

- VLAN
  - - 1. VLAN
    - 2. VLAN
    - 3. VLAN
- LLDP
  -
- LLDP MED
  - Voice VLAN
- -
  - -
- Q-in-Q
  - Q-in-Q
- USB-
  - USB-
- STP/RSTP
  - Spanning Tree
- PPP E1
  -
- MLPPP
  -
- Bridge
  - bridge VLAN L2TPv3-
  - bridge VLAN
  - / VLAN-
- Dual-Homing
  -
- (SPAN/RSPAN)
  -
- LACP
  -
- AUX
  - 
  -

VLAN

VLAN (. *Virtual Local Area Network*) — («») , , . VLAN Ethernet- 802.1q , VLAN Ethernet- VLAN-ID Ethernet-.

1	VLAN.	<code>esr(config)# vlan &lt;VID&gt;</code>	<VID> – VLAN, [2..4094].  vlan ( ), vlan ( ) .
2	vlan ( ).	<code>esr(config-vlan)# name &lt;vlan-name&gt;</code>	<vlan-name> – 255 .
3	, Ethernet- VLAN ( ).	<code>esr(config-vlan)# force-up</code>	
4	Ethernet- VLAN' (VLAN-ID – 1) ( ).	<code>esr(config-if-gi)# switchport forbidden default-vlan</code>	
5	L2-.	<code>esr(config-if-gi)# mode switchport</code>	
6	.	<code>esr(config-if-gi)# mode hybrid</code>	ESR-1000/1200/1500/1511 /1700

7	L2-	<b>esr(config-if-gi)# switchport access</b>	ESR-10/12V(F)/14VF/20/21/100/200 /3100.
		<b>esr(config-if-gi)# switchport trunk</b>	ESR-10/12V(F)/14VF/20/21/100/200 /3100.
		<b>esr(config-gi)# switchport general</b>	ESR-1000/1200/1500/1511 /1700.
8	VLAN .	<b>esr(config-if-gi)# switchport trunk allowed vlan add &lt;VID&gt;</b>	ESR-10/12V(F)/14VF/20/21/100/200/3100. <VID> – VLAN, [2..4094]. vlan ( ) vlan ( ).
		<b>esr(config-if-gi)# switchport general allowed vlan add &lt;VID&gt; tagged</b>	ESR-1000/1200/1500/1511 /1700. <VID> – VLAN, [2..4094]. vlan ( ) vlan ( ).
9	VLAN ( ).	<b>esr(config-if-gi)# switchport trunk native-vlan &lt;VID&gt;</b>	ESR-10/12V(F)/14VF/20/21/100/200/3100. <VID> – VLAN, [2..4094].
		<b>esr(config-if-gi)# switchport general allowed vlan add &lt;VID&gt; untagged</b>	ESR-1000/1200/1500/1511 /1700. <VID> – VLAN, [2..4094].
10	Ethernet- VLAN ( ).	<b>esr(config-if-gi)# switchport trunk allowed vlan auto-all</b>	ESR-10/12V(F)/14VF/20/21/100/200 /3100.
		<b>esr(config-if-gi)# switchport general allowed vlan auto-all</b>	ESR-1000/1200/1500/1511 /1700.

1. VLAN

:

VLAN 2 gi1/0/1.



:

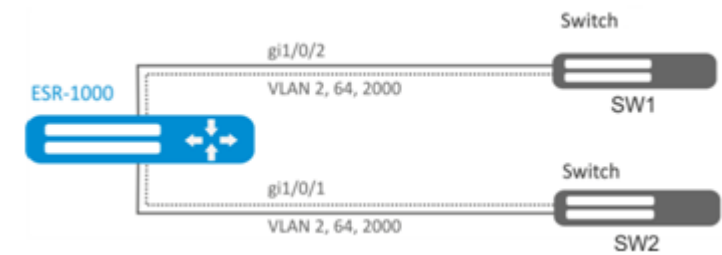
VLAN 2 gi1/0/1:

```
esr(config)# interface gi 1/0/1
esr(config-if-gi)# switchport general allowed vlan remove 2 untagged
esr(config-if-gi)# no switchport general pvid
```

2. VLAN

:

gi1/0/1 gi1/0/2 VLAN 2, VLAN 64, VLAN 2000.



:

VLAN 2, VLAN 64, VLAN 2000 ESR-1000:

```
esr-1000(config)# vlan 2,64,2000
```

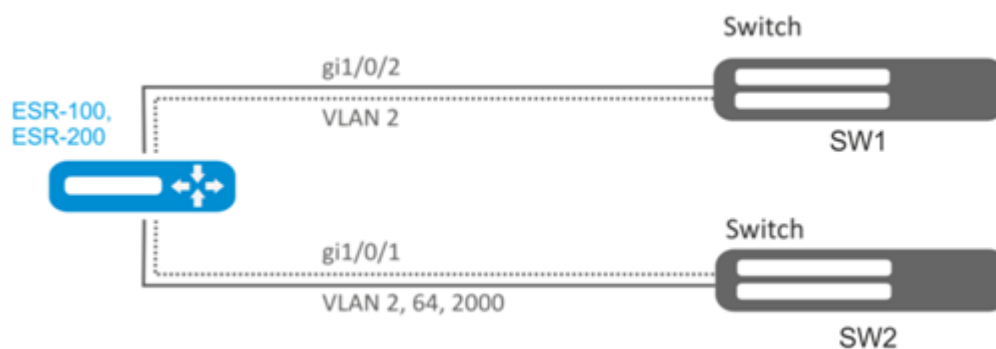
VLAN 2, VLAN 64, VLAN 2000 gi1/0/1-2:

```
esr-1000(config)# interface gi1/0/1
esr-1000(config-if-gi)# mode switchport
esr-1000(config-if-gi)# switchport forbidden default-vlan
esr-1000(config-if-gi)# switchport general allowed vlan add 2,64,2000 tagged
```

### 3. VLAN

:

gi1/0/1 VLAN 2, VLAN 64, VLAN 2000 trunk, gi1/0/2 access VLAN 2 ESR-100/ESR-200.



:

VLAN 2, VLAN 64, VLAN 2000 ESR-100/ESR-200:

```
esr(config)# vlan 2,64,2000
```

VLAN 2, VLAN 64, VLAN 2000 gi1/0/1:

```
esr(config)# interface gi1/0/1
esr(config-if-gi)# mode switchport
esr(config-if-gi)# switchport forbidden default-vlan
esr(config-if-gi)# switchport mode trunk
esr(config-if-gi)# switchport trunk allowed vlan add 2,64,2000
```

VLAN 2 gi1/0/2:

```
esr(config)# interface gi1/0/2
esr(config-if-gi)# mode switchport
esr(config-if-gi)# switchport access vlan 2
```

## LLDP

Link Layer Discovery Protocol (LLDP) — , , , , .

--	--	--	--

1	LLDP .	<b>esr(config)# lldp enable</b>	
2	LLDPDU .	<b>esr(config-if-gi)# lldp receive</b>	
3	LLDPDU .	<b>esr(config-if-gi)# lldp transmit</b>	
8	LLDPDU (.).	<b>esr(config)# lldp timer &lt;SEC&gt;</b>	<SEC> – , [1..32768]. : 30
4	, , LLDP (.).	<b>esr(config)# lldp hold-multiplier &lt;SEC&gt;</b>	<SEC> – , [1..10]. : 4
5	IP-, LLDP TLV management-address (.).	<b>esr(config)# lldp management-address &lt;ADDR&gt;</b>	<ADDR> – IP-, AAA.BBB.CCC.DDD, [0..255].
6	system-description, LLDP TLV system-description (.).	<b>esr(config)# lldp system-description &lt;DESCRIPTION&gt;</b>	<DESCRIPTION> – , 255 . .
7	system-name, LLDP TLV system-name (.).	<b>esr(config)# lldp system-name &lt;NAME&gt;</b>	<NAME> – , 255 . hostname

:

LLDPDU ESR-1 ESR-2.



:

1. R1  
LLDP :

```
esr(config)# lldp enable
```

LLDPDU gi 1/0/1.

```
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# lldp receive
esr(config-if-gi)# lldp transmit
```

2. R2

LLDP :

```
esr(config)# lldp enable
```

LLDPDU gi 1/0/1.

```
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# lldp receive
esr(config-if-gi)# lldp transmit
```

LLDP :

```
esr# show lldp neighbors
```

:

```
esr# show lldp neighbors gigabitethernet 1/0/1
```

LLDP :

```
esr# show lldp statistics
```

## LLDP MED

LLDP MED — LLDP, : VLAN ID, DSCP, priority.

1	LLDP	<b>esr(config)# lldp enable</b>	
2	LLDPDU .	<b>esr(config-if-gi)# lldp transmit</b>	
3	MED LLDP	<b>esr(config)# lldp med fast-start enable</b>	
4	.	<b>esr(config)# network-policy &lt;NAME&gt;</b>	<NAME> – network-policy, 31 .
5	.	<b>esr(config-net-policy)# application &lt;APP_TYPE&gt;</b>	<APP-TYPE> – , network-policy. : <ul style="list-style-type: none"><li>• voice;</li><li>• voice-signaling;</li><li>• guest-voice;</li><li>• guest-voice-signaling;</li><li>• softphone-voice;</li><li>• video-conferencing;</li><li>• streaming-video;</li><li>• video-signaling.</li></ul>
6	DSCP ( ).	<b>esr(config-net-policy)# dscp &lt;DSCP&gt;</b>	<DSCP> – DSCP, [0..63].
7	COS ( ).	<b>esr(config-net-policy)# priority &lt;PRIORITY&gt;</b>	<COS> – , : <ul style="list-style-type: none"><li>• best-effort – COS0;</li><li>• background – COS1;</li><li>• excellent-effort – COS2;</li><li>• critical-applications – COS3;</li><li>• video – COS4;</li><li>• voice – COS5;</li><li>• internetwork-control – COS6;</li><li>• network-control – COS7.</li></ul>
8	VLAN ID.	<b>esr(config-net-policy)# vlan &lt;VID&gt; [tagged]</b>	<VID> – VLAN, [1...4094]; <ul style="list-style-type: none"><li>• tagged – , Ethernet- .</li></ul>
9	.	<b>esr(config-if-gi)# lldp network-policy &lt;NAME&gt;</b>	<NAME> – network-policy, 31 .

## Voice VLAN

Voice VLAN — VLAN ID, IP- trunk VLAN ID VoIP-. VLAN ID MED LLDP.

:

VLAN, vid 10 vid 20 , Voice VLAN gi 1/0/1 ESR. IP- Voice VLAN.



VLAN 10 20 gi 1/0/1 trunk:

```
esr(config)# vlan 10,20
esr(config-vlan)# exit
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# mode switchport
esr(config-if-gi)# switchport mode trunk
esr(config-if-gi)# switchport trunk allowed vlan add 10,20
esr(config-if-gi)# exit
```

LLDP MED LLDP :

```
esr(config)# lldp enable
esr(config)# lldp med fast-start enable
```

, voice VLAN ID 20:

```
esr(config)# network-policy VOICE_VLAN
esr(config-net-policy)# application voice
esr(config-net-policy)# vlan 20 tagged
esr(config-net-policy)# exit
```

LLDP :

```
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# lldp transmit
esr(config-if-gi)# lldp receive
esr(config-if-gi)# lldp network-policy VOICE_VLAN
esr(config-if-gi)# exit
```

-

Ethernet- VLAN - VLAN, . - VLAN, /, Ethernet- .. - . - ( VLAN-ID) ,.. OSI.

1	- ( routeport hybrid).	<pre>esr(config)# interface gigabitethernet &lt;PORT&gt;.&lt;S-VLAN&gt;  interface tengigabitethernet &lt;PORT&gt;. &lt;S-VLAN&gt;  interface port-channel &lt;CH&gt;.&lt;S-VLAN&gt;</pre>	<p>&lt;PORT&gt; – .</p> <p>&lt;CH&gt; – .</p> <p>&lt;S-VLAN&gt; – S-VLAN.</p> <p>bridge-group, - .</p>
2	- ( ).	<pre>esr(config-subif)# description &lt;DESCRIPTION&gt;</pre>	<p>&lt;DESCRIPTION&gt; – , 255 .</p>
3	VRF, - ( ).	<pre>esr(config-subif)# ip vrf forwarding &lt;VRF&gt;</pre>	<p>&lt;VRF&gt; – VRF, 31 .</p>
4	IPv4/IPv6- IP- .	<pre>esr(config-subif)# ip address &lt;ADDR /LEN&gt;</pre>	<p>&lt;ADDR/LEN&gt; – IP- , AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32].</p> <p>IPv4- . IP-.</p>
		<pre>esr(config-subif)# ipv6 address &lt;IPv6- ADDR/LEN&gt;</pre>	<p>&lt;IPv6-ADDR/LEN&gt; – IP- , X:X:X:X::X/EE, X [0.. FFFF] EE [1..128].</p> <p>IPv6- . IPv6-.</p> <p>UIPV4/IPv6- . 8 IPv4/IPv6- .</p>
		<pre>esr(config-subif)# ip address dhcp</pre>	<p>DHCP- . DHCP-.</p>

5	Firewall ( <a href="#">Firewall</a> ).	esr(config-subif)# ip firewall disable	
		esr(config-subif)# security-zone <NAME>	<NAME> – , 31 .
6	, - ( ).	esr(config-subif)# load-average <TIME>	<TIME> – , [5..150].
7	IPv4/IPv6 ARP-, ( ).	esr(config-subif)# ip arp reachable-time <TIME>	<TIME> – MAC-, .  5000 100000000 . [0,5;1,5]*<TIME>.
		esr(config-subif)# ipv6 nd reachable-time <TIME>	
8	MTU (MaximumTransmissionUnit). MTU 1500 "system jumbo-frames" ( ).	esr(config-subif)# mtu <MTU>	<MTU> – MTU .  : 1500.
9	( ).	esr(config-subif)# history statistics	
10	MSS (Maximum segment size) TCP- ( ).	esr(config-subif)# ip tcp adjust-mss <MSS>	<MSS> – MSS, [500..1460].  : 1460
		esr(config-subif)# ipv6 tcp adjust-mss <MSS>	

- :

- QoS ( [QoS](#) );
- proxy ( [HTTP/HTTPS](#) );
- ( [Netflow sFlow](#) );
- ( . );
- VRRF ( . );
- BRAS ( [BRAS \(Broadband Remote Access Server\)](#) );
- IDS/IPS ( [IPS/IDS](#) ).

-

:

192.168.3.1/24 VLAN: 828 gigabitethernet 1/0/1.


:

- VLAN: 828

esr(config)# interface gigabitethernet 1/0/1.828

IP- :

esr(config)# interface gigabitethernet 1/0/1.828  
esr(config-subif)# ip address 192.168.3.1/24  
esr(config-subif)# exit

 IP-, - firewall, .

Q-in-Q — 802.1q-. VLAN . (InnerTag) 802.1q- payload. C-VLAN (Customer VLAN). (OuterTag) — 802.1q-, 802.1q-, S-VLAN (Service VLAN). Ethernet- 802.1ad.

--	--	--	--

1	- ( routeport hybrid).	<b>esr(config)# interface gigabitethernet &lt;PORT&gt;.&lt;S-VLAN&gt;</b>  <b>interface tengigabitethernet &lt;PORT&gt;.&lt;S-VLAN&gt;</b>  <b>interface port-channel &lt;CH&gt;.&lt;S-VLAN&gt;</b>	<PORT> – .  <CH> – .  <S-VLAN> – S-VLAN.  bridge-group, - .
2	Q-in-Q .	<b>esr(config)# interface gigabitethernet &lt;PORT&gt;.&lt;S-VLAN&gt;.&lt;C-VLAN&gt;</b>  <b>esr(config)# interface tengigabitethernet &lt;PORT&gt;.&lt;S-VLAN&gt;.&lt;C-VLAN&gt;</b>  <b>esr(config)# interface port-channel &lt;CH&gt;.&lt;S-VLAN&gt;.&lt;C-VLAN&gt;</b>	<PORT> – .  <CH> – .  <S-VLAN> – S-VLAN. <C-VLAN> – C-VLAN.  - bridge-group, - .
3	Q-in-Q ( ).	<b>esr(config-qinq-if)# description &lt;DESCRIPTION&gt;</b>	<DESCRIPTION> – , 255 .
4	VRF, Q-in-Q ( ).	<b>esr(config-qinq-if) # ip vrf forwarding &lt;VRF&gt;</b>	<VRF> – VRF, 31 .
5	IPv4/IPv6- IP- .	<b>esr(config-qinq-if)# ip address &lt;ADDR/LEN&gt;</b>	<ADDR/LEN> – IP- , AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32].  IPv4- . IP-.
		<b>esr(config-qinq-if)# ipv6 address &lt;IPv6-ADDR/LEN&gt;</b>	<IPv6-ADDR/LEN> – IP- , X:X:X:X::X/EE, X [0..FFFF] EE [1..128].  IPv6- . IPv6-.  UIPv4/IPv6- . 8 IPv4/IPv6- .
		<b>esr(config-qinq-if)# ip address dhcp</b>	DHCP- . DHCP-.
6	Firewall ( . Firewall).	<b>esr(config-qinq-if)# ip firewall disable</b>	
		<b>esr(config-qinq-if)# security-zone &lt;NAME&gt;</b>	<NAME> – , 31 .
7	, - ( ).	<b>esr(config-subif)# load-average &lt;TIME&gt;</b>	<TIME> – , [5..150].
8	IPv4/IPv6 ARP-, ( ).	<b>esr(config-subif)# ip arp reachable-time &lt;TIME&gt;</b>	<TIME> – MAC-, .  5000 100000000 . [0,5;1,5]*<TIME>.
		<b>esr(config-subif)# ipv6 nd reachable-time &lt;TIME&gt;</b>	
9	MTU (MaximumTransmissionUnit). MTU 1500 "system jumbo-frames" ( ).	<b>esr(config-subif)# mtu &lt;MTU&gt;</b>	<MTU> – MTU .  : 1500
10	( ).	<b>esr(config-subif)# history statistics</b>	
11	MSS (Maximum segment size) TCP- ( ).	<b>esr(config-subif)# ip tcp adjust-mss &lt;MSS&gt;</b>	<MSS> – MSS, [500..1460].
		<b>esr(config-subif)# ipv6 tcp adjust-mss &lt;MSS&gt;</b>	: 1460

Q-in-Q :

## Q-in-Q

:

192.168.1.1/24 C-VLAN: 741, S-VLAN: 828 gigabitethernet 1/0/1.

:

- S-VLAN: 828



```
esr(config)# interface gigabitethernet 1/0/1.828
esr(config-subif)# exit
```

Q-in-Q- S-VLAN: 741 IP- .

```
esr(config)# interface gigabitethernet 1/0/1.828.741
esr(config-qinq-if)# ip address 192.168.1.1/24
esr(config-qinq-if)# exit
```



IP-, Q-in-Q - firewall, .


## USB-

USB- . USB- USB-. 10- USB-.

## USB-

1	USB-, .		
2	, USB-.	esr# show cellulars status modem	"USB port" .
3	USB- .	esr(config)# cellular profile <ID>	<ID> – USB- [1..10].
4	( ).	esr(config-cellular-profile)# description <DESCRIPTION>	<DESCRIPTION> – , 255 .
5		esr(config-cellular-profile)# apn <NAME>	<NAME> – , 31 .
6	( /).	esr(config-cellular-profile)# user <NAME>	<NAME> – , 31 .
7	( /).	esr(config-user)# password ascii-text { <CLEAR-TEXT>   encrypted <ENCRYPTED-TEXT> }	<CLEAR-TEXT> – , [1 .. 64] , [0-9a-fA-F]; <ENCRYPTED-TEXT> – , [2..128] .
8	( /).	esr(config-user)# enable	
9	.	esr(config-cellular-profile)# number <WORD>	<WORD> – , 15 .
10	( ).	esr(config-cellular-profile)# allowed-auth <TYPE>	<TYPE> – [none, PAP, CHAP, MSCHAP, MSCHAPv2, EAP]. : PAP
11	IP- .	esr(config-cellular-profile)# ip-version { ipv4   ipv6 }	<ul style="list-style-type: none"> <li>• ipv4 – IPv4;</li> <li>• ipv6 – IPv6;</li> </ul>
12	USB- .	esr(config)# cellular modem <ID>	<ID> – USB- [1..10].
13	( ).	esr(config-cellular-modem)# description <DESCRIPTION>	<DESCRIPTION> – , 255 .
14	VRF, ( ).	esr(config-cellular-modem)# ip vrf forwarding <VRF>	<VRF> – VRF, 31 .
15	USB-, ( 2).	esr(config-cellular-modem)# device <WORD>	<WORD> – USB- [1..12].
16	USB-.	esr(config-cellular-modem)# profile <ID>	<ID> – USB- [1..10].
17	SIM- ( ).	esr(config-cellular-modem)# pin <WORD>	<WORD> – SIM- [4..8] .
18	USB- ( ).	esr(config-cellular-modem)# allowed-mode <MODE>	<MODE> – USB- [2g, 3g, 4g]. : , .
19	( ).	esr(config-cellular-modem)# mru { <MRU> }	<MRU> – MRU, [128..16383]. : 1500.
20	MTU (MaximumTransmissionUnit). MTU 1500 "system jumbo-frames" ( ).	esr(config-cellular-modem)# mtu <MTU>	<MTU> – MTU . : 1500.

21	USB- ().	esr(config-cellular-modem)# preferred-mode { <MODE> }	<MODE>- USB- [2g, 3g, 4g]
22	Firewall (. Firewall).	esr(config-subif)# ip firewall disable	
		esr(config-subif)# security-zone <NAME>	<NAME>- , 31 .
23	USB-.	esr(config-cellular-modem)# enable	
: <ul style="list-style-type: none"><li>• QoS (. QoS);</li><li>• proxy (. HTTP/HTTPS-);</li><li>• (. Netflow sFlow);</li><li>• (. Policy-based routing MultiWAN).</li></ul>			

 , NAT.

:  
 , USB-.

:  
 .  
 , . , USB-:

```
esr# show cellular status modem
```

Number	device	USB port	Manufacturer	Model	Current state	Interface	Link
state	1	1-2	huawei	E3372	Disabled	--	Down

USB-:

```
esr(config)# cellular profile 1
```

APN, , . APN:

```
esr(config-cellular-profile)# apn internet.mts.ru
```

, , :

```
esr(config-cellular-profile)# user mts
esr(config-ppp-user)# password ascii-text mts
esr(config-cellular-profile)# number *99#
esr(config-cellular-profile)# allowed-auth PAP
```

USB- , , :

```
esr(config)# cellular modem 1
esr(config-cellular-modem)# device 1-2
```

:

```
esr(config-cellular-modem)# profile 1
esr(config-cellular-modem)# enable
```

## STP/RSTP

Spanning Tree Protocol – , Ethernet , , , , .

Rapid () STP (RSTP) – STP, .

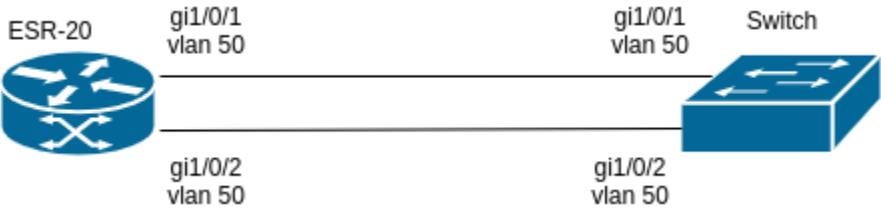
### Spanning Tree

1	spanning-tree vlan-aware.	esr(config)# spanning-tree	
2	, .	esr(config)# spanning-tree forward-time <TIME>	<TIME> – , [4..30]. : 15
3	BPDU-.	esr(config)# spanning-tree hello-time <TIME>	<TIME> – , [1..10]. : 2
4	STP.	esr(config)# spanning-tree max-age <TIME>	<TIME> – , [6..40]. : 20
5	STP.	esr(config)# spanning-tree mode <MODE>	<MODE> – STP: <ul style="list-style-type: none"><li>• STP – IEEE 802.1D Spanning Tree Protocol;</li><li>• RSTP – IEEE 802.1W Rapid Spanning Tree Protocol;</li><li>• MSTP – IEEE 802.1s Multiple Spanning Trees.</li></ul> : RSTP
6	.	esr(config)# spanning-tree pathcost method <short   long>	long – [1..2000000000]; short – [1..65535]. : short
7	STP.	esr(config)# spanning-tree priority <PRIORITY>	<PRIORITY> – , c 4096 [0..61440]. : 32768
8	// .	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.
9	spanning-tree.	esr(config-bridge)# spanning-tree	
10	, .	esr(config-bridge)# spanning-tree forward-time <TIME>	<TIME> – , [4..30]. : 15
11	BPDU-.	esr(config-bridge)# spanning-tree hello-time <TIME>	<TIME> – , [1..10]. : 2
12	STP.	esr(config-bridge)# spanning-tree max-age <TIME>	<TIME> – , [6..40]. : 20
13	STP.	esr(config-bridge)# spanning-tree mode <MODE>	<MODE> – STP: <ul style="list-style-type: none"><li>• STP – IEEE 802.1D Spanning Tree Protocol;</li><li>• RSTP – IEEE 802.1W Rapid Spanning Tree Protocol;</li></ul> : RSTP
14	STP.	esr(config-bridge)# spanning-tree priority <PRIORITY>	<PRIORITY> – , c 4096 [0..61440]. : 32768
15	STP	esr(config-if-gi)# spanning-tree disable	

16	.	esr(config-if-gi)# spanning-tree cost	<COST> – , [1..20000000]. : 4
17	root.	esr(config-if-gi)# spanning-tree guard root	
18	RSTP – «-», «».	esr(config-if-gi)# spanning-tree link-type {point-to-point shared}	point-to-point – «-»; shared – «». : point-to-point
19	STP.	esr(config-if-gi)# spanning-tree port-priority <PRIORITY>	<PRIORITY> – , c 16 [0..240].
20	, , , , .	esr(config-if-gi)# spanning-tree portfast	

 MSTP ESR-1000, MSTP .

:  
STP 10 15 .



:  
.  
ESR RSTP.

```
esr-20# configure
```

```
STP:  
esr-20(config)# spanning-tree mode stp
```

```
-15 -10:  
esr-20(config)# spanning-tree max-age 15  
esr-20(config)# spanning-tree forward-time 10
```

show spanning-tree active:

```
esr-20# show spanning-tree active
```

```
Protocol version: STP
```

```
Root ID: [32768] a8:f9:4b:ad:5a:00
```

```
Root port: [128] gil/0/1
```

```
Pathcost 32768
```

```
Message Age 300
```

```
Hello time: 2 Max age time: 20 Forward delay: 15
```

```
Bridge ID: [32768] a8:f9:4b:ad:8e:5d
```

```
Hello time: 2 Max age time: 15 Forward delay: 10
```

```
Transmit hold count: 6 Topology change: 0
```

```
Time since topology change: 16 Topology change count: 2
```

Name	State	Prio.Num	Cost	Status	Role	PortFast	Type
-----	-----	-----	-----	-----	-----	-----	-----
gil/0/1	en	128.2	32768	FRW	Root	No	STP
gil/0/2	en	128.3	32768	BLK	Altr	No	STP

## PPP E1

PPP (. *Point-to-Point Protocol*) — , . , .

PPP- E1, ToPGATE-SFP ESR.

1	.	esr(config-if-gi)# mode switchport	
2	e1.	esr(config-if-gi)# switchport mode e1	
3	.	esr(config-if-gi)# switchport e1 clock source <SOURCE>	<SOURCE> – : <ul style="list-style-type: none"><li>• Internal () – ;</li><li>• line – .</li></ul>
4	MTU (Maximum Transmission Unit) .	esr(config-if-gi)# mtu <MTU>	<MTU> – MTU, E1 Multilink [128..1500].
5	- ().	esr(config-if-gi)# switchport e1 crc <FCS>	<FCS> – : <ul style="list-style-type: none"><li>• 16 () – FCS16;</li><li>• 32 – FCS32.</li></ul>
6	().	esr(config-if-gi)# switchport e1 framing <CRC>	<CRC> – : <ul style="list-style-type: none"><li>• crc-4 – CRC-4;</li><li>• no-crc4 () – .</li></ul>
7	().	esr(config-if-gi)# switchport e1 invert data	
8	().	esr(config-if-gi)# switchport e1 linecode <CODE>	<CODE> – ; <ul style="list-style-type: none"><li>• ami – ;</li><li>• hdb3 () – 3.</li></ul>
9	-.	esr(config-if-gi)# switchport e1 timeslots <RANGE>	<RANGE> – -.
10	1 , ().	esr(config-if-gi)# switchport e1 unframed	
11	E1.	esr(config)# interface e1 1/<SLOT>/1	<SLOT> – .
12	CHAP- PPP ().	esr(config-e1)# ppp authentication chap	
13	, CHAP- ().	esr(config-e1)# ppp chap hostname <NAME>	<NAME> – .
14	().	esr(config-e1)# ppp chap password ascii-text <CLEAR-TEXT>	<CLEAR-TEXT> – , [1 .. 64] , [0-9a-fA-F].
15	().	esr(config-e1)# ppp chap refuse	
16	().	esr(config-e1)# ppp chap username <NAME>	<NAME> – .
17	IP- IP- ().	esr(config-e1)# ppp ipcp accept-address	
18	IP-, ().	esr(config-e1)# ppp ipcp remote-address <ADDR>	<ADDR> – IP- .
19	Configure-Request , ().	esr(config-e1)# ppp max-configure <VALUE>	<VALUE> – .

20	Configure-NAK , ( ).	esr(config-e1)# ppp max-failure <VALUE>	<VALUE> – .
21	Terminate-Request , ( ).	esr(config-e1)# ppp max-terminate <VALUE>	<VALUE> – .
22	MRU (Maximum Receive Unit) ( ).	esr(config-e1)# ppp mru <MRU>	<MRU> – MRU.
23	MLPPP ( ).	esr(config-e1)# ppp multilink	
24	MLPPP- ( ).	esr(config-e1)# ppp multilink-group <GROUP-ID>	<GROUP-ID> – .
25	, keepalive- ( ).	esr(config-e1)# ppp timeout keepalive <TIME>	<TIME> – .
26	, ( ).	esr(config-e1)# ppp timeout retry <TIME>	<TIME> – .

:

PPP- IP- 10.77.0.1/24 ToPGATE-SFP, 1-8 ; – .



:

, ToPGATE-SFP, gigabitethernet 1/0/3 1:

```
esr# configure
esr(config)# interface gigabitethernet 1/0/3
esr(config-if-gi)# description "**** ToPGATE ****"
esr(config-if-gi)# switchport mode e1
esr(config-if-gi)# switchport e1 timeslots 1-8
esr(config-if-gi)# switchport e1 clock source line
esr(config-if-gi)# switchport e1 slot 3
esr(config-if-gi)# exit
```

interface e1 1/3/1:

```
esr(config)# interface e1 1/3/1
esr(config-e1)# security-zone trusted
esr(config-e1)# ip address 10.77.0.1/24
esr(config-e1)# exit
```

:

```
esr# commit
Configuration has been successfully committed
esr# confirm
Configuration has been successfully confirmed
```

## MLPPP

Multilink PPP (MLPPP) , , .



1	.	<b>esr(config)# interface multilink &lt;IF&gt;</b>	<IF> – .
2	( ).	<b>esr(config-multilink)# description &lt;DESCRIPTION&gt;</b>	<DESCRIPTION> – , 255 .
3	, ( ).	<b>esr(config-multilink)# load-average &lt;TIME&gt;</b>	<TIME> – , [5..150]. : 5.
4	MTU (Maximum Transmission Unit) ( ). MTU 1500 "system jumbo-frames".	<b>esr(config-multilink)# mtu &lt;MTU&gt;</b>	<MTU> – MTU, [1280..1500]. : 1500.
5	CHAP-.	<b>esr(config-multilink)# ppp authentication chap</b>	
6	( ).	<b>esr(config-multilink)# ppp chap refuse</b>	
7	, CHAP-.	<b>esr(config-multilink)# ppp chap hostname &lt;NAME&gt;</b>	<NAME> – , 31
8	, CHAP-.	<b>esr(config-multilink)# ppp chap password ascii-text { &lt;CLEAR-TEXT&gt;   encrypted &lt;ENCRYPTED- TEXT&gt; }</b>	<CLEAR-TEXT> – , [8 .. 64] , [0- 9a-fA-F]. <ENCRYPTED-TEXT> – , [16.. 128] .
9	IP- IP- ( ).	<b>esr(config-multilink)# ppp ipcp accept-address</b>	
10	IP-, .	<b>esr(config-multilink)# ppp iccp remote- address &lt;ADDR&gt;</b>	<ADDR> – IP- .
11	.	<b>esr(config-multilink)# chap username &lt;NAME&gt;</b>	<NAME> – , 31 .
12	.	<b>esr(config-ppp-user)# password ascii-text { &lt;CLEAR-TEXT&gt;   encrypted &lt;ENCRYPTED- TEXT&gt; }</b>	<CLEAR-TEXT> – , [8 .. 64] , [0- 9a-fA-F]. <ENCRYPTED-TEXT> – , [16.. 128] .
13	Configure-Request , ( ).	<b>esr(config-multilink)# ppp max-configure &lt;VALUE&gt;</b>	<VALUE> – , [1..255]. : 10.
14	Configure-NAK , ( ).	<b>esr(config-multilink)# ppp max-failure &lt;VALUE&gt;</b>	<VALUE> – , [1..255].
15	Terminate-Request , ( ).	<b>esr(config-multilink)# ppp max-terminate &lt;VALUE&gt;</b>	<VALUE> – , [1..255]. : 2.
16	MRU (Maximum Receive Unit) .	<b>esr(config-multilink)# ppp mru &lt;MRU&gt;</b>	<MRU> – MRU, [128..1485]. : 1500.
17	, keepalive- ( ).	<b>esr(config-multilink)# ppp timeout keepalive &lt;TIME&gt;</b>	<TIME> – , [1..32767]. : 10.
18	, ( ).	<b>esr(config-multilink)# ppp timeout retry &lt;TIME&gt;</b>	<TIME> – , [1..255]. : 3.
19	MLPP-.	<b>esr(config-multilink)# mrru &lt;MRRU&gt;</b>	<MRRU> – MLPP-, [1500.. 10000].
20	e1 .	<b>esr(config-if-gi)# switchport e1 &lt;SLOT&gt;</b>	<SLOT> – , [0..3].
21	SFPe1-.	<b>esr(config-if-gi)# switchport mode e1</b>	
22	MLPPP E1-.	<b>esr(config-e1)# ppp multilink</b>	
23	E1- .	<b>esr(config-e1)# ppp multilink-group &lt;GROUP- ID&gt;</b>	<GROUP-ID> – , [1..4].

:

MLPPP- IP- 10.77.0.1/24 MXE.



gigabitethernet 1/0/10 1:

```
esr# configure
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# switchport mode e1
esr(config-if-gi)# switchport e1 slot 0
esr(config-if-gi)# exit
esr(config)# interface gigabitethernet 1/0/2
esr(config-if-gi)# switchport mode e1
esr(config-if-gi)# switchport e1 slot 1
esr(config-if-gi)# exit
```

MLPPP 3:

```
esr(config)# interface multilink 3
esr(config-multilink)# ip address 10.77.0.2/24
esr(config-multilink)# security-zone trusted
esr(config-multilink)# exit
esr(config)# exit
```

interface e1 1/0/1, interface e1 1/0/2 MLPPP 3:

```
esr(config)# interface e1 1/0/1
esr(config-e1)# ppp multilink
esr(config-e1)# ppp multilink-group 3
esr(config-e1)# exit
esr(config)# interface e1 1/0/2
esr(config-1)# ppp multilink
esr(config-1)# ppp multilink-group 3
esr(config-1)# exit
```

## Bridge

Bridge () — Ethernet , IP. Ethernet-, IP-. ( 2 OSI), .

1	(bridge) .	<b>esr(config)# bridge &lt;BRIDGE-ID&gt;</b>	<BRIDGE-ID> – , : <ul style="list-style-type: none"><li>• ESR-10/12V(F)/14VF – [1..50];</li><li>• ESR-20/21/100/200 – [1..250];</li><li>• ESR-1000/1200/1500 /1511/1700/3100 – [1..500].</li></ul>
2	.	<b>esr(config-bridge)# enable</b>	
3	VRF, ().	<b>esr(config-bridge)# ip vrf forwarding &lt;VRF&gt;</b>	<VRF> – VRF, 31 .
4	(.).	<b>esr(config-bridge)# description &lt;DESCRIPTION&gt;</b>	<DESCRIPTION> – , 255 .



5	-, qinq-, L2GRE- L2TPv3- . / L2- ( ).	<b>esr(config-if-gi)# bridge-group &lt;BRIDGE-ID&gt;</b>  <b>esr(config-if-l2tpv3)# bridge-group &lt;BRIDGE-ID&gt;</b>	<BRIDGE-ID> – , : <ul style="list-style-type: none"><li>• ESR-10/12V(F)/14VF – [1..50];</li><li>• ESR-20/21/100/200 – [1..250];</li><li>• ESR-1000/1200/1500 /1511/1700/3100 – [1..500].</li></ul>
6	VLAN. L2-, VLAN, L2- ( ).	<b>esr(config-bridge)# vlan &lt;VID&gt;</b>	<VID> – VLAN, [1..4094].
7	MTU (Maximum Transmission Unit), bridge ( ; , bridge VLAN). MTU 1500 "system jumbo-frames"	<b>esr(config-bridge)# mtu &lt;MTU&gt;</b>	<MTU> – MTU, : <ul style="list-style-type: none"><li>• ESR-10/12V(F)/14VF – [552..9600];</li><li>• ESR-20/21 – [552..9500];</li><li>• ESR-100/200/1000/1200/1500/1511/1700 – [552..10000]</li><li>• ESR-1500/1511/1700 /3100 – [552..9190].</li></ul> : 1500
8	IPv4/IPv6- IP- .	<b>esr(config-bridge)# ip address &lt;ADDR /LEN&gt;</b>	<ADDR/LEN> – IP- , AAA.BBB.CCC.DDD/EE, AAA – DDD [0..255] EE [1..32].  IPv4- . <a href="#">IP-</a> .
		<b>esr(config-bridge)# ipv6 address &lt;IPV6-ADDR/LEN&gt;</b>	<IPV6-ADDR/LEN> – IP- , X:X:X:X:X/EE, X [0..FFFF] EE [1..128].  IPv6- . <a href="#">IPv6-</a> .  UIPv4/IPv6- . 8 IPv4/IPv6- .
		<b>esr(config-bridge)# ip address dhcp</b>	DHCP- . <a href="#">DHCP-</a> .
9	Firewall ( . <a href="#">Firewall</a> ).	<b>esr(config-bridge)# ip firewall disable</b>	
		<b>esr(config-bridge)# security-zone &lt;NAME&gt;</b>	<NAME>- , 31 .
9	( ).	<b>esr(config-bridge)# history statistics</b>	
8	, bridge ( ).	<b>esr(config-bridge)# load-average &lt;TIME&gt;</b>	<TIME> – , [5..150].  : 5
9	MAC- , ( ).	<b>esr(config-bridge)# mac-address &lt;ADDR&gt;</b>	<ADDR> – - , XX:XX:XX:XX:XX:XX, [00..FF].
10	bridge- . ( ; ESR-1000/1200/1500/1511/1700 /3100).	<b>esr(config-bridge)# protected-ports [ exclude vlan ]</b>	exclude vlan – , VLAN ( bridge) .
11	unknown-unicast ( MAC- ) bridge. ( ; ESR-1000/1200/1500/1511/1700 /3100).	<b>esr(config-bridge)# unknown-unicast-forwarding disable</b>	
12	IPv4/IPv6- ARP-, bridge ( ).	<b>esr(config-bridge)# ip arp reachable-time &lt;TIME&gt;</b>	<TIME> – MAC-, . 5000 100000000 . [0,5;1,5] *<TIME>.
		<b>esr(config-bridge)# ipv6 nd reachable-time &lt;TIME&gt;</b>	

bridge- :

- QoS ( . [QoS](#));
- proxy ( . [HTTP/HTTPS](#));
- ( . [Netflow sFlow](#));
- ( . );
- VRRF ( . );
- BRAS ( . [BRAS \(Broadband Remote Access Server\)](#));
- IDS/IPS ( . [IPS/IDS](#)).

## bridge VLAN L2TPv3-

:

L2- , , L2TPv3-, . VLAN 333.



:

VLAN 333:

```
esr(config)# vlan 333
esr(config-vlan)# exit
```

«trusted»:

```
esr(config)# security-zone trusted
esr(config-zone)# exit
```

gi1/0/11, gi1/0/12 VLAN 333:

```
esr(config)# interface gigabitethernet 1/0/11-12
esr(config-if)# mode switchport
esr(config-if)# switchport general allowed vlan add 333 tagged
```

bridge 333, VLAN 333 «trusted»:

```
esr(config)# bridge 333
esr(config-bridge)# vlan 333
esr(config-bridge)# security-zone trusted
esr(config-bridge)# enable
```

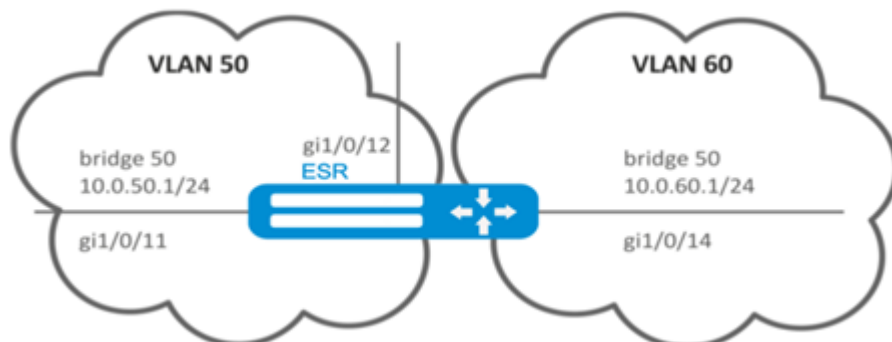
L2TPv3- , (L2TPv3- [L2TPv3-](#)). VID .

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

## bridge VLAN

:

VLAN 50 (10.0.50.0/24) VLAN 60 (10.0.60.0/24). VLAN 50 «LAN1», VLAN 60 – «LAN2», .



:

VLAN 50, 60:

```
esr(config)# vlan 50,60
esr(config-vlan)# exit
```

«LAN1» «LAN2»:

```
esr(config)# security-zone LAN1
esr(config-zone)# exit
esr(config)# security-zone LAN2
esr(config-zone)# exit
```

gi1/0/11, gi1/0/12 VLAN 50:

```
esr(config)# interface gigabitethernet 1/0/11-12
esr(config-if-gi)# switchport general allowed vlan add 50 tagged
```

gi1/0/14 VLAN 60:

```
esr(config)# interface gigabitethernet 1/0/14
esr(config-if-gi)# switchport general allowed vlan add 60 tagged
```

bridge 50, VLAN 50, IP- 10.0.50.1/24 «LAN1»:

```
esr(config)# bridge 50
esr(config-bridge)# vlan 50
esr(config-bridge)# ip address 10.0.50.1/24
esr(config-bridge)# security-zone LAN1
esr(config-bridge)# enable
```

bridge 60, VLAN 60, IP- 10.0.60.1/24 «LAN2»:

```
esr(config)# bridge 60
esr(config-bridge)# vlan 60
esr(config-bridge)# ip address 10.0.60.1/24
esr(config-bridge)# security-zone LAN2
esr(config-bridge)# enable
```

Firewall, :

```
esr(config)# security zone-pair LAN1 LAN2
esr(config-zone-pair)# rule 1
esr(config-zone-pair-rule)# action permit
esr(config-zone-pair-rule)# enable
esr(config-zone-pair-rule)# exit
esr(config-zone-pair)# exit
esr(config)# security zone-pair LAN2 LAN1
esr(config-zone-pair)# rule 1
esr(config-zone-pair-rule)# action permit
esr(config-zone-pair-rule)# enable
esr(config-zone-pair-rule)# exit
esr(config-zone-pair)# exit
esr(config)# exit
```

:

```
esr# show interfaces bridge
```

/ VLAN-

gigabitethernet 1/0/1 Ethernet- VLAN-. gigabitethernet 1/0/2, VLAN-ID 828. gigabitethernet 1/0/2 Ethernet- VLAN-ID 828, gigabitethernet 1/0/1.

bridge VLAN IP-.

```
esr(config)# bridge 1
esr(config-bridge)# enable
esr(config-bridge)# exit
```

gigabitethernet 1/0/1 bridge 1.


```
esr(config)# interface gigabitethernet 1/0/1
esr(config-if-gi)# bridge-group 1
esr(config-if-gi)# exit
```

- gigabitethernet 1/0/2.828 bridge 1.

```
esr(config)# interface gigabitethernet 1/0/2.828
esr(config-subif)# bridge-group 1
esr(config-subif)# exit
```

 VLAN- Ethernet-, 4. gigabitethernet 1/0/2 Q-in-Q MTU 4 .

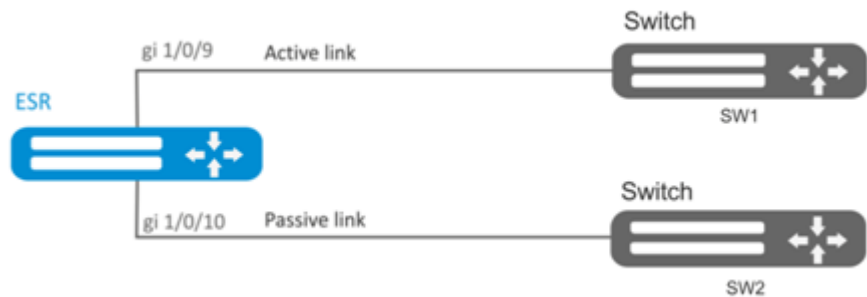
Dual-Homing

 ESR-1000.

Dual-Homing – , .

1	, .	esr(config-if-gi)# backup interface<IF> vlan <VID>	<IF> – , . <VID> – VLAN, [2...4094]. «-» «,».
2	MAC-, ().	esr(config)# backup-interface mac-duplicate <COUNT>	<COUNT> – , [1..4].
3	, ().	esr(config)# backup-interfacemac-per-second<COUNT>	<COUNT> – MAC- , [50..400].
4	, ().	esr(config)# backup-interface preemption	

L2- ESR VLAN 50-55 SW1 SW2.



:

:

VLAN 50-55:

```
esr(config)# vlan 50-55
```

STP gigabitethernet 1/0/9 gigabitethernet 1/0/10, :

```
esr(config)# interface gigabitethernet 1/0/9-10
esr(config-if-gi)# spanning-tree disable
```

gigabitethernet 1/0/9 gigabitethernet 1/0/10 VLAN 50-55 general.

```
esr(config-if-gi)# switchport general allowed vlan add 50-55
esr(config-if-gi)# exit
```

:

gigabitethernet 1/0/10 gigabitethernet 1/0/9:

```
esr(config)# interface gigabitethernet 1/0/9
esr(config-if-gi)# backup interface gigabitethernet 1/0/10 vlan 50-55
```

:

```
esr# show interfaces backup
```

(SPAN/RSPAN)

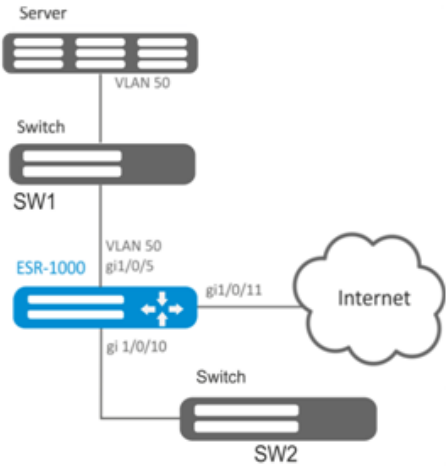
 (RSPAN) ESR-1000/1200/1500/1511/1700

— , ( ) ( ).

1	VLAN, ( ).	esr(config)# port monitor remote vlan <VID> <DIRECTION>	<VID> – VLAN, [2...4094]; <DIRECTION> – : <ul style="list-style-type: none"><li>• tx – VLAN ;</li><li>• rx – VLAN .</li></ul>
2	( ).	esr(config)# port monitor remote	

3	( ).	<b>esr(config)# port monitor mode &lt;MODE&gt;</b>	<MODE> – :  <ul style="list-style-type: none"> <li>• <b>network</b> – ( );</li> <li>• <b>monitor-only</b> – .</li> </ul>
4	.	<b>esr(config-if-gi)# port monitor interface &lt;IF&gt; [ &lt;DIRECTION&gt; ]</b>	<IF> – c ;  <DIRECTION> – :  <ul style="list-style-type: none"> <li>• <b>tx</b> – ;</li> <li>• <b>rx</b> – .</li> </ul>

:  
VLAN 50 gi1/0/11 .



:  
:  

- VLAN 50;
- gi 1/0/5 VLAN 50 general.

:  
VLAN, :

```
sr1000(config)# port monitor remote vlan 50
```

gi 1/0/5 :

```
sr1000(config)# interface gigabitethernet 1/0/5
sr1000(config-if-gi)# port monitor interface gigabitethernet 1/0/11
```

gi 1/0/5 :

```
sr1000(config-if-gi)# port monitor remote
```

## LACP

LACP — , . . .

1	LACP.	<b>esr(config)# lacp system-priority &lt;PRIORITY&gt;</b>	<PRIORITY> – , [1..65535]. : 1.
2	.	<b>esr(config)# port-channel load-balance { src-dst-mac-ip   src-dst-mac   src-dst-ip   src-dst-mac-ip-port }</b>	<ul style="list-style-type: none"> <li>• <b>src - dst - mac - ip</b> – MAC- IP- ;</li> <li>• <b>src - dst - mac</b> – MAC- ;</li> <li>• <b>src - dst - ip</b> – IP- ;</li> <li>• <b>src - dst - mac - ip - port</b> – MAC-, IP- .</li> </ul>
3	LACP.	<b>esr(config)# lacp timeout {short   long }</b>	<ul style="list-style-type: none"> <li>• <b>long</b> – ;</li> <li>• <b>short</b> – .</li> </ul> : long.
4	.	<b>esr(config)# interface port-channel &lt;ID&gt;</b>	<ID> – , [1..12].
5	.		
6	.	<b>esr(config)# interface &lt;IF-TYPE&gt;&lt;IF-NUM&gt;</b>	<IF-TYPE> (gigabitethernet tengigabitethernet).  <IF-NUM> – F/S/P – F- (1), S – (0), P – .
7	.	<b>esr(config-if-gi)# channel-group &lt;ID&gt; mode &lt;MODE&gt;</b>	<ID> – , [1..12].  <MODE> – : <ul style="list-style-type: none"> <li>• <b>auto</b> – LACP;</li> <li>• <b>on</b> – .</li> </ul>
8	LACP- Ethernet.	<b>esr(config-if-gi)# lacp port-priority &lt;PRIORITY&gt;</b>	<PRIORITY> – , [1..65535]. : 1
9	, - ().	<b>esr(config-subif)# load-average &lt;TIME&gt;</b>	<TIME> – , [5..150].
10	IPv4/IPv6 ARP-, ().	<b>esr(config-subif)# ip arp reachable-time &lt;TIME&gt;</b>  <b>esr(config-subif)# ipv6 nd reachable-time &lt;TIME&gt;</b>	<TIME> – MAC-, .  5000 100000000 . [0,5;1,5] *<TIME>.
11	MTU (MaximumTransmissionUnit). MTU 1500 "system jumbo-frames" ().	<b>esr(config-subif)# mtu &lt;MTU&gt;</b>	<MTU> – MTU . : 1500.
12	( ).	<b>esr(config-subif)# history statistics</b>	
13	MSS (Maximum segment size) TCP- ().	<b>esr(config-subif)# ip tcp adjust-mss &lt;MSS&gt;</b>  <b>esr(config-subif)# ipv6 tcp adjust-mss &lt;MSS&gt;</b>	<MSS> – MSS, [500..1460]. : 1460
: <ul style="list-style-type: none"> <li>• IPv4/IPv6- (. <a href="#">IP-</a>, <a href="#">IPv6-</a> DHCP-);</li> <li>• Firewall (. <a href="#">Firewall</a>);</li> <li>• QoS (. <a href="#">QoS</a>);</li> <li>• proxy (. <a href="#">HTTP/HTTPS-</a>);</li> <li>• (. <a href="#">Netflow</a> sFlow);</li> <li>• (. );</li> <li>• VRRF (. );</li> <li>• BRAS (. <a href="#">BRAS (Broadband Remote Access Server)</a>);</li> <li>• IDS/IPS (. <a href="#">IPS/IDS</a>).</li> </ul>			

:

ESR .



gi1/0/1, gi1/0/2 «no security-zone».

port-channel 2:

```
esr(config)# interface port-channel 2
```

gi1/0/1, gi1/0/2 :

```
esr(config)# interface gigabitethernet 1/0/1-2
esr(config-if-gi)# channel-group 2 mode auto
```

port-channel .

## AUX

 **ESR-21.**

AUX , ESR.

1	.	<b>esr(config)# line aux &lt;NUM&gt;</b>	<NUM> – , [1..3].
2	( ). , , . .	<b>esr(config-line-aux) databits &lt;BITS&gt;</b> <b>esr(config-line-aux) flowcontrol &lt;FMODE&gt;</b> <b>esr(config-line-aux) parity &lt;PMODE&gt;</b> <b>esr(config-line-aux) speed &lt;SPEED&gt;</b> <b>esr(config-line-aux) stopbits &lt;STOP-BITS&gt;</b>	<BITS> - [7..8]; "8", <FMODE> – . : <ul style="list-style-type: none"><li>• software – ;</li><li>• hardware – ;</li><li>• disabled – ;</li></ul> "disabled", <PMODE> – . : <ul style="list-style-type: none"><li>• odd – ;</li><li>• even – ;</li><li>• none – ;</li></ul> "none", <SPEED> – /. : 300; 1200; 2400; 4800; 9600; 19200; 38400; 57600; 115200; "115200", <STOP-BITS> - [1..2]; "1".



3	( ).	<b>esr(config-line-aux)# description</b> <b>&lt;DESCRIPTION&gt;</b>	<DESCRIPTION> – , 255 .
4	, ( ). : "transport telnet port".	<b>esr(config-line-aux)# modem inout</b>	
5	ESR TCP-, TCP- ESR telnet ( ). : "modem inout".	<b>esr(config-line-aux)# transport telnet port</b> <b>&lt;PORT&gt;</b>	<PORT> – TCP- . [1..65535].

1:

IP- ESR Serial-, Leased line ( ),



Modem Zyxel U-336E Plus.

:

**ESR-21**

:

```

esr-21-1(config)# line aux 2
esr-21-1(config-line-aux)# flowcontrol hardware
esr-21-1(config-line-aux)# exit
esr-21-1(config)#

```

RS-232 :

```

esr-21-1(config)# interface serial 1/0/2
esr-21-1(config-serial)# ip address 1.1.1.1/24
esr-21-1(config-serial)# exit
esr-21-1(config)#

```

firewall :

```
esr-21-1(config)# security zone xx
esr-21-1(config-zone)# exit
esr-21-1(config)# security zone-pair xx self
esr-21-1(config-zone-pair)# rule 1
esr-21-1(config-zone-pair-rule)# action permit
esr-21-1(config-zone-pair-rule)# enable
esr-21-1(config-zone-pair-rule)# exit
esr-21-1(config-zone-pair)# exit
esr-21-1(config)#
```

:

```
esr-21-1(config)# interface serial 1/0/2
esr-21-1(config-serial)# security-zone xx
esr-21-1(config-serial)# exit
esr-21-1(config)#
```

## ESR-21

:

```
esr-21-2(config)# line aux 2
esr-21-2(config-line-aux)# flowcontrol hardware
esr-21-2(config-line-aux)# exit
esr-21-2(config)#
```

## RS-232 :

```
esr-21-2(config)# interface serial 1/0/2
esr-21-2(config-serial)# ip address 1.1.1.2/24
esr-21-2(config-serial)# exit
esr-21-2(config)#
```

## firewall :

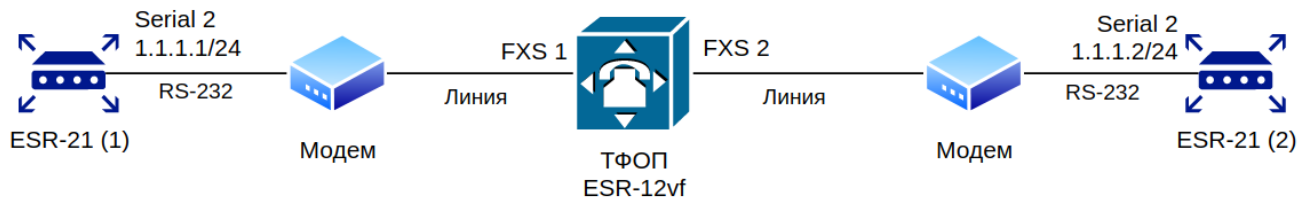
```
esr-21-2(config)# security zone xx
esr-21-2(config-zone)# exit
esr-21-2(config)# security zone-pair xx self
esr-21-2(config-zone-pair)# rule 1
esr-21-2(config-zone-pair-rule)# action permit
esr-21-2(config-zone-pair-rule)# enable
esr-21-2(config-zone-pair-rule)# exit
esr-21-2(config-zone-pair)# exit
esr-21-2(config)#
```

:

```
esr-21-2(config)# interface serial 1/0/2
esr-21-2(config-serial)# security-zone xx
esr-21-2(config-serial)# exit
esr-21-2(config)#
```

## 2:

IP- ESR Serial-, Dial-Up ().



ESR-12VF :

```

dialplan pattern factory_test
  description "dialplan for factory test"
  pattern "S5, L5 (00[1-3]@{local} | [xABCD*#].S)"
  enable
exit
sip profile 1
  dialplan pattern "factory_test"
  enable
  proxy primary
  enable
  ip address proxy-server 192.0.2.5
  registration
  ip address registration-server 192.0.2.5
exit
interface voice-port 1
  sip user phone 001
  profile sip 1
exit
interface voice-port 2
  sip user phone 002
  profile sip 1
  caller-id mode fsk-bell
exit

```



- Modem ZyXEL OMNI 56K (MINI)
- Modem Acorp-M56SCD

:

**ESR-21**

:

```

esr-21-1(config)# line aux 2
esr-21-1(config-line-aux)# flowcontrol hardware
esr-21-1(config-line-aux)# modem inout
esr-21-1(config-line-aux)# exit
esr-21-1(config)#

```

RS-232 :

```

esr-21-1(config)# interface serial 1/0/2
esr-21-1(config-serial)# ip address 1.1.1.1/24
esr-21-1(config-serial)# exit
esr-21-1(config)#

```

firewall :

```
esr-21-1(config)# security zone xx
esr-21-1(config-zone)# exit
esr-21-1(config)# security zone-pair xx self
esr-21-1(config-zone-pair)# rule 1
esr-21-1(config-zone-pair-rule)# action permit
esr-21-1(config-zone-pair-rule)# enable
esr-21-1(config-zone-pair-rule)# exit
esr-21-1(config-zone-pair)# exit
esr-21-1(config)#
```

:

```
esr-21-1(config)# interface serial 1/0/2
esr-21-1(config-serial)# security-zone xx
esr-21-1(config-serial)# exit
esr-21-1(config)#
```

:

```
esr-21-1(config)# interface serial 1/0/2
esr-21-1(config-serial)# dialer string 002
esr-21-1(config-serial)# dialer
esr-21-1(config-serial)# exit
esr-21-1(config)#
```

## ESR-21

:

```
esr-21-2(config)# line aux 2
esr-21-2(config-line-aux)# flowcontrol hardware
esr-21-2(config-line-aux)# modem inout
esr-21-2(config-line-aux)# exit
esr-21-2(config)#
```

RS-232 :

```
esr-21-2(config)# interface serial 1/0/2
esr-21-2(config-serial)# ip address 1.1.1.2/24
esr-21-2(config-serial)# exit
esr-21-2(config)#
```

firewall :

```
esr-21-2(config)# security zone xx
esr-21-2(config-zone)# exit
esr-21-2(config)# security zone-pair xx self
esr-21-2(config-zone-pair)# rule 1
esr-21-2(config-zone-pair-rule)# action permit
esr-21-2(config-zone-pair-rule)# enable
esr-21-2(config-zone-pair-rule)# exit
esr-21-2(config-zone-pair)# exit
esr-21-2(config)#
```

:

```
esr-21-2(config)# interface serial 1/0/2
esr-21-2(config-serial)# security-zone xx
esr-21-2(config-serial)# exit
esr-21-2(config)#
```

3:

2

- 1 V.22bis
- 

ESR-21,

- AT&N1"- V.22bis
- ATM0L0 -

```
esr-21-1(config)# chat-script dial_test "ABORT 'BUSY' ABORT 'NO CARRIER' ABORT ERROR ' ' AT OK AT&F OK AT&N14 OK
ATM0L0 OK ATD\\T CONNECT ' '"
esr-21-1(config)#
```

:

```
esr-21-1(config)# interface serial 1/0/2
esr-21-1(config-serial)# dialer string 001 modem-script dial_test
esr-21-1(config-serial)# exit
esr-21-1(config)#
```

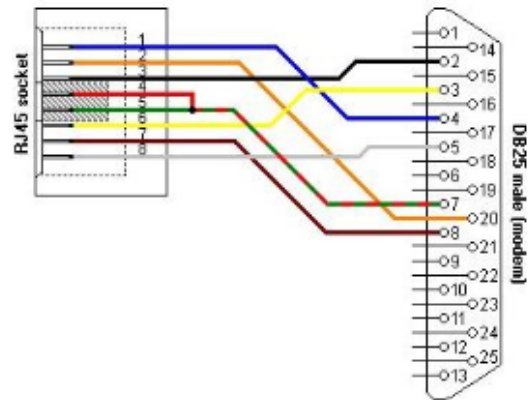
ESR-21:

```
esr-21-2(config)# chat-script answer_test "ABORT 'BUSY' ABORT 'NO CARRIER' ' ' AT OK AT&F OK ATM0L0 RING ATAr
CONNECT ' '"
esr-21-2(config)#
```

:

```
esr-21-2(config)# interface serial 1/0/2
esr-21-2(config-serial)# dialer string 000 modem-script answer_test
esr-21-2(config-serial)# exit
esr-21-2(config)#
```

**RJ-45 <--> DB-25 pinout**



RJ-45 <--> RJ-45 pinout (rolled over cable)

