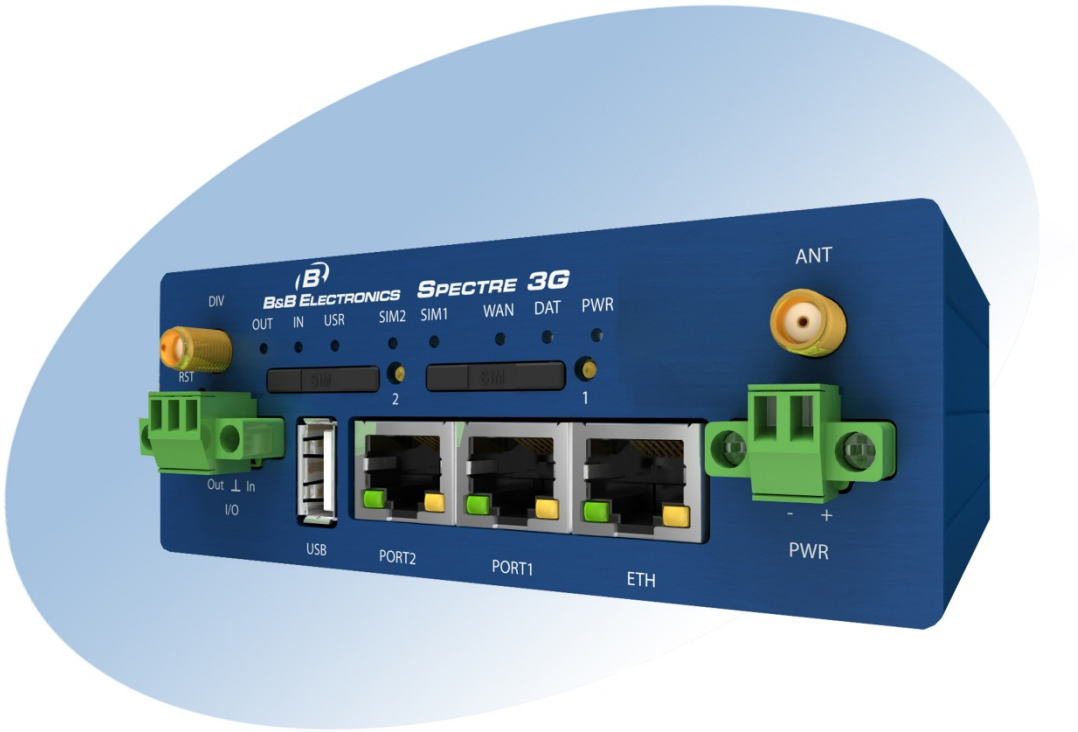
IPSec Tunnel
APPLICATION GUIDE



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Revision One – April 2013

Used symbols

 Danger – important notice, which may have an influence on the user's safety or the function of the device.

 Attention – notice on possible problems, which can arise in specific cases.

 Information, notice – information, which contains useful advice or special interest.

GPL

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Declared quality system

ISO 9001

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1. IPSec protocol

IPSec (Internet Protocol Security) is a protocol for securing IP communications by authenticating and/or encrypting each IP packet in the data flow.

- ***Authenticating*** – Verifies whether the sent packet corresponds to the sender or whether the sender actually exists (Phase I, IKE phase, Main mode). In PSK 's case, an exchange of keys is performed at the end.
- ***Encrypting*** – Both sides agree on the form of packet encrypting in advance. Then the entire packet will be encrypted, apart from the IP header. (Alternatively the entire packet is encrypted and then the new IP header is added). Phase II, IPSec phase, Quick mode. The tunnel is established at the end.

IPSec protocol includes protocols for secure exchange of keys. It works on the network layer of the OSI model.

NAT-T (or NAT-Traversal) is an acronym for Network Address Translation Traversal. It is a technology that is used to share one public IP address of a group of computers in the internal network with non-public IP range. NAT-T allows interconnection of private network using IPSec.

1.1. Openswan

Openswan Version 2.4.5 X.509-1.5.4 with Pluto daemon is implemented in the router. It offers the following parameters:

- Simple and advanced options for configuring tunnels
- Full RFC (AH, ESP, transport and tunnel mode)
- Complete support for NAT-Traversal
- Flexible encryption (based on public key in DNS/DNSSEC) with DHCP integration
- Extended roadwarrior support (clients with dynamic IP)
- The ability to run custom scripts
- The original RSA keys (public keys are specified directly)
- Extended use of X.509 certificates, CAs and intermediate CA treatment
- Dynamic Certificate Revocation List (CRL) using FTP, HTTP or LDAP
- Dead Peer Detection – check of accessibility of the other end of the tunnel
- Aggressive mode support
- Support for Windows L2TP via IPSec transport mode
- Cooperation with many non-standard commercial implementations (software)
- Implementation of all public known VENDOR-ID
- Well portable source code fitting into many Linux platforms (MIPS, ARM, Sparc, Alpha)

1.2. Restriction of the IPSec protocol with CISCO routers

CISCO routers support IPSec protocol only, with IOS 7.1 and later.
DH1 is not supported.

1.3. Firewall changes

- V1.0.2 (14.2.2007):
  IPSec tunnel configuration extended by parameters Rekey Margin and Rekey Fuzz (parameters of the keys expiration time)

- v1.0.3 (22.3.2007):
  Added support for entering the computer name in the configuration of the IPSec tunnel

- v1.1.1 (27.5.2008)
  Added support for IPSec X.509 certificates and NAT Traversal

- v1.1.2 (25.8.2008)
  Added support for three other IPSec tunnels
  Added support for IPSec passthru (in transport mode)

- v1.1.9 (15.5.2009)
  Added support for aggressive mode at IPSec tunnel establishing

- v2.0.0 (19.11.2009)
  Added support for Dead Peer Detection for IPSec tunnels

- v2.0.1 (27.1.2010)
  Modified restart the IPSec tunnel and packets routing

- v2.0.6 (26.10.2010)
  Increased the limit for Rekey Margin parameter (this parameter determines the expiration time of keys)

2. Examples of use the IPSec protocol

2.1. IPSec tunnel – initiator on the router

The IP address of the SIM card inserted into the router can be static or dynamic, because IPSec tunnel connects to the initiator in the router. In this case the Linux/CISCO server offers services for IPSec tunnel. So it must be available on a static IP address or domain-name.

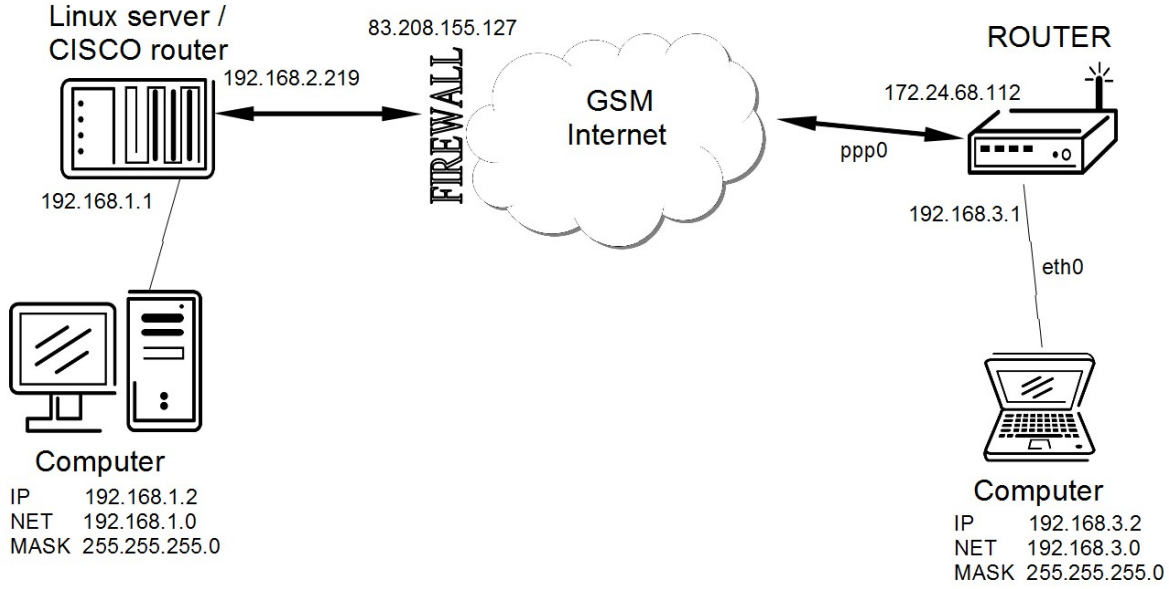

Fig. 1: IPSec tunnel – initiator on the router

2.1.1. Router configuration via web browser

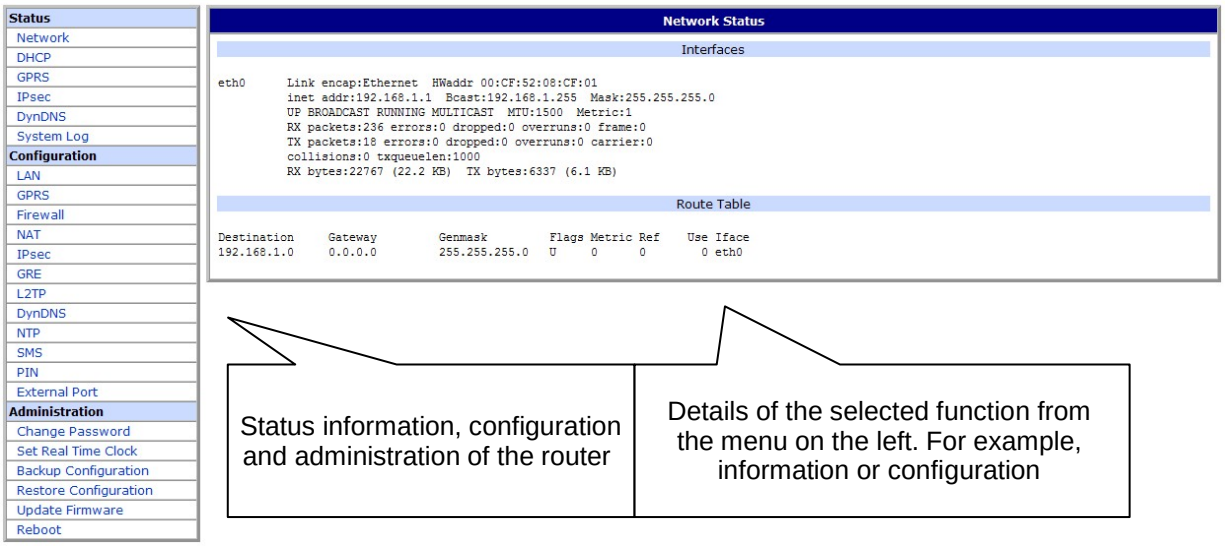

Fig. 2: Web interface for router configuration (initiator)

2.1.2. IPSec tunnel configuration in web interface

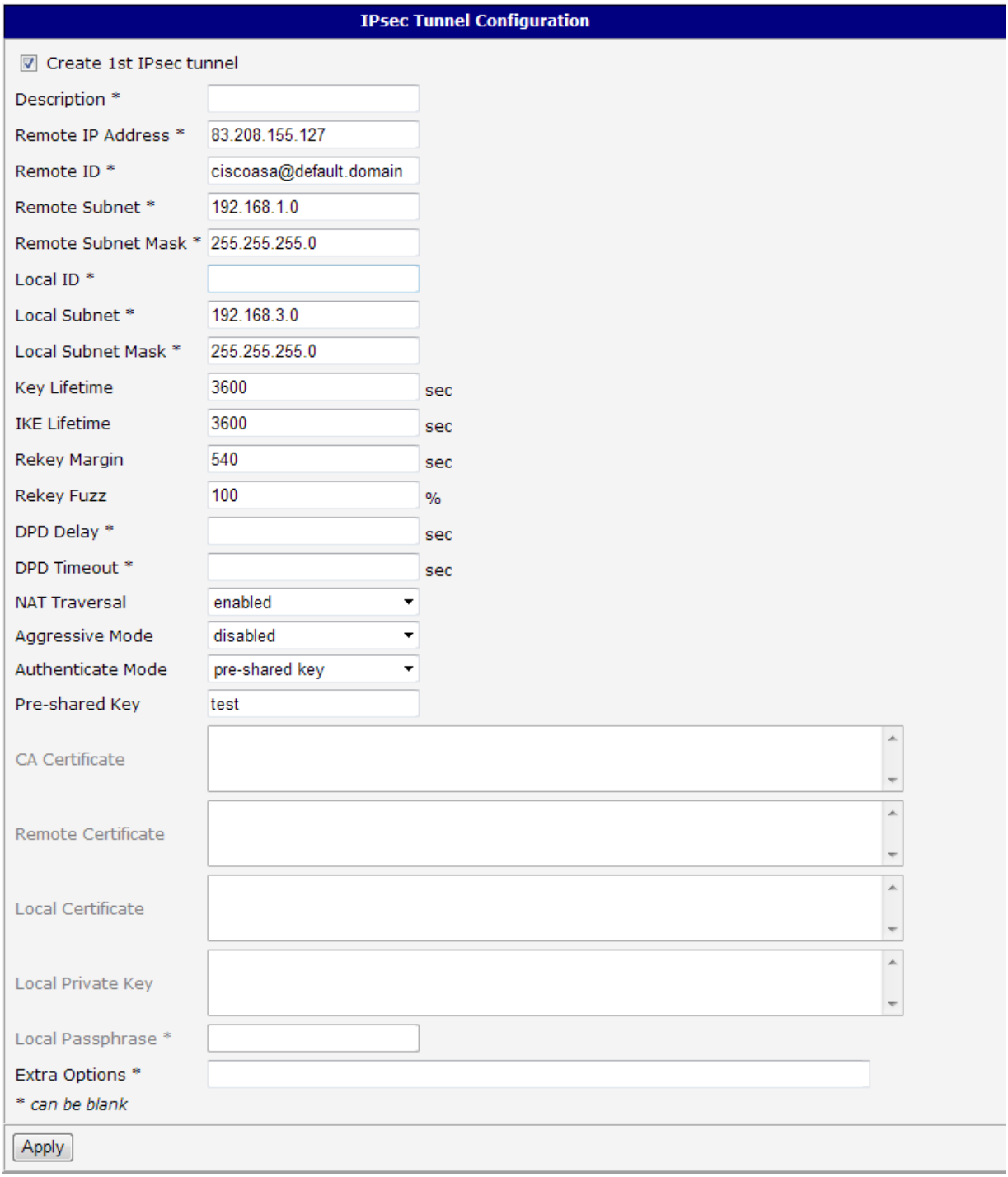

Fig. 3: IPSec tunnel configuration (initiator)

If addresses of tunnel ends are mutually visible, just set Remote IP address, Remote Subnet, Remote Subnet Mask, Local Subnet and Local Subnet Mask. If not (one end of the tunnel is in a private network), it is necessary to enable NAT Traversal.

It is also necessary to set Remote ID (if NAT-T is active). As the ID is usually filled FQDN, which is the designation for a fully specified domain-name of a computer (an acronym for the term **F**ully **Q**ualified **D**omain **N**ame). It is also possible to set up authentication using certificates, but then there is no need to enter the Remote ID.

There is an example of IPSec tunnel settings in the following table:

Item	Router
Remote External IP Address	83.208.155.127
Remote ID	ciscoasa@default.domain
Remote Subnet	192.168.1.0
Remote Subnet Mask	255.255.255.0
Local Subnet	192.168.3.0
Local Subnet Mask	255.255.255.0
Pre-shared Key	test
NAT Traversal	Enabled

Tab. 1: IPSec tunnel setting (initiator)

Other parameters can be left in default setting. If the parameter „Remote External IP Address“ on one side of the IPSec tunnel is empty, this side waits for a connection and doesn't attempt to establish a connection.

Items marked with * may be empty. These items are used to accurately identify the IPSec tunnel.

2.1.3. Detection of the successful establishment of an IPSec tunnel

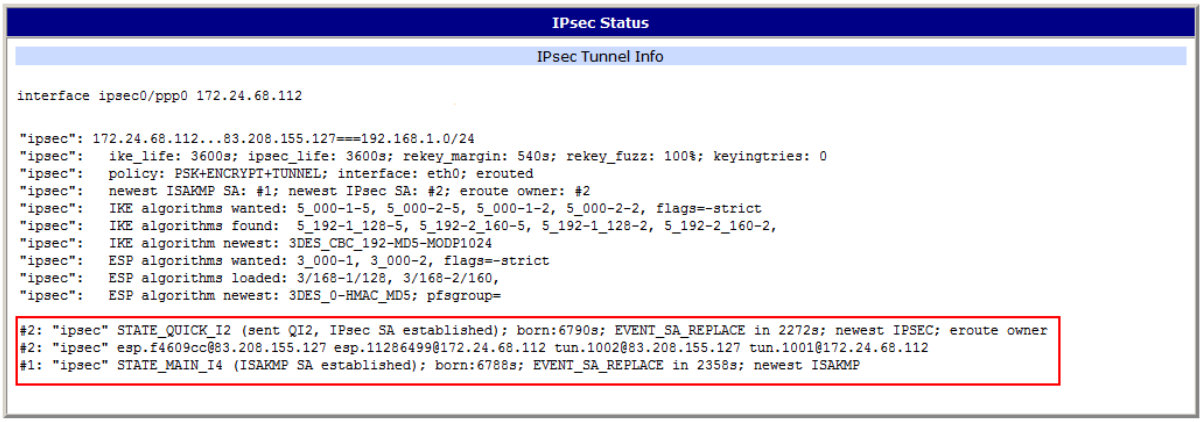

Fig. 4: Information about IPSec tunnel (initiator)

The previous figure shows the selected encryption in component stages for establishing the IPSec tunnel.

- IKE: 3DES_CBC_192-MD5-MODP1536
- IPSec: 3DES_0-HMAC_MD5, pfsgroup = none

In the highlighted part of this figure you can see that the tunnel is successfully established.

2.2. IPSec tunnel – responder on the router

If you are using dynamically assigned IP addresses for the DynDNS domain name, the router must have an available static IP address or dynamic IP address of inserted SIM card. In this case Linux/CISCO server is the initiator and it establishes an IPSec tunnel.

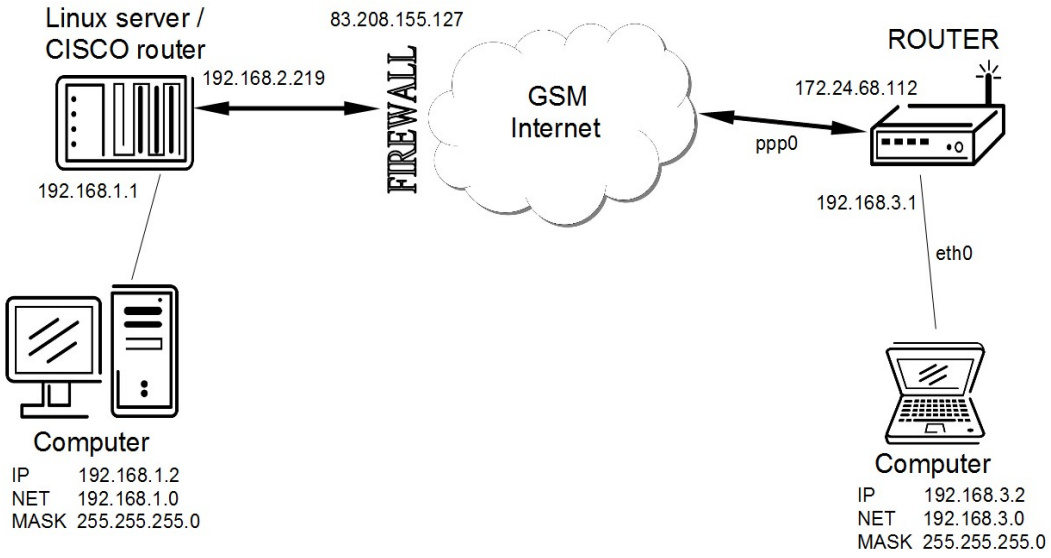

Fig. 5: IPSec tunnel – responder on the routeru

2.2.1. Router configuration via web browser

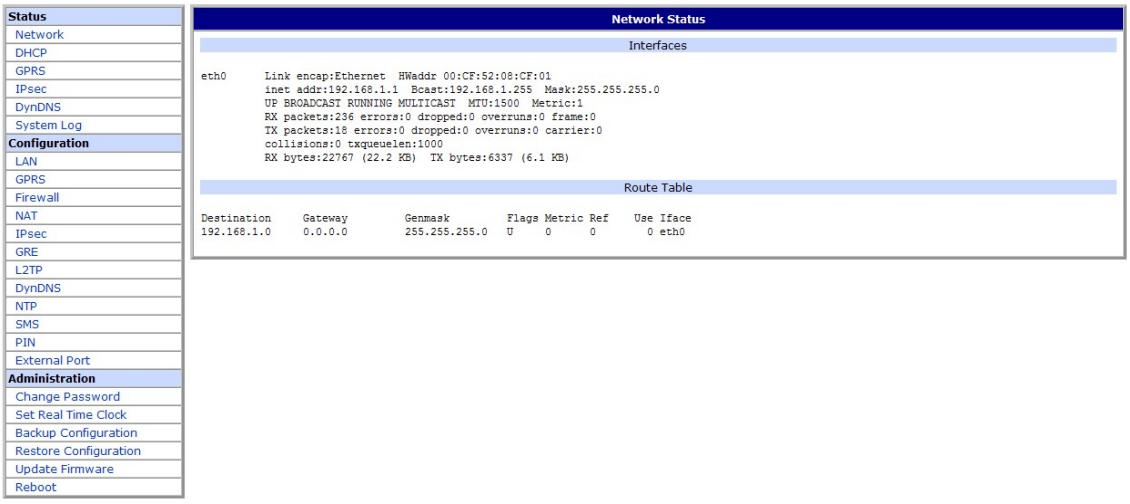

Fig. 6: Web interface for router configuration (responder)

2.2.2. IPSec tunnel configuration in web interface

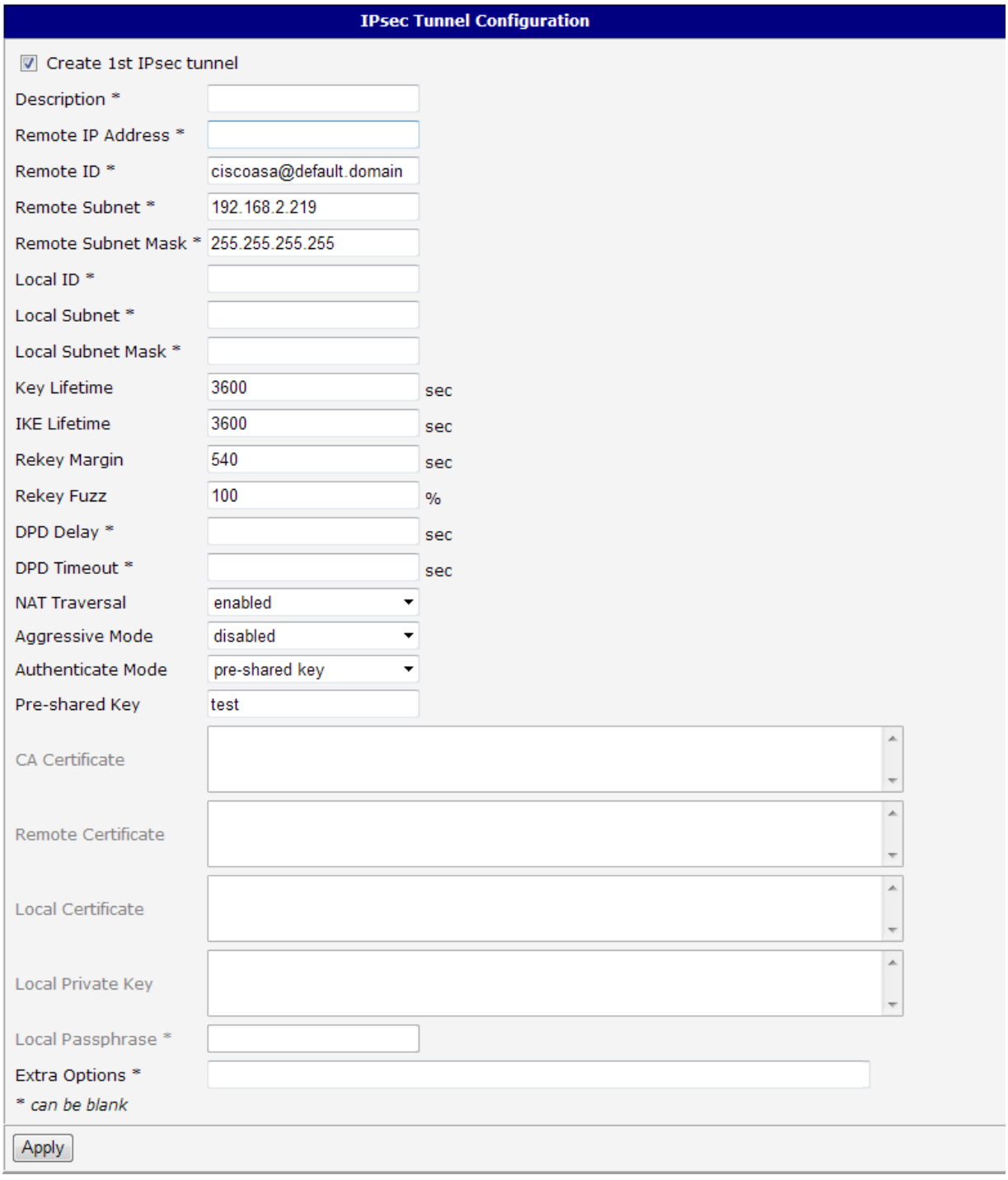

Fig. 7: IPSec tunnel configuration (responder)

If addresses of tunnel ends are mutually visible, just set Remote IP address, Remote Subnet, Remote Subnet Mask, Local Subnet and Local Subnet Mask. If not (one end of the tunnel is in a private network), it is necessary to enable NAT Traversal.

It is also necessary to set Remote ID (if NAT-T is active). As the ID is usually filled FQDN, which is the designation for a fully specified domain-name of a computer (an acronym for the term **F**ully **Q**ualified **D**omain **N**ame). It is also possible to set up authentication using certificates, but then there is no need to enter the Remote ID.

There is given an example of IPSec tunnel setting in the following table:

Item	Router
Remote ID	ciscoasa@default.domain
Remote Subnet	192.168.2.219
Remote Subnet Mask	255.255.255.255
Pre-shared Key	test
NAT Traversal	Enabled

Tab. 2: IPSec tunnel setting (responder)

Other parameters can be left in default setting. If the parameter „Remote External IP Address“ on one side of the IPSec tunnel is empty, this side waits for a connection and doesn't attempt to establish a connection.

Items marked with * may be empty. These items are used to accurate identify the IPSec tunnel.

2.2.3. Detection of successful establishment of an IPSec tunnel

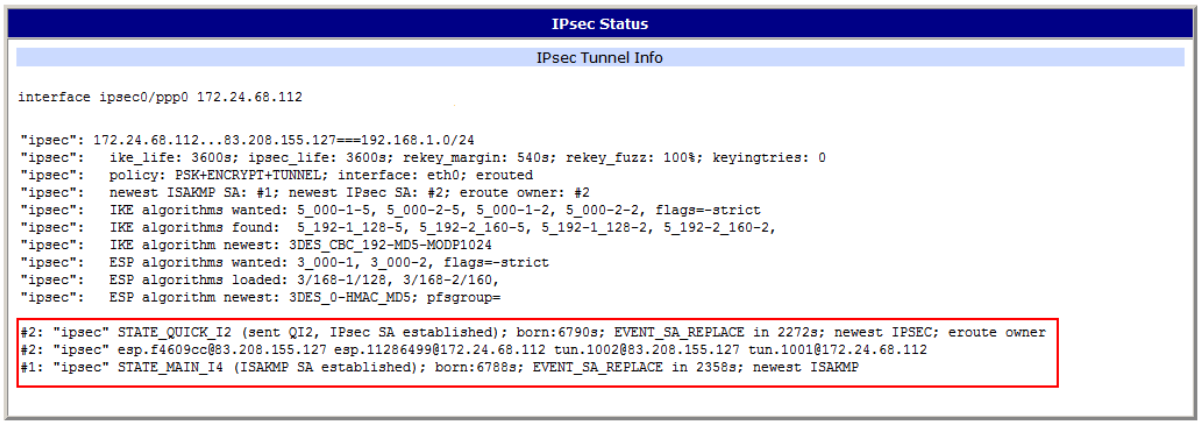

Fig. 8: Information about IPSec tunnel (responder)

The previous figure shows the selected encryption in component stages of establishing the IPSec tunnel.

- IKE: 3DES_CBC_192-MD5-MODP1536
- IPSec: 3DES_0-HMAC_MD5, pfsgroup = none

In the highlighted part of this figure you can see that the tunnel is successfully established.

2.3. Using the IPSec tunnel – Linux server

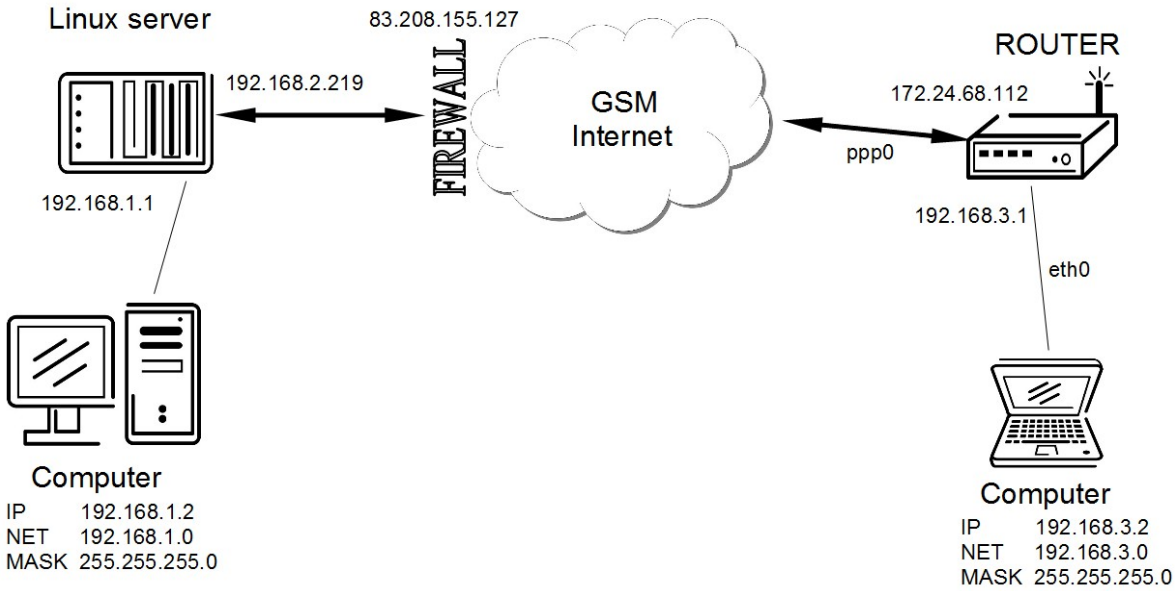

Fig. 9: IPSec tunnel – Linux server

It is necessary to set the configuration file ***ipsec.conf***.

```
conn conelur
        authby=secret
        type=tunnel
        left=83.208.155.127
        leftsubnet=192.168.1.0/24
        right=172.24.68.112
        rightsubnet=192.168.3.0/24
        ikelifetime=3600s
        keylife=3600s
        pfs=no
        auto=add
```

Fig. 10: Configuration file ipsec.cong

It is also necessary to set the configuration file ***ipsec.secrets***.

```
83.208.155.127 172.24.68.112 :PSK "test"
```

Fig. 11: Configuration file ipsec.secrets.

2.4. Using the IPSec tunnel – CISCO router

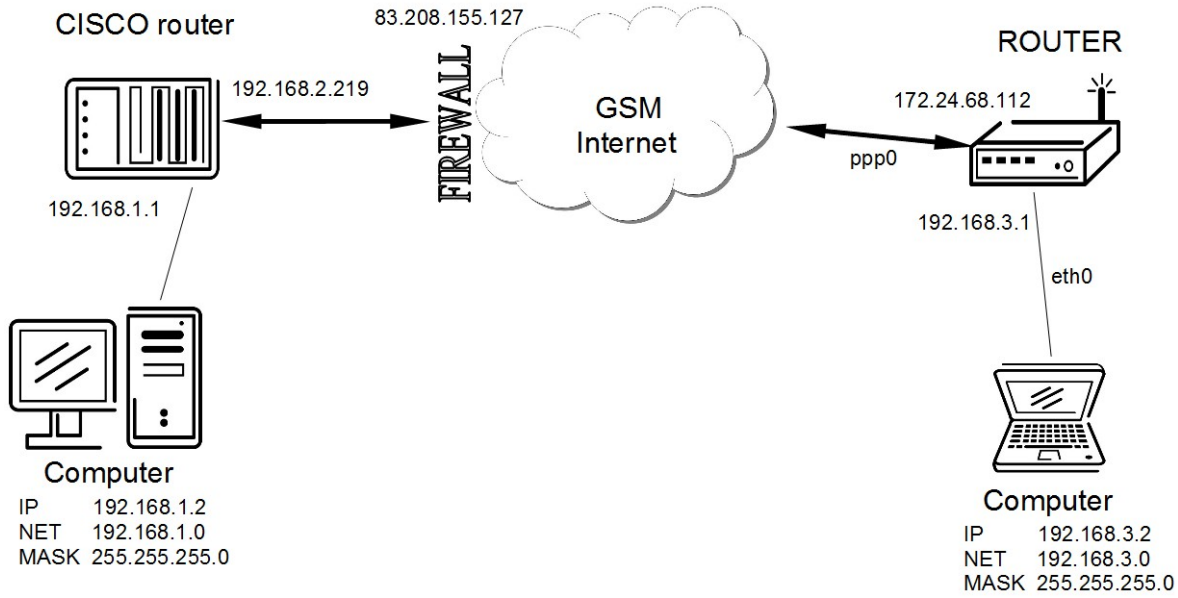

Fig. 12: IPSec tunnel – CISCO router

ATTENTION!!! CISCO routers support IPSec protocol only, with IOS 7.1 and later.

2.4.1. Configuration – initiator on the router

```
ASA Version 7.2(3)
!
hostname ciscoasa
domain-name default.domain
!
interface Vlan1
 nameif inside
 security-level 100
 ip address 192.168.1.1 255.255.255.0
!
interface Vlan2
 nameif outside
 security-level 100
 ip address 192.168.2.219 255.255.255.0
!
interface Ethernet0/0
 switchport access vlan 2
!
interface Ethernet0/1
!
```

```
interface Ethernet0/2
!
interface Ethernet0/3
!
interface Ethernet0/4
!
interface Ethernet0/5
!
interface Ethernet0/6
!
interface Ethernet0/7
!
passwd 2KFQnbNIdI.2KYOU encrypted
ftp mode passive
dns server-group DefaultDNS
 domain-name default.domain
same-security-traffic permit inter-interface
access-list outside_access_in extended permit ip any any
access-list outside_access_out extended permit ip any any
access-list inside_access_in extended permit ip any any
access-list inside_access_out extended permit ip any any
access-list outside_2_cryptomap extended permit ip 192.168.1.0 255.255.255.0
192.168.3.0 255.255.255.0
pager lines 24
logging enable
logging asdm informational
logging class auth asdm emergencies
logging class ip asdm critical
mtu inside 1500
mtu outside 1500
icmp unreachable rate-limit 1 burst-size 1
asdm image disk0:/asdm-523.bin
no asdm history enable
arp timeout 14400
global (outside) 1 interface
access-group inside_access_in in interface inside
access-group inside_access_out out interface inside
access-group outside_access_in in interface outside
access-group outside_access_out out interface outside
route outside 0.0.0.0 0.0.0.0 192.168.2.27 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 icmp 0:00:02
timeout sunrpc 0:10:00 h323 0:05:00 h225 1:00:00 mgcp 0:05:00 mgcp-pat 0:05:00
timeout sip 0:30:00 sip_media 0:02:00 sip-invite 0:03:00 sip-disconnect 0:02:00
timeout uauth 0:05:00 absolute
http server enable
http 192.168.1.0 255.255.255.0 inside
no snmp-server location
no snmp-server contact
snmp-server enable traps snmp authentication linkup linkdown coldstart
```

```
crypto ipsec transform-set ESP-DES-MD5 esp-des esp-md5-hmac
crypto ipsec transform-set ESP-DES-SHA esp-des esp-sha-hmac
crypto ipsec transform-set ESP-3DES-SHA esp-3des esp-sha-hmac
crypto ipsec transform-set ESP-AES-128-SHA esp-aes esp-sha-hmac
crypto ipsec transform-set ESP-AES-256-MD5 esp-aes-256 esp-md5-hmac
crypto ipsec transform-set ESP-AES-256-SHA esp-aes-256 esp-sha-hmac
crypto ipsec transform-set ESP-AES-128-MD5 esp-aes esp-md5-hmac
crypto ipsec transform-set ESP-AES-192-MD5 esp-aes-192 esp-md5-hmac
crypto ipsec transform-set ESP-AES-192-SHA esp-aes-192 esp-sha-hmac
crypto ipsec transform-set UR1 esp-3des esp-none
crypto ipsec transform-set UR2 esp-des esp-none
crypto ipsec transform-set ESP-3DES-MD5 esp-3des esp-md5-hmac
crypto map outside_map 1 match address outside_2_cryptomap
crypto map outside_map 1 set connection-type answer-only
crypto map outside_map 1 set peer 172.24.68.112
crypto map outside_map 1 set transform-set ESP-3DES-MD5
crypto map outside_map interface outside
crypto isakmp identity hostname
crypto isakmp enable outside
crypto isakmp policy 10
authentication pre-share
encryption 3des
 hash md5
 group 2
 lifetime 3600
crypto isakmp nat-traversal  20
vpn-sessiondb max-session-limit 1
telnet timeout 5
ssh timeout 5
console timeout 0
l2tp tunnel hello 300
dhcpd auto_config outside
!
dhcpd address 192.168.1.2-192.168.1.33 inside
dhcpd enable inside
!
!
class-map inspection_default
 match default-inspection-traffic
!
!
policy-map type inspect dns preset_dns_map
 parameters
  message-length maximum 512
policy-map global_policy
 class inspection_default
  inspect dns preset_dns_map
  inspect ftp
  inspect h323 h225
  inspect h323 ras
```

```
  inspect rsh
  inspect rtsp
  inspect esmtp
  inspect sqlnet
  inspect skinny
  inspect sunrpc
  inspect xdmcp
  inspect sip
  inspect netbios
  inspect tftp
  inspect icmp
  inspect icmp error
  inspect ipsec-pass-thru
!
service-policy global_policy global
ssl encryption 3des-sha1 aes128-sha1 aes256-sha1 des-sha1 rc4-md5
group-policy DfltGrpPolicy attributes
 banner none
 wins-server none
 dns-server none
 dhcp-network-scope none
 vpn-access-hours none
 vpn-simultaneous-logins 3
 vpn-idle-timeout none
 vpn-session-timeout none
 vpn-filter none
 vpn-tunnel-protocol IPSec l2tp-ipsec webvpn
 password-storage disable
 ip-comp  disable
 re-xauth  disable
 group-lock  none
 pfs disable
 ipsec-udp enable
 ipsec-udp-port 10000
 split-tunnel-policy tunnelall
 split-tunnel-network-list none
 default-domain none
split-dns none
 intercept-dhcp 255.255.255.255 disable
 secure-unit-authentication disable
 user-authentication disable
 user-authentication-idle-timeout none
 ip-phone-bypass disable
 leap-bypass disable
 nem disable
 backup-servers keep-client-config
 msie-proxy server none
 msie-proxy method no-modify
 msie-proxy except-list none
 msie-proxy local-bypass disable
```

```
 nac disable
 nac-sq-period 300
 nac-reval-period 36000
 nac-default-acl none
 address-pools none
 smartcard-removal-disconnect enable
 client-firewall none
 client-access-rule none
 webvpn
  functions none
html-content-filter none
  homepage none
  keep-alive-ignore 4
  http-comp gzip
  filter none
  url-list none
  customization value DfltCustomization
  port-forward none
  port-forward-name value Application Access
  sso-server none
  deny-message value Login was successful, but because certain criteria have not
 been met or due to some specific group policy, you do not have permission to use
 any of the VPN features. Contact your IT administrator for more information
  svc none
  svc keep-installer installed
  svc keepalive none
  svc rekey time none
  svc rekey method none
  svc dpd-interval client none
  svc dpd-interval gateway none
  svc compression deflate
tunnel-group DefaultL2LGroup ipsec-attributes
 pre-shared-key *
isakmp keepalive threshold 20 retry 10
tunnel-group 172.24.68.112 type ipsec-l2l
tunnel-group 172.24.68.112 ipsec-attributes
pre-shared-key *
tunnel-group-map enable rules
tunnel-group-map default-group DefaultL2LGroup
prompt hostname context
no compression svc http-comp
zonelabs-integrity fail-timeout 20
Cryptochecksum:57784235ddef16872374b10e67a1415d
: end
```

2.4.2. Configuration – responder on the router

```
ASA Version 7.2(3)
!
hostname ciscoasa
domain-name default.domain
!
interface Vlan1
 nameif inside
 security-level 100
 ip address 192.168.1.1 255.255.255.0
!
interface Vlan2
 nameif outside
 security-level 100
 ip address 192.168.2.219 255.255.255.0
!
interface Ethernet0/0
 switchport access vlan 2
!
interface Ethernet0/1
!
interface Ethernet0/2
!
interface Ethernet0/3
!
interface Ethernet0/4
!
interface Ethernet0/5
!
interface Ethernet0/6
!
interface Ethernet0/7
!
passwd 2KFQnbNIdI.2KYOU encrypted
ftp mode passive
dns server-group DefaultDNS
 domain-name default.domain
same-security-traffic permit inter-interface
access-list outside_access_in extended permit ip any any
access-list outside_access_out extended permit ip any any
access-list inside_access_in extended permit ip any any
access-list inside_access_out extended permit ip any any
access-list outside_2_cryptomap extended permit ip 192.168.1.0 255.255.255.0 192
.168.3.0 255.255.255.0
pager lines 24
logging enable
logging asdm informational
logging class auth asdm emergencies
logging class ip asdm critical
```

```
mtu inside 1500
mtu outside 1500
icmp unreachable rate-limit 1 burst-size 1
asdm image disk0:/asdm-523.bin
no asdm history enable
arp timeout 14400
global (outside) 1 interface
access-group inside_access_in in interface inside
access-group inside_access_out out interface inside
access-group outside_access_in in interface outside
access-group outside_access_out out interface outside
route outside 0.0.0.0 0.0.0.0 192.168.2.27 1
timeout xlate 3:00:00
timeout conn 1:00:00 half-closed 0:10:00 udp 0:02:00 icmp 0:00:02
timeout sunrpc 0:10:00 h323 0:05:00 h225 1:00:00 mgcp 0:05:00 mgcp-pat 0:05:00
timeout sip 0:30:00 sip_media 0:02:00 sip-invite 0:03:00 sip-disconnect 0:02:00
timeout uauth 0:05:00 absolute
http server enable
http 192.168.1.0 255.255.255.0 inside
no snmp-server location
no snmp-server contact
snmp-server enable traps snmp authentication linkup linkdown coldstart
crypto ipsec transform-set ESP-DES-MD5 esp-des esp-md5-hmac
crypto ipsec transform-set ESP-DES-SHA esp-des esp-sha-hmac
crypto ipsec transform-set ESP-3DES-SHA esp-3des esp-sha-hmac crypto
ipsec transform-set ESP-AES-128-SHA esp-aes esp-sha-hmac crypto ipsec
transform-set ESP-AES-256-MD5 esp-aes-256 esp-md5-hmac crypto ipsec
transform-set ESP-AES-256-SHA esp-aes-256 esp-sha-hmac crypto ipsec
transform-set ESP-AES-128-MD5 esp-aes esp-md5-hmac crypto ipsec
transform-set ESP-AES-192-MD5 esp-aes-192 esp-md5-hmac crypto ipsec
transform-set ESP-AES-192-SHA esp-aes-192 esp-sha-hmac crypto ipsec
transform-set UR1 esp-3des esp-none
crypto ipsec transform-set UR2 esp-des esp-none
crypto ipsec transform-set ESP-3DES-MD5 esp-3des esp-md5-hmac
crypto map outside_map 1 match address outside_2_cryptomap
crypto map outside_map 1 set connection-type originate-only
crypto map outside_map 1 set peer 172.24.68.112
crypto map outside_map 1 set transform-set ESP-3DES-MD5
crypto map outside_map interface outside
crypto isakmp identity hostname
crypto isakmp enable outside
crypto isakmp policy 10
authentication pre-share
encryption 3des
 hash md5
 group 2
 lifetime 3600
crypto isakmp nat-traversal  20
vpn-sessiondb max-session-limit 1
telnet timeout 5
```

```
ssh timeout 5
console timeout 0
l2tp tunnel hello 300
dhcpd auto_config outside
!
dhcpd address 192.168.1.2-192.168.1.33 inside
dhcpd enable inside
!

!
class-map inspection_default
 match default-inspection-traffic
!
!
policy-map type inspect dns preset_dns_map
 parameters
  message-length maximum 512
policy-map global_policy
 class inspection_default
  inspect dns preset_dns_map
  inspect ftp
  inspect h323 h225
  inspect h323 ras
  inspect rsh
  inspect rtsp
  inspect esmtp
  inspect sqlnet
  inspect skinny
  inspect sunrpc
  inspect xdmcp
  inspect sip
  inspect netbios
  inspect tftp
  inspect icmp
  inspect icmp error
  inspect ipsec-pass-thru
!
service-policy global_policy global
ssl encryption 3des-sha1 aes128-sha1 aes256-sha1 des-sha1 rc4-md5
group-policy DfltGrpPolicy attributes
 banner none
 wins-server none
 dns-server none
 dhcp-network-scope none
 vpn-access-hours none
 vpn-simultaneous-logins 3
 vpn-idle-timeout none
 vpn-session-timeout none
 vpn-filter none
 vpn-tunnel-protocol IPSec l2tp-ipsec webvpn
```

password-storage disable
ip-comp disable
re-xauth disable
group-lock none
pfs disable
ipsec-udp enable
ipsec-udp-port 10000
split-tunnel-policy tunnelall
split-tunnel-network-list none
default-domain none
split-dns none
intercept-dhcp 255.255.255.255 disable
secure-unit-authentication disable
user-authentication disable
user-authentication-idle-timeout none
ip-phone-bypass disable
leap-bypass disable
nem disable
backup-servers keep-client-config
msie-proxy server none
msie-proxy method no-modify
msie-proxy except-list none
msie-proxy local-bypass disable
nac disable
nac-sq-period 300
nac-reval-period 36000
nac-default-acl none
address-pools none
smartcard-removal-disconnect enable
client-firewall none
client-access-rule none
webvpn
functions none
html-content-filter none
homepage none
keep-alive-ignore 4
http-comp gzip
filter none
url-list none
customization value DfltCustomization
port-forward none
port-forward-name value Application Access
sso-server none
deny-message value Login was successful, but because certain criteria have not been met or due to some specific group policy, you do not have permission to use any of the VPN features. Contact your IT administrator for more information
svc none
svc keep-installer installed
svc keepalive none
svc rekey time none

```
  svc rekey method none
  svc dpd-interval client none
  svc dpd-interval gateway none
  svc compression deflate
tunnel-group DefaultL2LGroup ipsec-attributes
 pre-shared-key *
 isakmp keepalive threshold 20 retry 10
tunnel-group 172.24.68.112 type ipsec-l2l
tunnel-group 172.24.68.112 ipsec-attributes
pre-shared-key *
tunnel-group-map enable rules
tunnel-group-map default-group DefaultL2LGroup
prompt hostname context
no compression svc http-comp
zonelabs-integrity fail-timeout 20
Cryptochecksum:3745a840258fc10269e066655f5b252e
: end
```

2.5. Using the IPSec tunnel – Windows

Recommended program for IPSec in Windows is NCP Secure Entry Client.

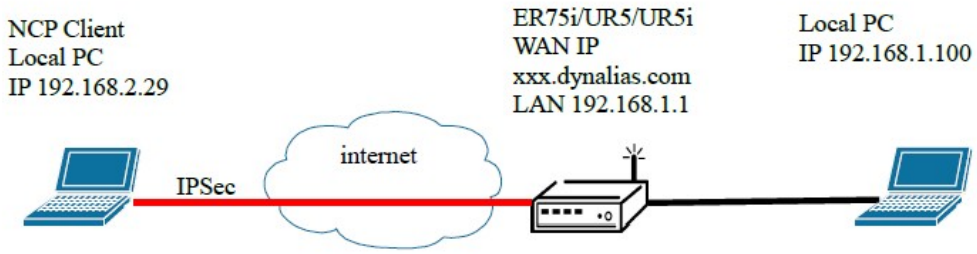

Fig. 13: IPSec tunnel – Windows

2.5.1. NCP Secure Entry Client program (version 9.23, build 18)

Obr. 14: NCP Secure Entry Client

2.5.2. Create a profile for IPSec tunnel establishing

Select *Configuration* item in the menu of the opening window of NCP Secure Entry Client (see previous figure) and then select *profiles*.

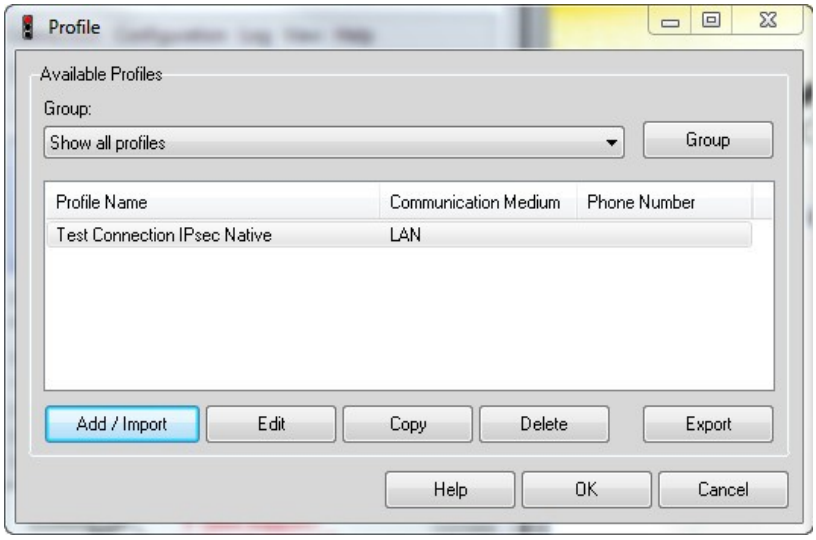

Fig. 15: Create a profile

Add a new profile by pressing the *Add/Import* button. Enter a profile name and on all screens only confirm by clicking on the *Next* (last on the *Finish*) button.

2.5.3. IPSec tunnel configuration

In the window that you used to creat the profile for IPSec tunnel establishing, click the *Edit* button.

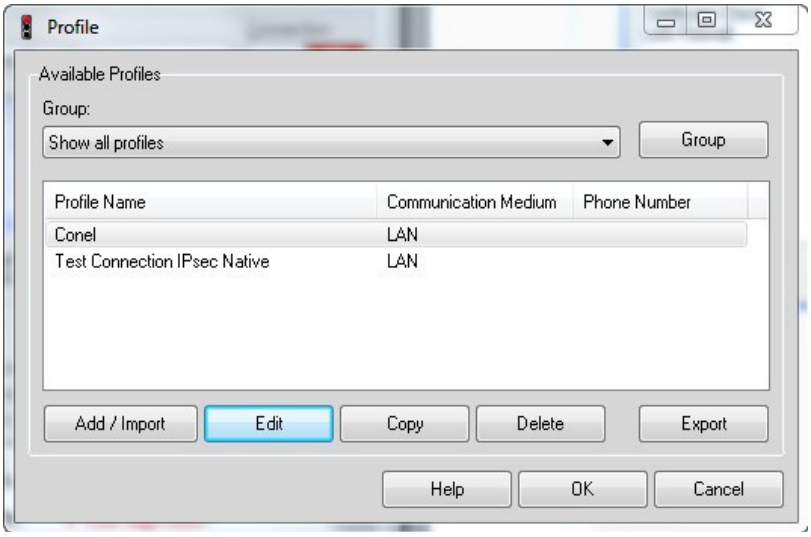

Fig. 16: IPSec tunnel configuration

Basic Settings

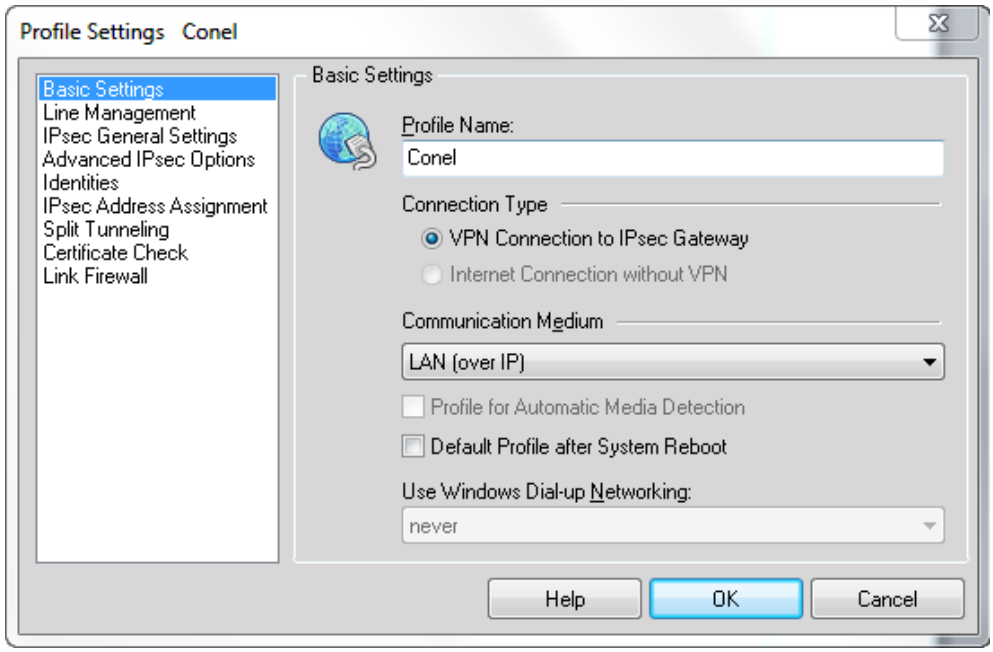

Fig. 17: Basic Settings

Line Management

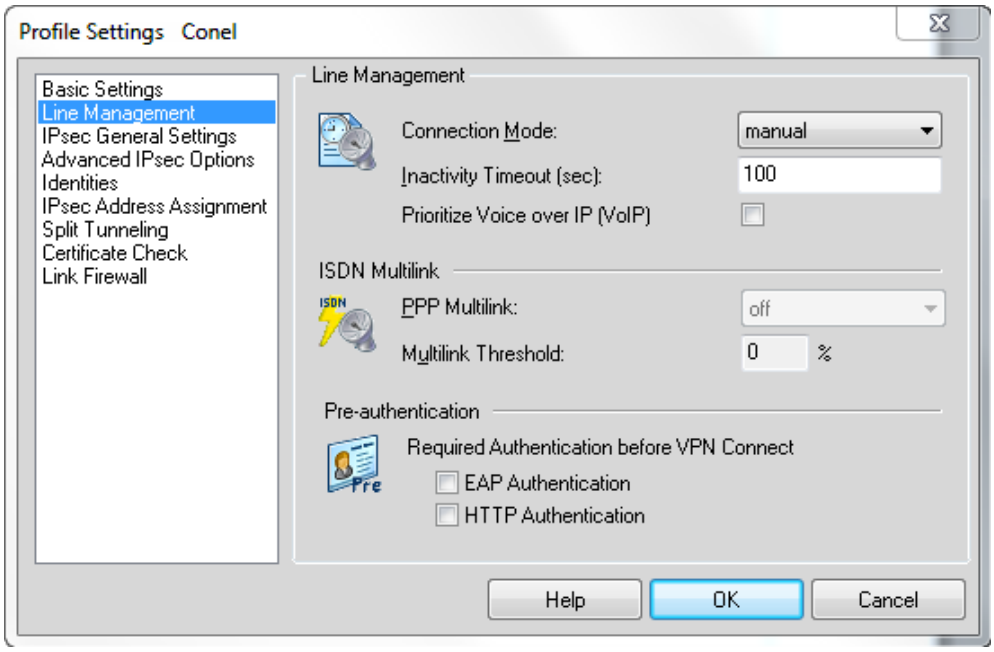

Fig. 18: Line Management

❒IPSec General Settings

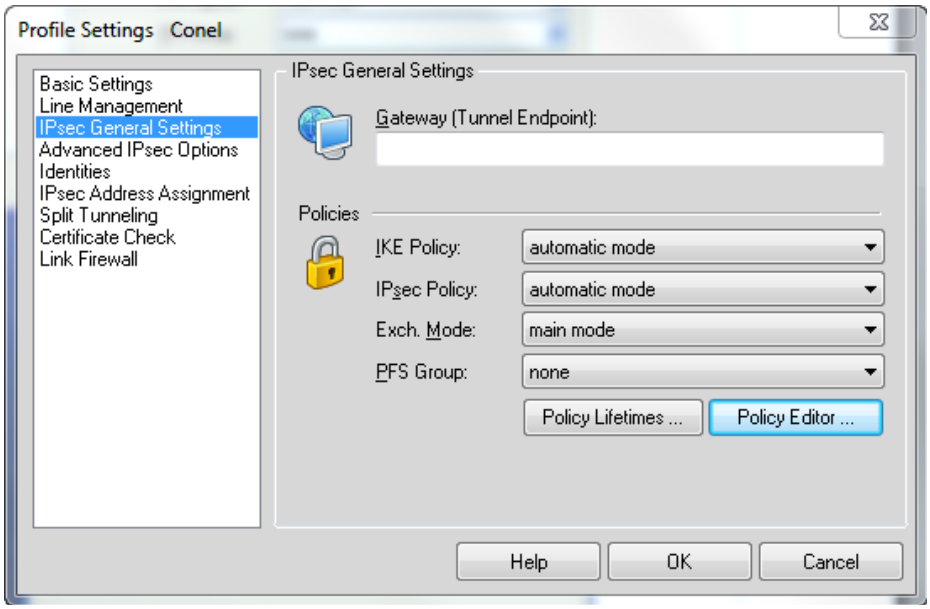

Fig. 19: IPSec General Settings

In this window press the *Police Editor...* button. Then, in the section named *IKE Policy (in the new window)* select *Pre-shared Key* item and click on the *Edit* button.

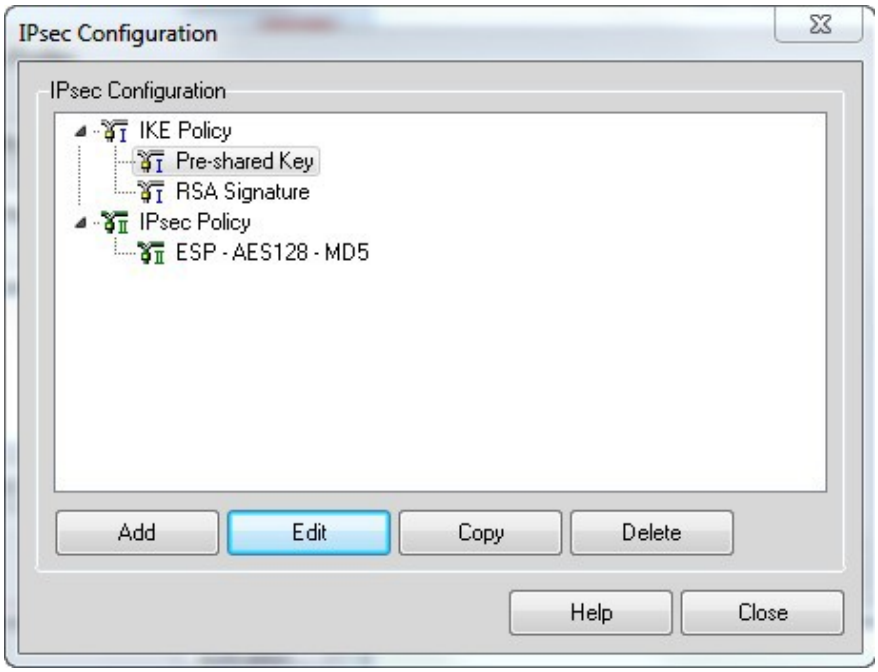

Fig. 20: Police Editor I (IPSec Configuration)

You will see the window shown in the figure below. Select *Pre-shared Key*, *Triple DES*, *MD5*, *DH-Group 2* and then press *OK*.

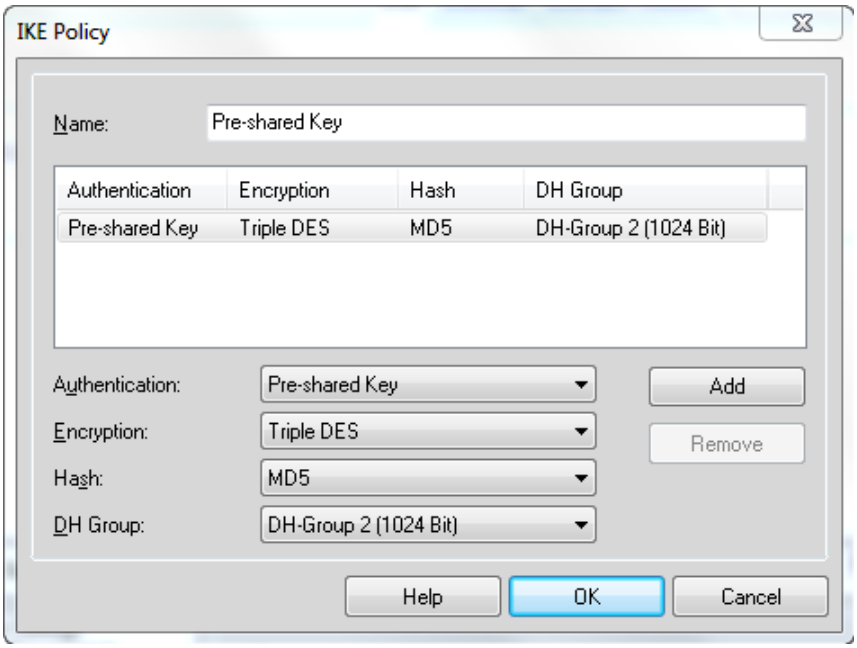

Fig. 21: Pre-shared Key (IPSec Configuration)

Now in the configuration window in *IPsec Policy* section select the only available item and click on the *Edit* button.

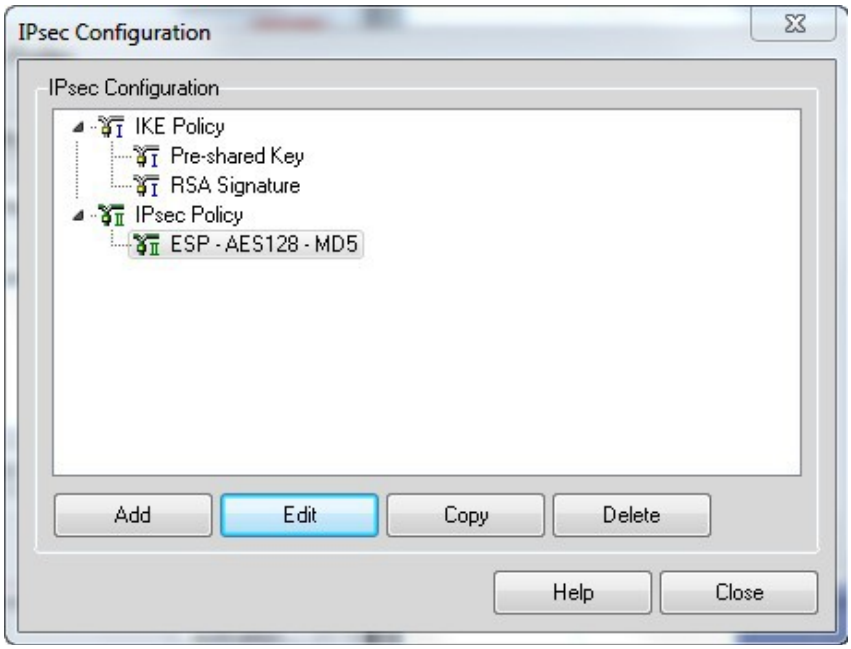

Fig. 22: Police Editor II (IPSec Configuration)

In the new window enter the name (e.g. ipsec) and select *Triple DES* and *MD5*. Then confirm by clicking *OK*.

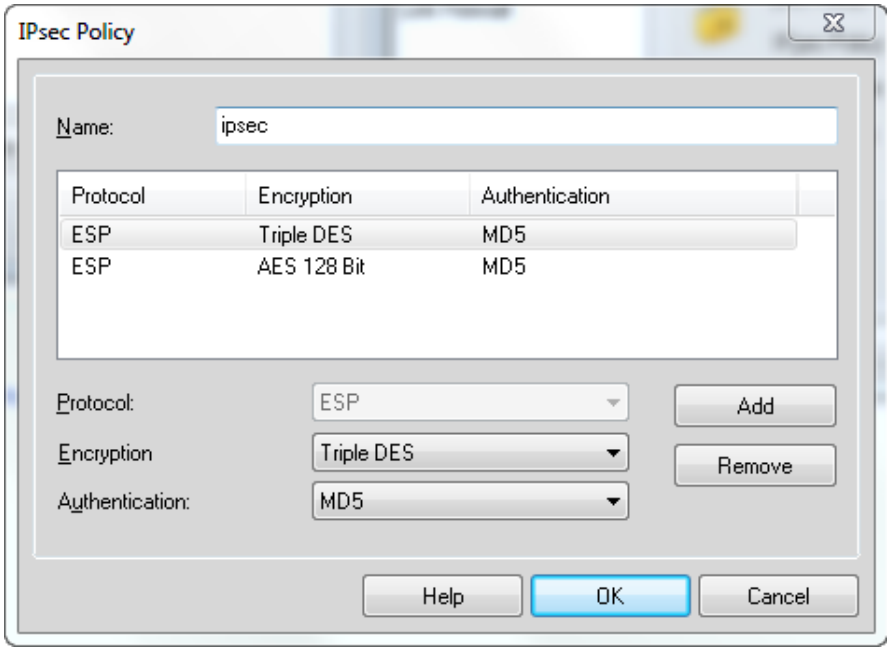

Fig. 23: IPSec Policy (IPSec Configuration)

Return to the main window of IPSec General Settings item and set the IKE Policy item and the IPSec Policy item on the basis of the previous configuration (see figure below).

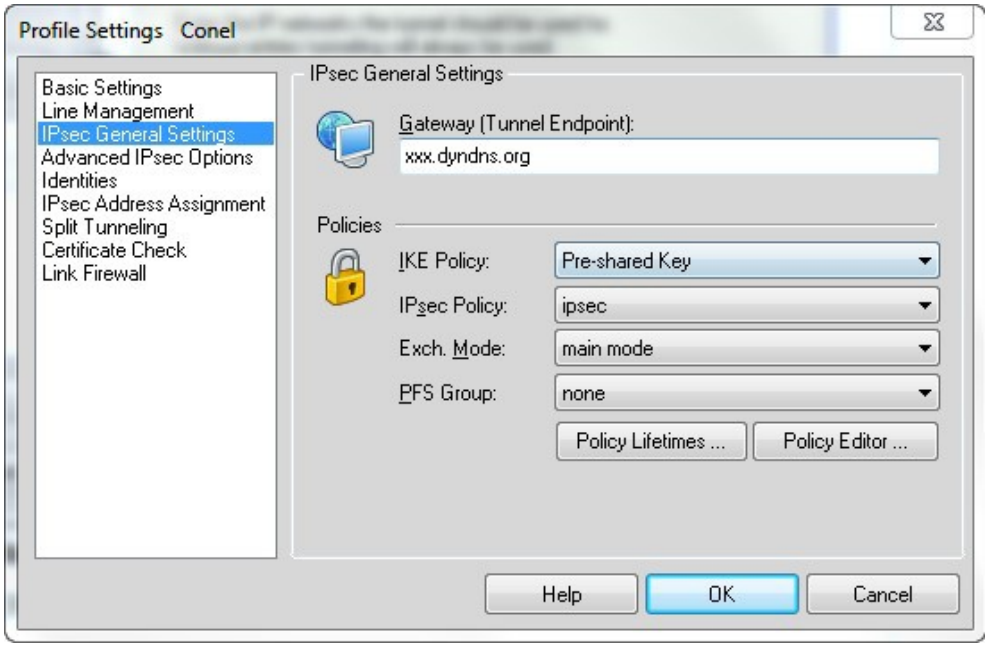

Fig. 24: IPSec General Settings – final setting

Advanced IPSec Options

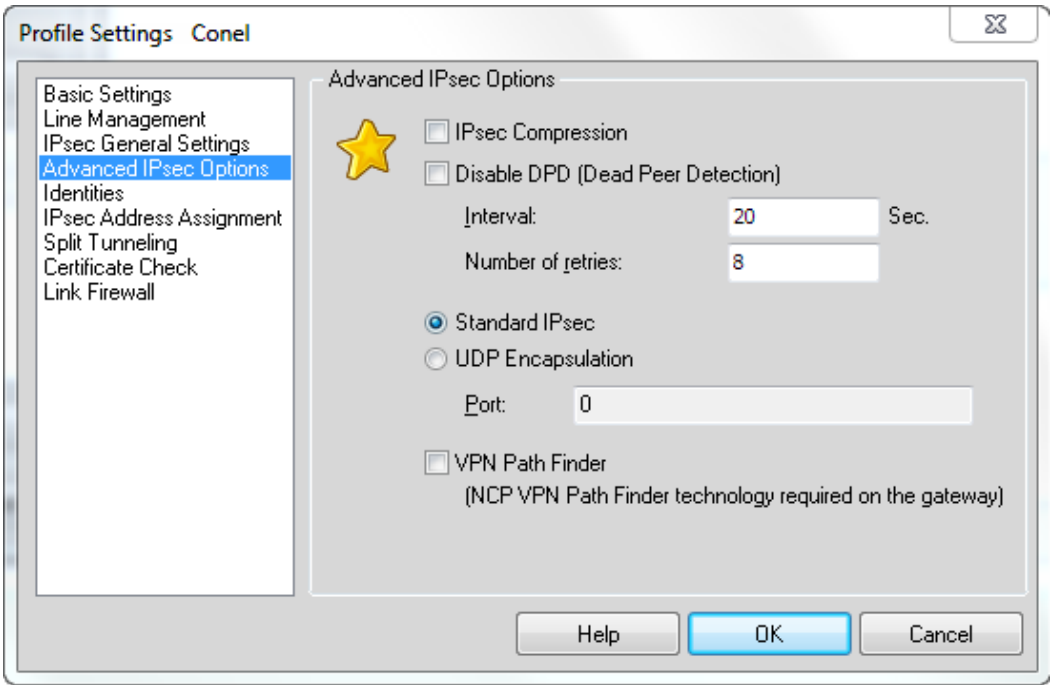

Fig. 25: Advanced IPSec Options

Identities

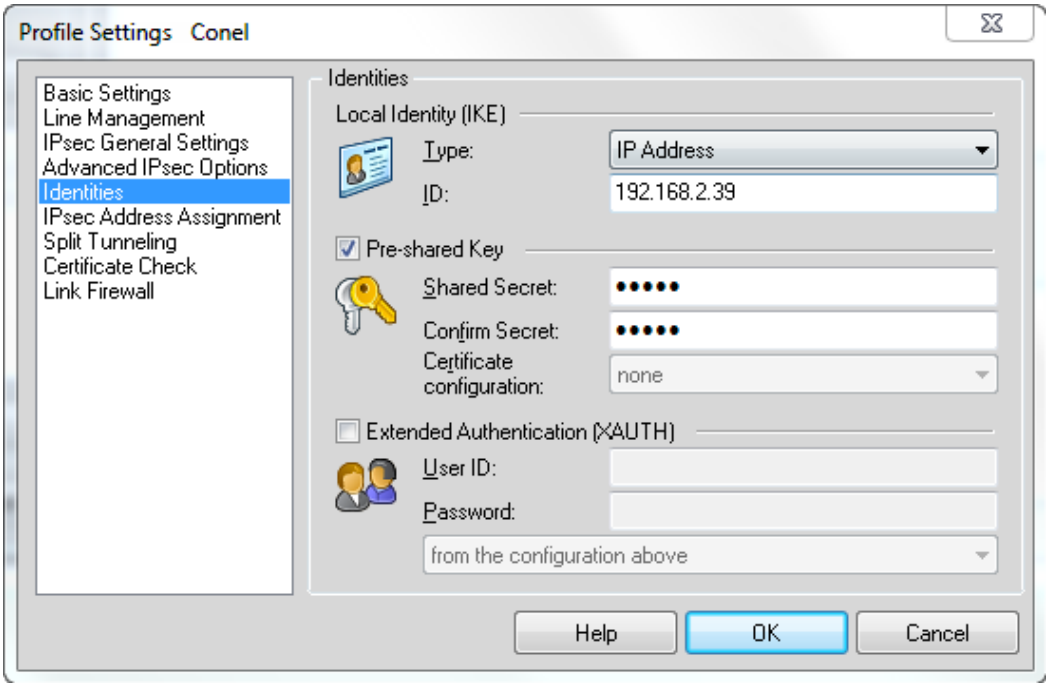

Fig. 26: Identities

IPSec Address Assignment

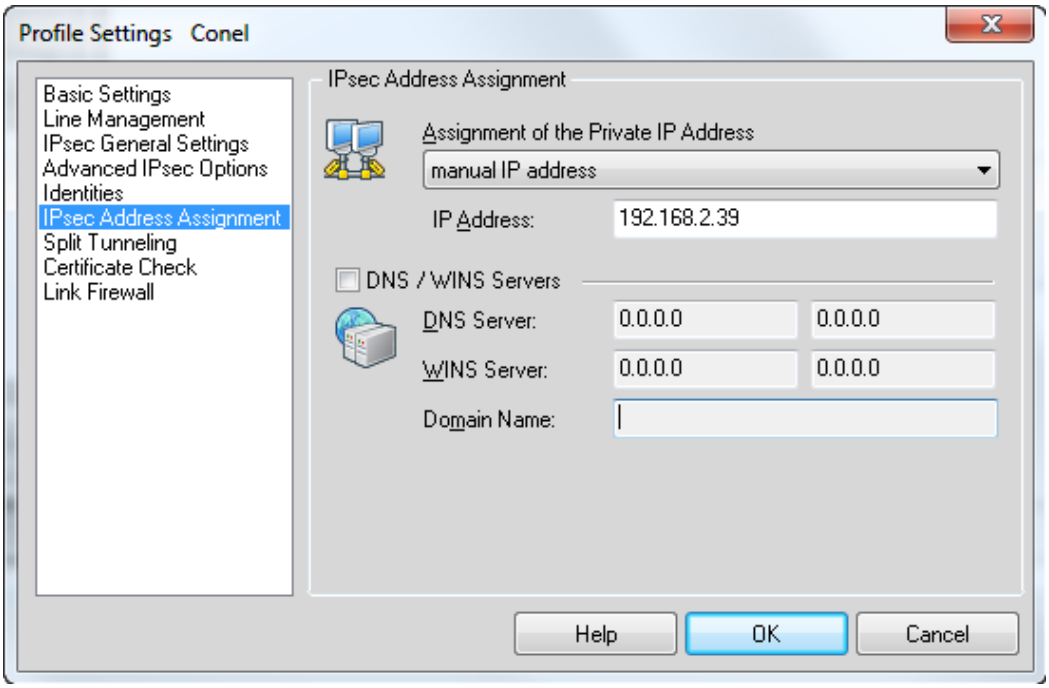

Fig. 27: IPSec Address Assignment

Split Tunneling

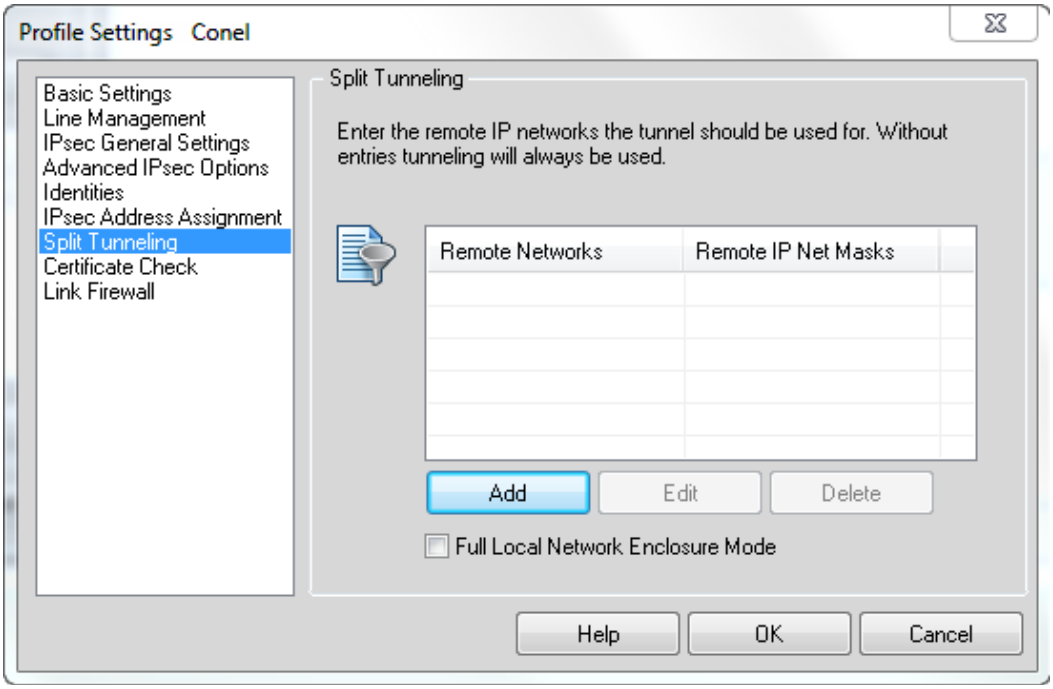

Fig. 28: Split Tunneling

Click the *Add* button and enter the subnet on the ETH port of the corresponding router.

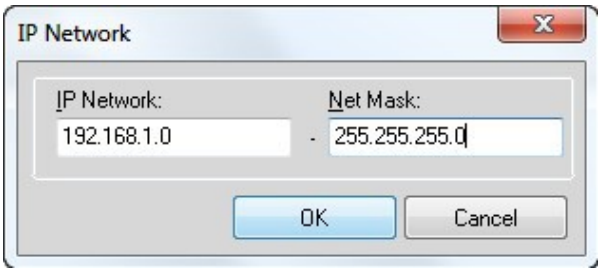

Fig. 29: IP Network

Confirm by clicking on the *OK* button. You will see the entered data in the original window of *Split Tunneling* item:

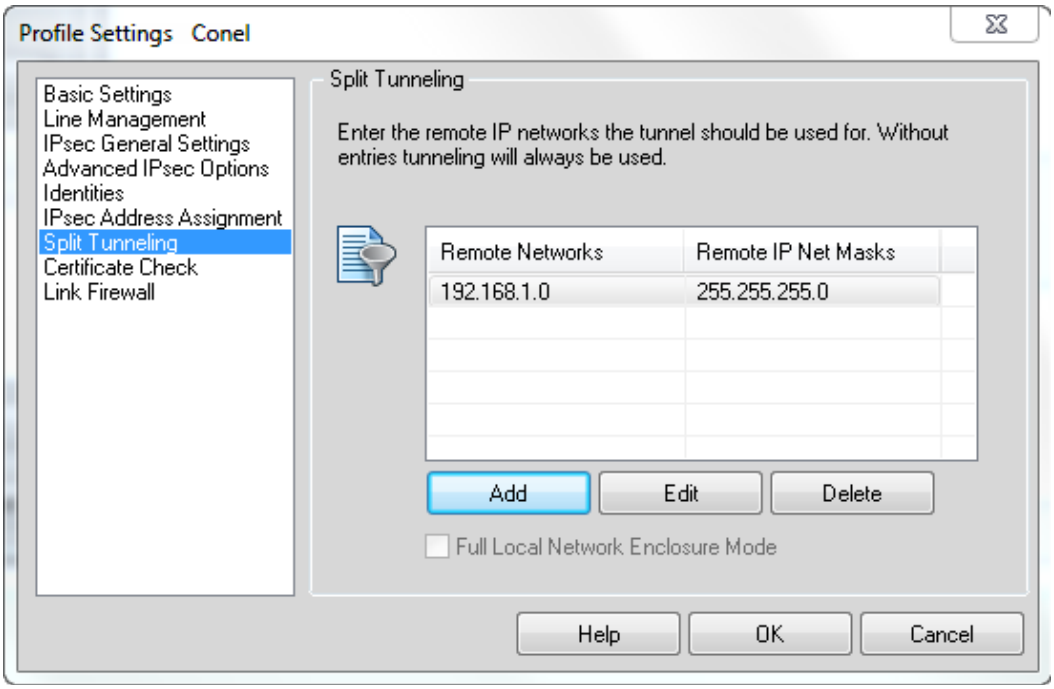

Fig. 30: Split Tunneling – entered data

☐**Certificate Check** and **Link Firewall** do not need to change.

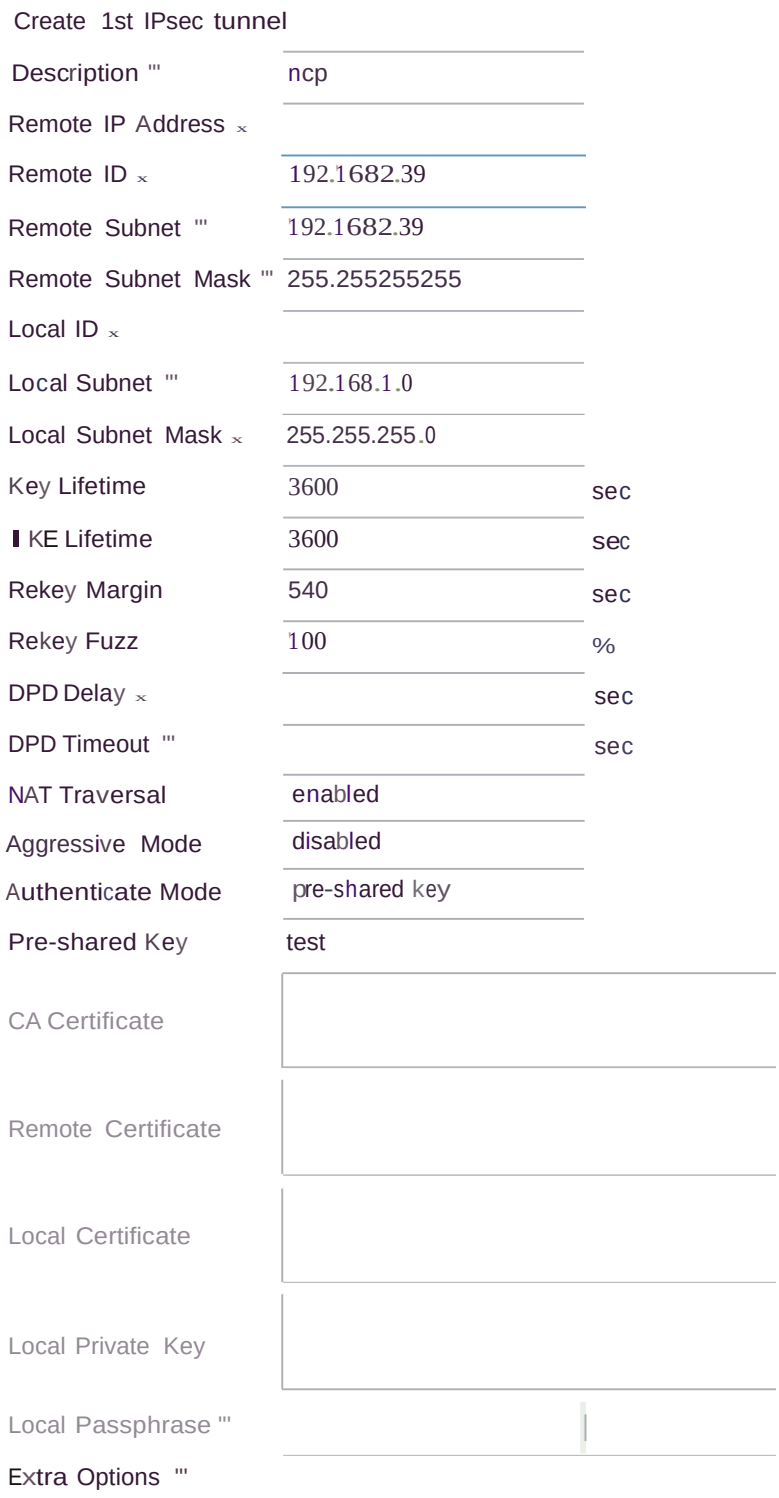

Fig. 31: Router setting (Windows)

2.5.5. Connection successfully established

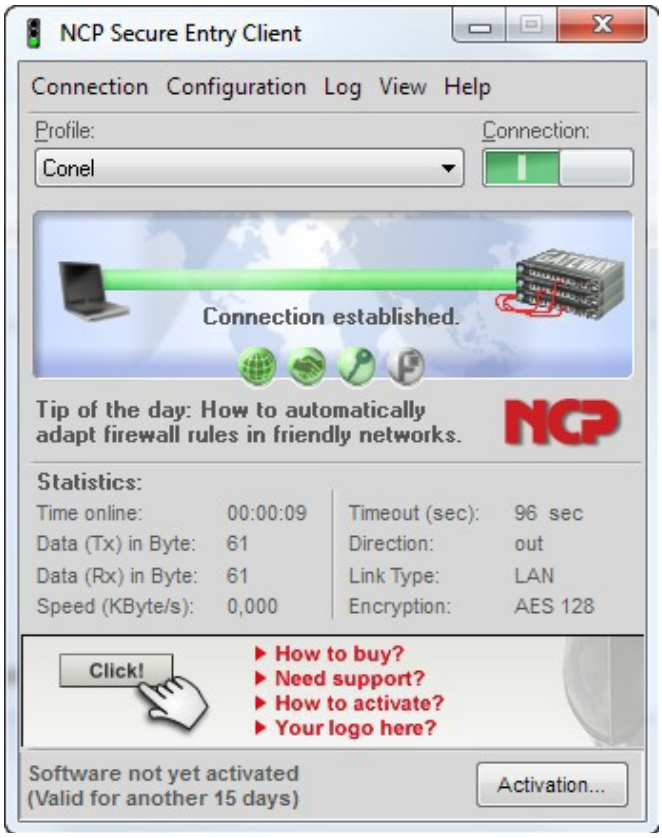

Fig. 32: Connection successfully established

Ping 192.168.1.100 (32 bytes):

Odpověď od 192.168.1.100: bajty=32 čas=651ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=287ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=305ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=326ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=324ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=321ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=299ms TTL=127
Odpověď od 192.168.1.100: bajty=32 čas=299ms TTL=127

Fig. 33: Ping 192.168.1.100

2.6. Using the IPSec tunnel- Mikrotik

2.6.1. Router setting

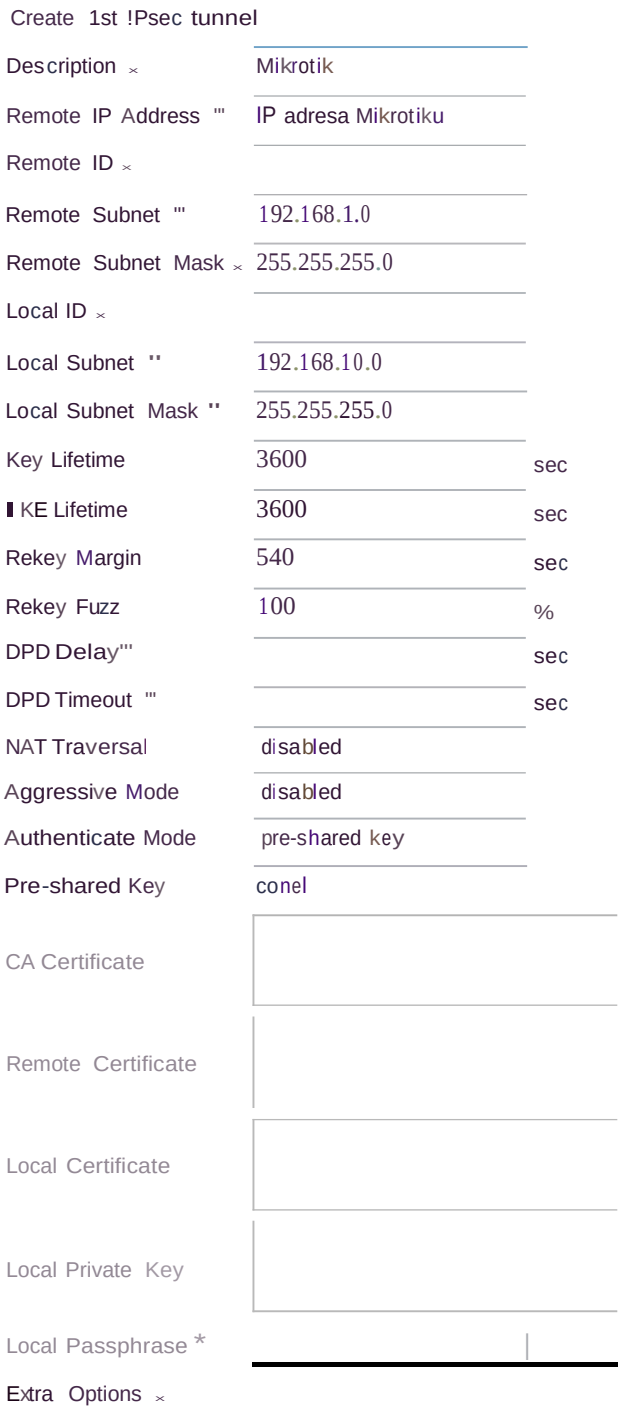

Fig. 34: Router setting (Mikrotik)

2.6.2. Mikrotik router setting

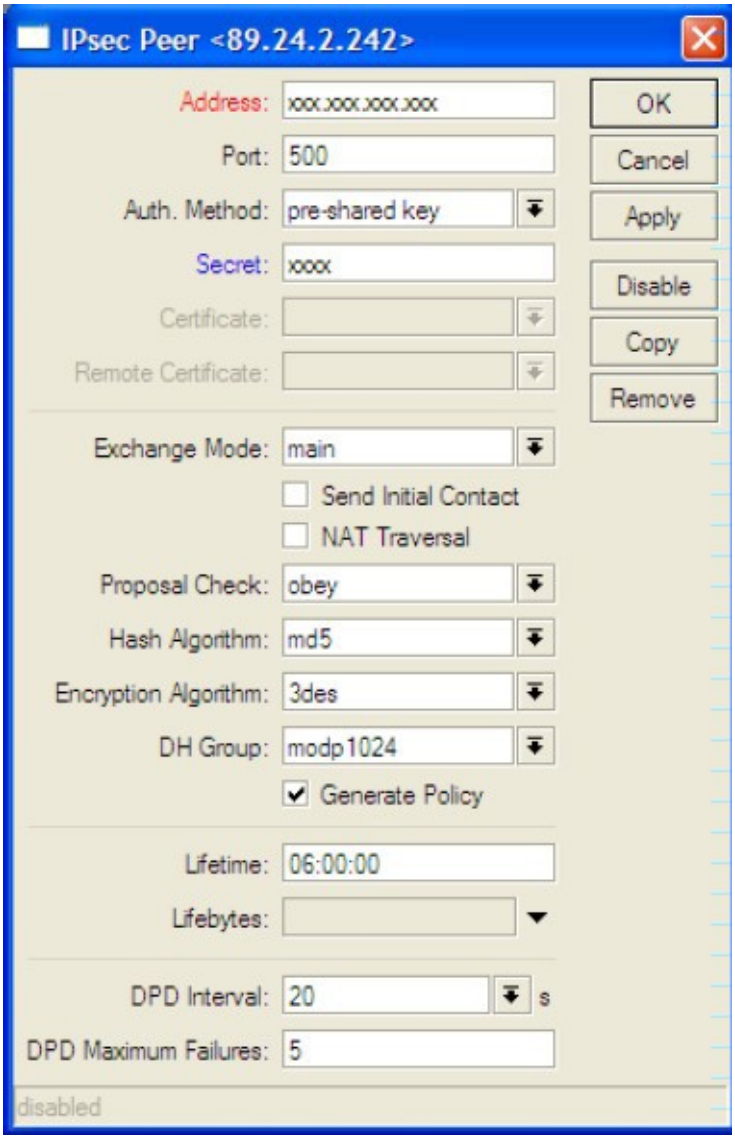

Fig. 35: Mikrotik router setting

In *Address* item you can enter 0.0.0.0/0 if the opposite side establishes the tunnel (it means router).

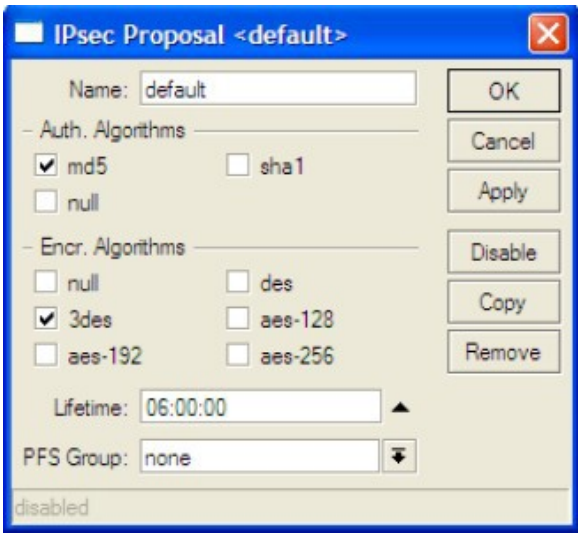

Fig. 36: IPSec Proposal

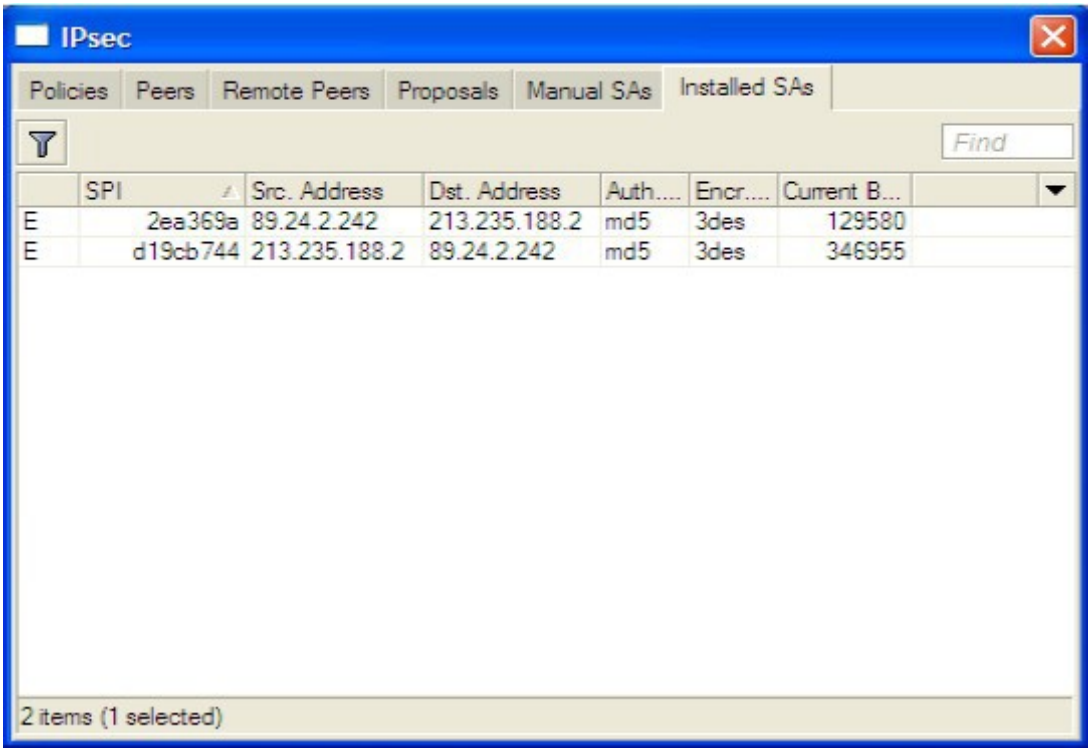

Fig. 37: IPSec – Installed SAs

2.7. Using the IPSec tunnel – Lancom 1721

2.7.1. VPN – General

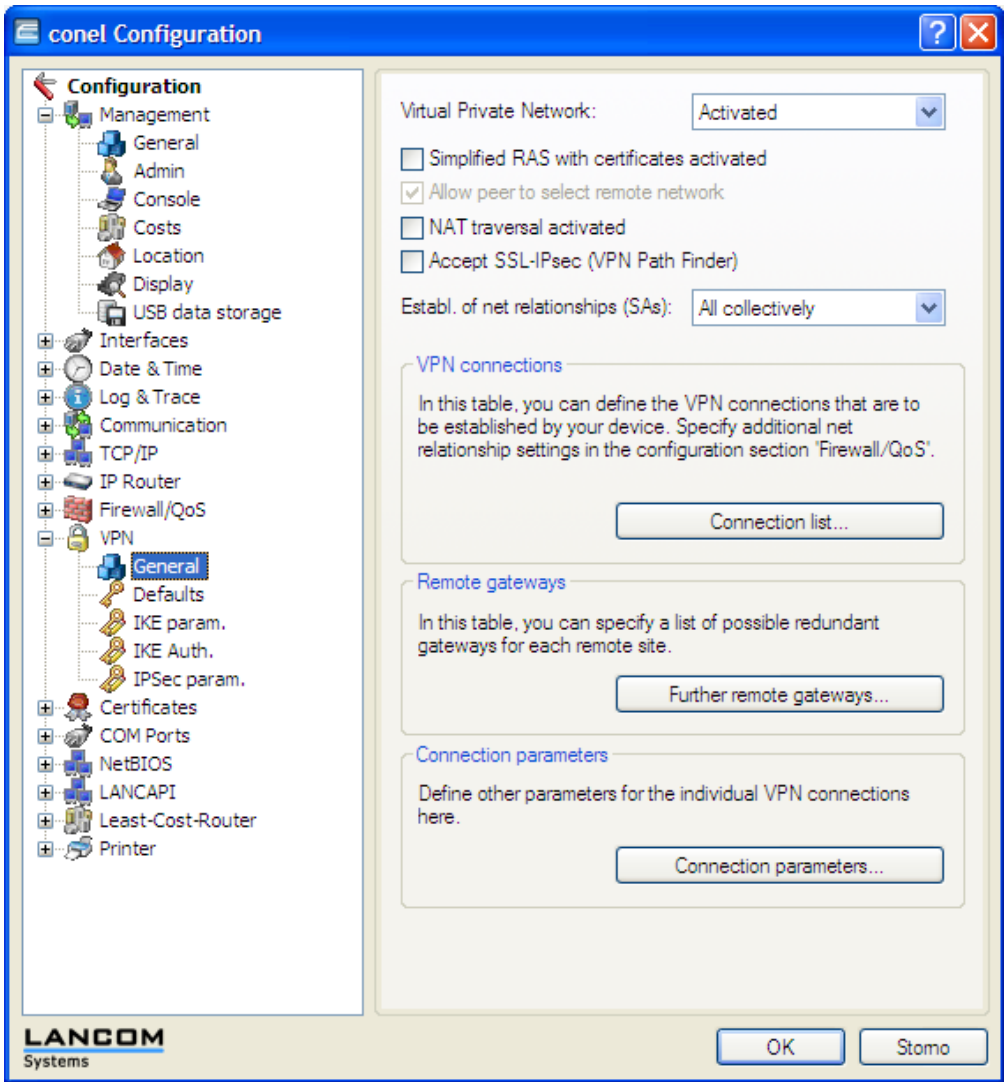

Fig. 38: VPN – General

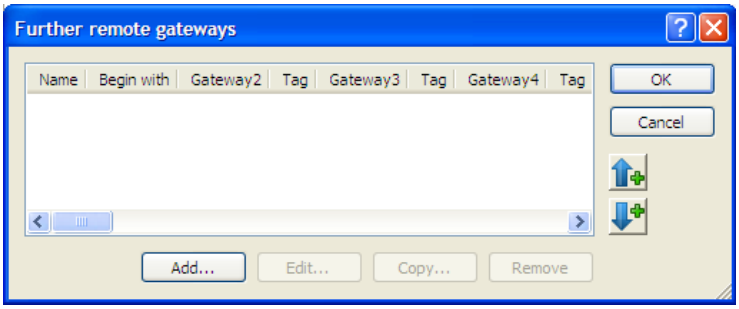

Fig. 39: Remote gateways

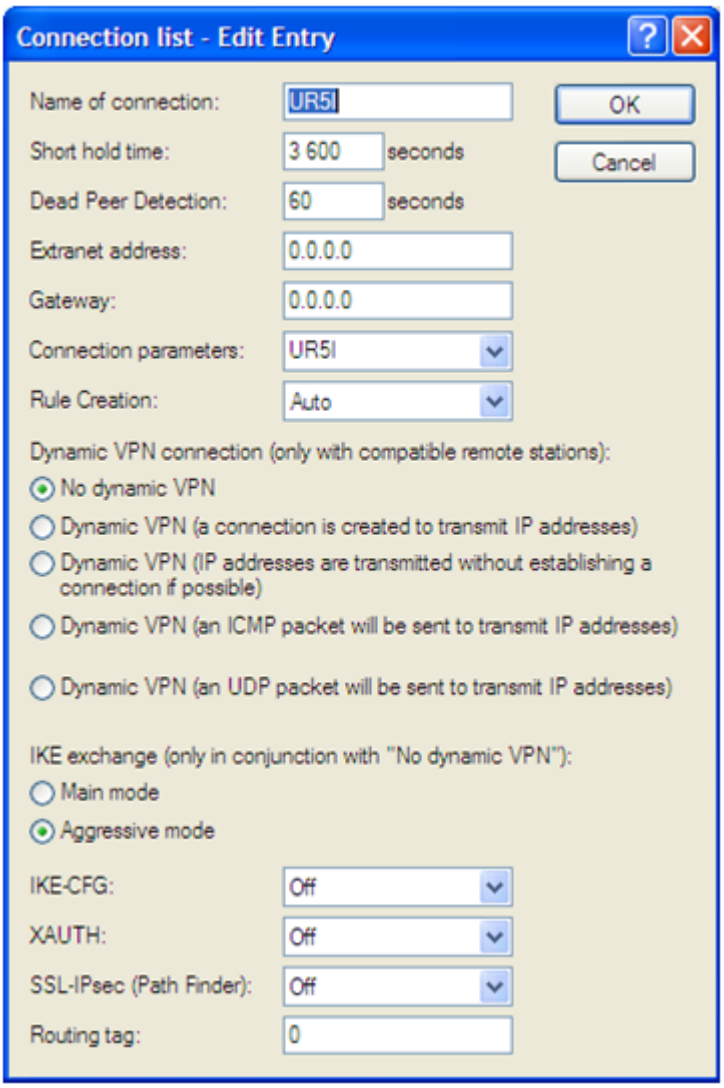

Fig. 40: Connection list – Edit Entry

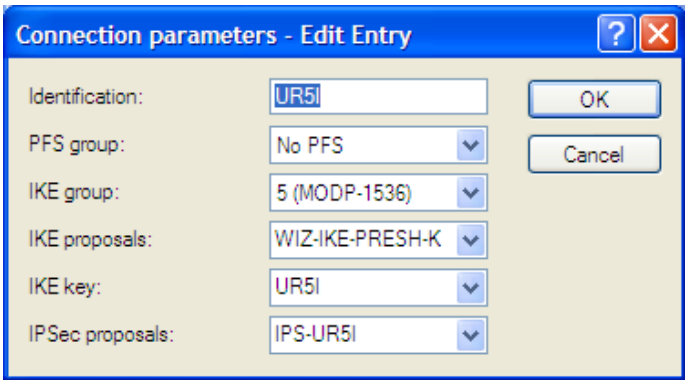

Fig. 41: Connection parameters – Edit Entry

2.7.2. VPN – Defaults

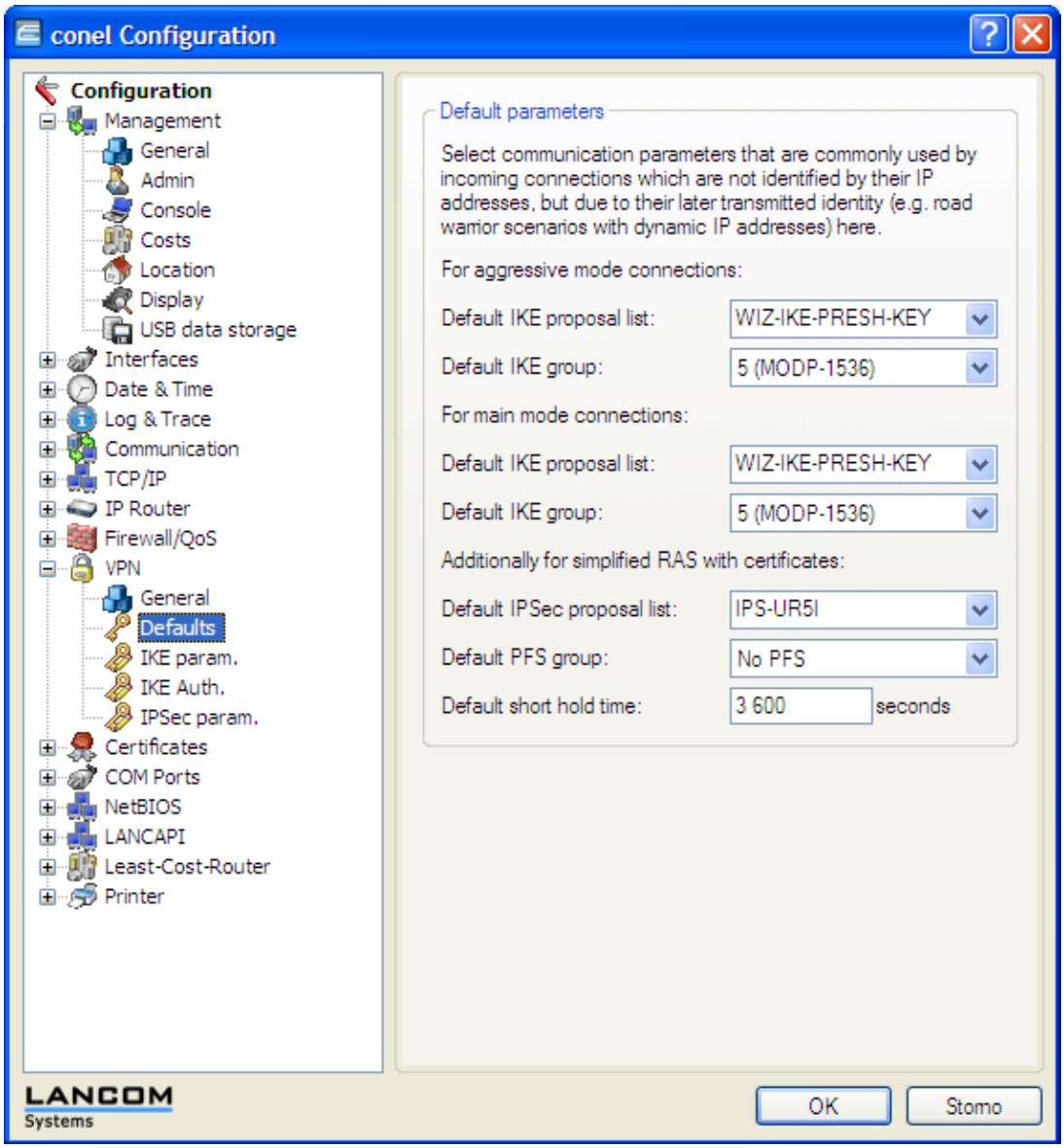

Fig. 42: VPN – Defaults

2.7.3. VPN – IKE parameters

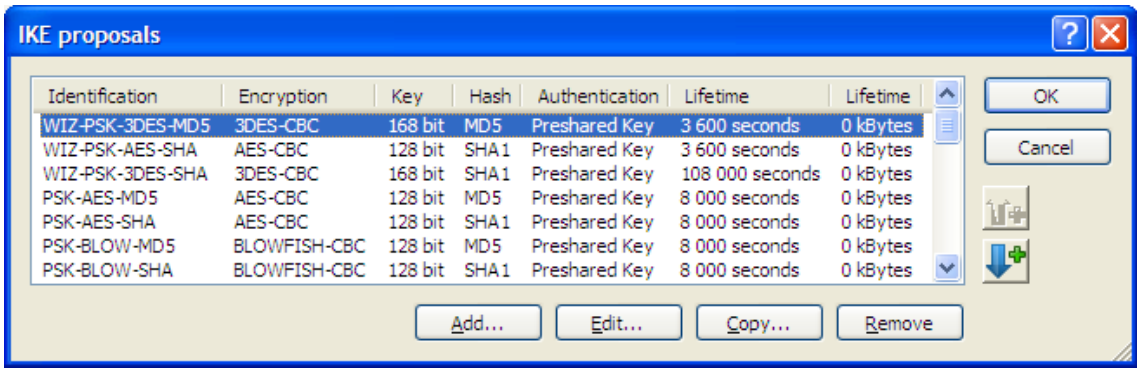

Fig. 43: VPN – IKE parameters

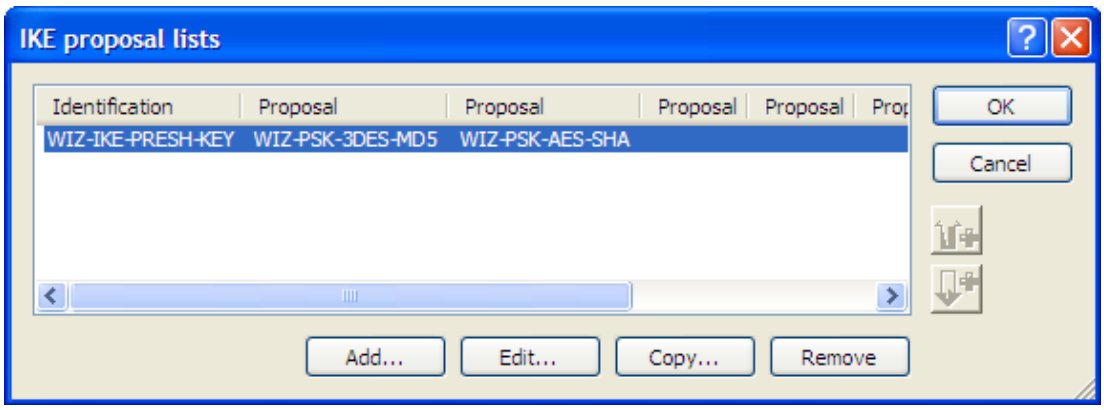

Fig. 44: IKE proposal lists

2.7.4. VPN – IKE Authorities

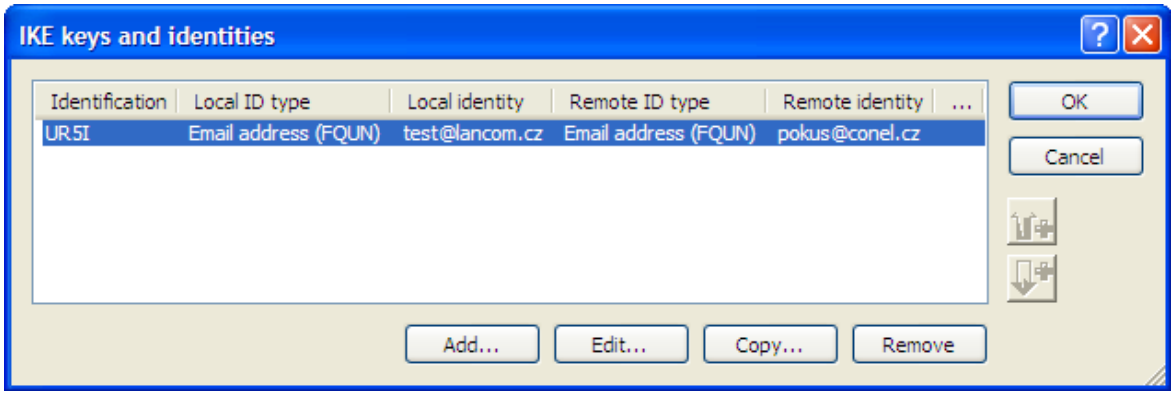

Fig. 45: VPN – IKE Authorities

2.7.5. VPN – IPSec parameters

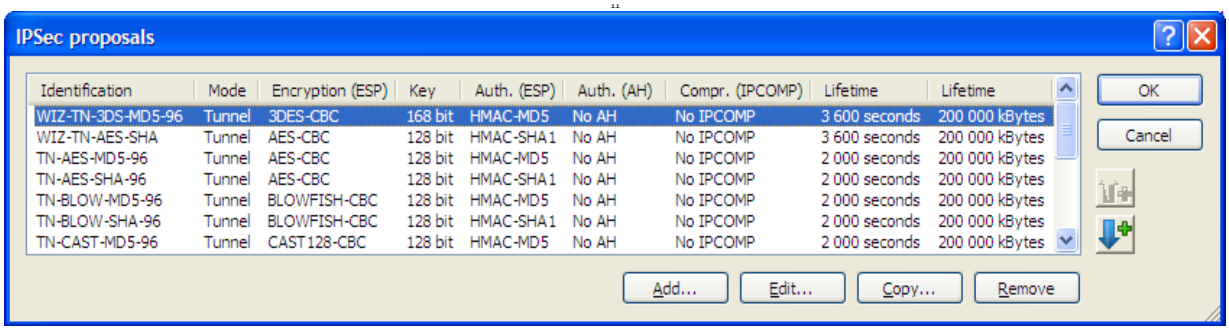

Fig. 46: VPN – IPSec parameters

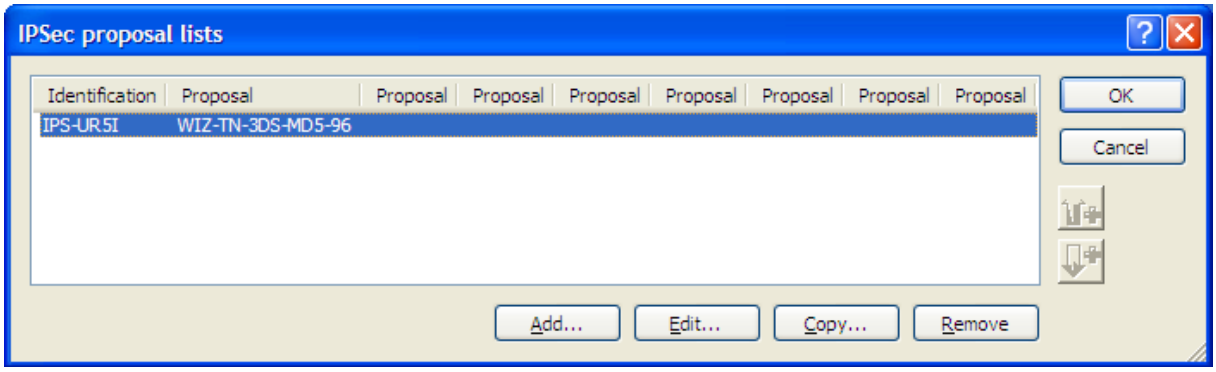

Fig. 47: IPSec proposal lists

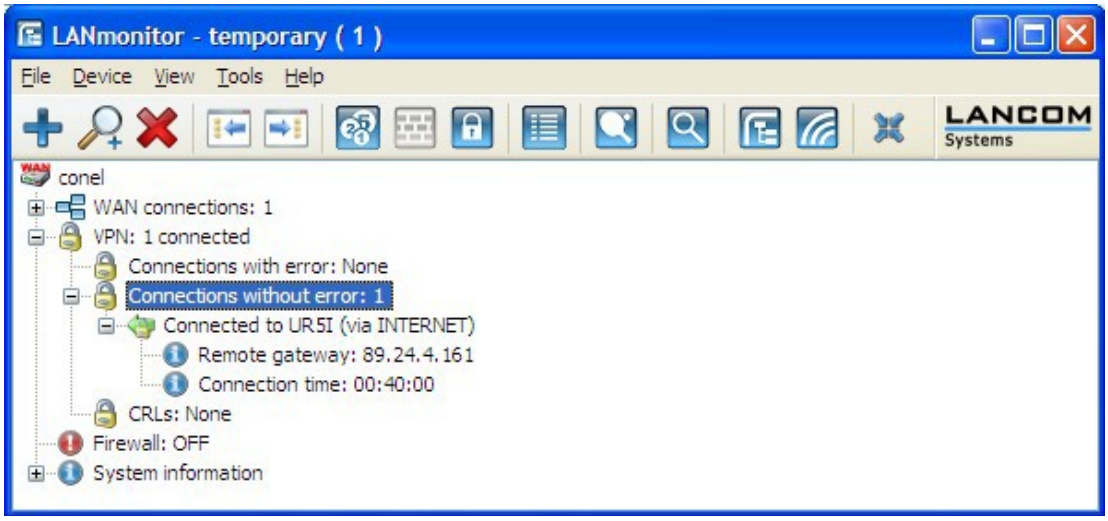

Fig. 48: LANmonitor

2.7.6. Router setting (Lancom 1721)

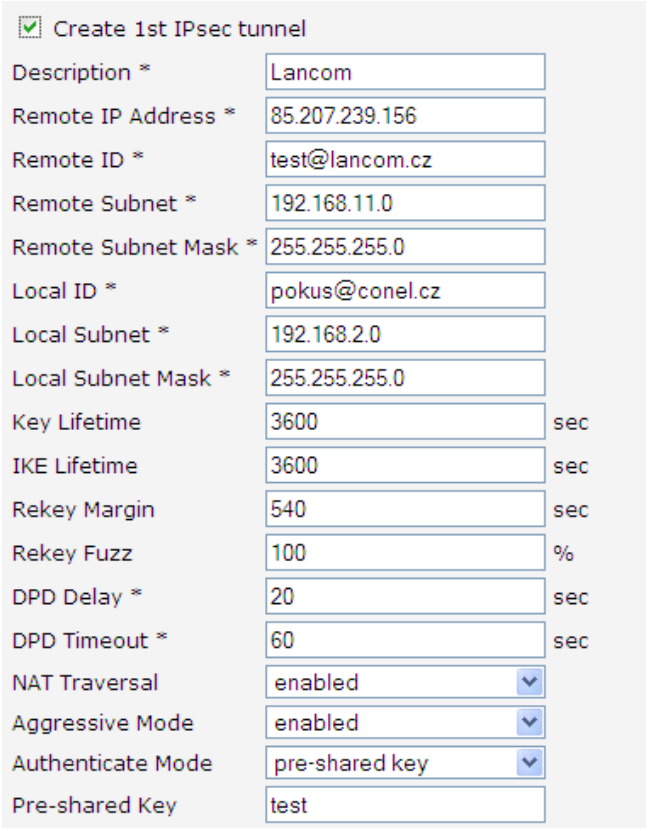

Fig. 49: Router setting (Lancom 1721)

IPsec Tunnel Informations

```
interface eth0/eth0 192.168.2.1
interface eth0/eth0 192.168.2.1
interface ppp0/ppp0 10.169.175.215
interface ppp0/ppp0 10.169.175.215
%myid = (none)
debug none

"ipsec1": 192.168.2.0/24===10.169.175.215[pokus@conel.cz,S?C]...85.207.239.156[test@lancom.cz,S?C]===192.168.11.0/24; erouted; eroute owner: #2
"ipsec1":     srcip=unset; dstip=unset; srcup=/etc/scripts/updown; dstup=/etc/scripts/updown;
"ipsec1":   ike_life: 3600s; ipsec_life: 3600s; rekey_margin: 540s; rekey_fuzz: 100%; keyingtries: 0
"ipsec1":   policy: PSK+ENCRYPT+TUNNEL+UP+AGGRESSIVE; prio: 24,24; interface: ppp0;
"ipsec1":   dpd: action:restart_by_peer; delay:20; timeout:60;
"ipsec1":   newest ISAKMP SA: #1; newest IPsec SA: #2;
"ipsec1":   IKE algorithms wanted: 5_000-1-5, flags=strict
"ipsec1":   IKE algorithms found:  5_192-1_128-5,
"ipsec1":   IKE algorithm newest: 3DES_CBC_192-MD5-MODP1536

#2: "ipsec1":500 STATE_QUICK_I2 (sent QI2, IPsec SA established); EVENT_SA_REPLACE in 489s; newest IPSEC; eroute owner
#2: "ipsec1" esp.5a4396d3@85.207.239.156 esp.22a66bd5@10.169.175.215 tun.0@85.207.239.156 tun.0@10.169.175.215
#1: "ipsec1":500 STATE_AGGR_I2 (sent AI2, ISAKMP SA established); EVENT_SA_REPLACE in 542s; newest ISAKMP; lastdpd=19s(seq in:30797 out:0)
```

Fig. 50: Information about IPSec tunnel (Lancom 1721)