth access-profile xauth client client1
esr(config-ike-gw)# exit
```

IPsec-. 3DES, SHA1. IPsec-:

```
esr(config)# security ipsec proposal IPSECPROP
esr(config-ipsec-proposal)# authentication algorithm md5
esr(config-ipsec-proposal)# encryption algorithm aes128
esr(config-ipsec-proposal)# exit
```

IPsec-. IPsec-, .

```
esr(config)# security ipsec policy IPSECPOLICY
esr(config-ipsec-policy)# proposal IPSECPROP
esr(config-ipsec-policy)# exit
```

IPsec VPN. VPN IKE-, IP sec-, . *enable.*

```
esr(config)# security ipsec vpn IPSECVPN
esr(config-ipsec-vpn)# mode ike
esr(config-ipsec-vpn)# ike establish-tunnel immediate
esr(config-ipsec-vpn)# ike gateway IKEGW
esr(config-ipsec-vpn)# ike ipsec-policy IPSECPOLICY
esr(config-ipsec-vpn)# enable
esr(config-ipsec-vpn)# exit
```

esp udp 500,4500 firewall IPsec VPN:

```
esr(config)# security zone-pair untrusted self
esr(config-zone-pair)# rule 1
esr(config-zone-pair-rule)# action permit
esr(config-zone-pair-rule)# match protocol udp
esr(config-zone-pair-rule)# match destination-port ISAKMP
esr(config-zone-pair-rule)# enable
esr(config-zone-pair-rule)# exit
esr(config-zone-pair)#   rule 2
esr(config-zone-pair-rule)# action permit
esr(config-zone-pair-rule)# match protocol esp
esr(config-zone-pair-rule)# enable
esr(config-zone-pair-rule)# exit
esr(config-zone-pair)# end
```

:

```
esr# show security ipsec vpn status IPSECVPN
```

:

```
esr# show security ipsec vpn configuration IPSECVPN
```


firewall ESP ISAKMP (UDP- 500,4500).

LT-

LT (. Logical Tunnel –) – , (VRF Lite), . LT- VRF firewall.

1	LT- VRF.	`esr(config)# tunnel lt <ID>`	<ID> – [1..128].
2	( ).	`esr(config-lt)# description <DESCRIPTION>`	<DESCRIPTION> – , 255 .
3	LT- VFR.	`esr(config-lt)# ip vrf forwarding <VRF>`	<VRF> – VRF, 31 .
4	LT- firewall LT-.	`esr(config-lt)# security-zone<NAME>`	<NAME> – , 12 .
		`esr(config-lt)# ip firewall disable`	
5	LT- LT (VRF).	`esr(config-lt)# peer lt <ID>`	<ID> – [1..128].
6	LT- IP- . LT-, IP- IP-.	`esr(config-lt)# ip address <ADDR/LEN>`	<ADDR/LEN> – IP- , AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32].
7	.	`esr(config-lt)# enable`	
8	VRF LT-.		

9	, ( )	`esr(config-lt)# load-average <TIME>`	<TIME> – , [5..150]. : 5
10	MTU (Maximum Transmition Unit) , bridge (; , bridge VLAN). MTU 1500 "system jumbo-frames"	`esr(config-lt)# mtu <MTU>`	<MTU> – MTU, : • ESR-10/12V(F)/14VF – [1280..9600]; • ESR-20/21 – [1280..9500]; • ESR-100/200/1000/1200/1500/1700 [1280..10000]. : 1500.

:

, VRF vrf_1 vrf_2.

:

```
hostname esr
ip vrf vrf_1
exit
ip vrf vrf_2
exit
interface gigabitethernet 1/0/1
  ip vrf forwarding vrf_1
  ip firewall disable
  ip address 10.0.0.1/24
exit
interface gigabitethernet 1/0/2
  ip vrf forwarding vrf_2
  ip firewall disable
  ip address 10.0.1.1/24
exit
```

:

LT- VRF IP- :

```
esr(config)# tunnel lt 1
esr(config-lt)# ip vrf forwarding vrf_1
esr(config-lt)# ip firewall disable
esr(config-lt)# ip address 192.168.0.1/30
esr(config-lt)# exit
esr(config)# tunnel lt 2
esr(config-lt)# ip vrf forwarding vrf_2
esr(config-lt)# ip firewall disable
esr(config-lt)# ip address 192.168.0.2/30
esr(config-lt)# exit
```

LT- LT- VRF, , :

```
esr(config)# tunnel lt 1
esr(config-lt)# peer lt 2
esr(config-lt)# enable
esr(config-lt)# exit
esr(config)# tunnel lt 2
esr(config-lt)# peer lt 1
esr(config-lt)# enable
esr(config-lt)# exit
```

VRF , VRF:

```
esr(config)# ip route vrf vrf_1 0.0.0.0/0 192.168.0.2
esr(config)# ip route vrf vrf_2 0.0.0.0/0 192.168.0.1
```