geneko

GWR

USER MANUAL

GWR Cellular Router Series

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Description of the GPRS/EDGE/HSPA Router Series

GWR routers represent a robust solution designed to provide remote connectivity across cellular networks. Low transmission delay and very high data rates offered by existing cellular networks completely eliminate the need for expensive wired infrastructure. GWR series brings scalability of even most demanding corporate networks on highest possible level. Installing a reliable, high performance backup solution for existing land lines or satellite networks is now a simple task thanks to modern cellular networks. Therefore, no matter if the goal is to provide primary internet access or backup solution for already existing network GWR router series represents a top rated solution.

Figure 1 – GWR Router

There are practically no limits when it comes to possible application of GWR routers. Wired infrastructure is no longer necessary for building scalable and high performance systems. GWR routers will reduce the costs and speed up the ROI process for each one of possible applications. The list of most common GWR router applications is presented bellow.

Typical application

Data collection and system supervision

- Extra–high voltage equipment monitoring,
- Running water, gas pipe line supervision,
- Centralized heating system supervision,
- Environment protection data collection,
- Flood control data collection,
- Alert system supervision,
- Weather station data collection,
- Power Grid,
- Oilfield,
- Light Supervision,
- Solar PV Power Solutions.

Financial and department store

- Connection of ATM machines to central site,
- Vehicle based bank service,
- POS,
- Vending machine,
- Bank office supervision.

Security

- Traffic control,
- Video Surveillance Solutions,

Other

- Remote Office Solution,
- Remote Access Solution.

There are numerous variations of each and every one of above listed applications. Therefore GENEKO formed highly dedicated, top rated support team that can help you analyze your requirements and existing system, chose the right topology for your new system, perform initial configuration and tests and monitor the complete system after installation. Enhance your system performance and speed up the ROI with high quality cellular routers and all relevant knowledge of GWR support team behind you.

Technical Parameters

Complies with standards	EMC		Directive 2004/108/EC
			EN 301 489–1 V1.6.1(2005–09)
			EN 301 489–7 V1.3.1(2005–11)
	LVD		EN 60950–1:2001(1st Ed.) and/or EN 60950–1:2001
	R&TTE		Directive 1999/05/EC
			ETSI EN 301 511 V9.0.2
			EN 301 908–1 & EN 301 908–2(v2.2.1)
	RoHS		Directive 2002/95/EC
			EU Commission 2005/618/EC, 2005/717/EC, 2005/747/EC, 2006/310/EC, 2006/690/EC, 2006/691/EC and 2006/692/EC
Ethernet interface	Connector RJ–45 Standard: IEEE 802.3 Physical layer: 10/100Base–T Speed: 10/100Mbps Mode: full or half duplex		
Other interfaces	1 x UART(RS–232C) 1 x USB Host		
RF characteristics	GWR202	GPRS	Tri–band: 900/1800/1900 GPRS multi–slot class 10, mobile station class B GPRS DL: 85.6Kbps, UL: 42.8Kbps
	GWR252	GPRS EDGE	Quad band: GSM 850/900/1800/1900MHz GPRS/EDGE multi–slot class 12, mobile station class B EDGE DL: 236.8Kbps, UL: 236.8Kbps GPRS DL: 85.6Kbps, UL: 85.6Kbps
	GWR352	GPRS EDGE UMTS HSPA	UMTS/HSDPA/HSUPA: Quad band, 850/900/1900/2100MHz GSM/GPRS/EDGE: Quad band, 850/900/1800/1900MHz GPRS/EDGE multi–slot class 12, mobile station class B HSUPA DL: 7.2Mbps, HSDPA: UL: 5.76Mbps UMTS DL: 384Kbps, UL: 384Kbps EDGE DL: 236.8Kbps, UL: 236.8Kbps GPRS DL: 85.6Kbps, UL: 85.6Kbps
RF Connector	SMA, 50Ω		
Status LED	Ethernet activity/network traffic Power on GSM link activity Signal quality Reset		
Power requirements	9 – 12VDC / 1000mA		
Environmental	Operation: –10° C to 55° C (14° F to 131° F) Storage: –20° C to +85° C (–4° F to +185° F) Relative humidity: 5% to 95% (non–condensing)		
Dimensions and weight	Width/Length/Height: 95mm/135mm/35mm Weight: 380g		

Table 1 – Technical parameters

Protocols and features

Features	*Short description*
Network	
Routing	Static
DHCP Server: • **Static lease reservation** • **Address exclusions**	DHCP Server support.
RIP	The Routing Information Protocol is a dynamic routing protocol used in local and wide area networks.
IP forwarding	IP, TCP, UDP packets from WAN to LAN.
DMZ support	DMZ host is a host on the internal network that has all ports exposed, except those ports otherwise forwarded.
SNMP v1,2c	Simple Network Management Protocol is used in network management systems to monitor network–attached devices for conditions that warrant administrative attention.
NTP(RFC1305)	The Network Time Protocol is a protocol for synchronizing the clocks of router.
DynDNS	Client for various dynamic DNS services. This is a small utility for updating your host name for the any of the dynamic DNS service offered at: http://www.ez–ip.net, http://www.justlinux.com, http://www.dhs.org, http://www.dyndns.org, http://www.ods.org, http://www.dyn.ca, http://www.tzo.com, http://www.easydns.com, http://www.dyns.cx, http://www.zoneedit.com, http://www.no–ip.com.
Firewall: • **NAT** • **PAT** • **IP filtering** • **MAC filtering**	IP address / Network filtering
Serial over TCP/UDP	Serial to Ethernet converter
Modbus serial/IP gateway	The serial server will perform conversion from Modbus/TCP to Modbus/RTU, allowing polling by a Modbus/TCP master. The Modbus IP–Serial Gateway carries out translation between Modbus/TCP and Modbus/RTU. This means that Modbus serial slaves can be directly attached to the unit's serial ports without any external protocol converters.
VPN	
GRE	Generic Routing Encapsulation is a tunneling protocol that can encapsulate a wide variety of network layer protocol packet types inside IP tunnels.
GRE keepalive	• Keepalive for GRE tunnels, • Cisco compliant.
GRE – max. number of tunnels	50
IPSec pass–through	ESP tunnels.
IPsec	Internet Protocol Security is a suite of protocols for securing IP communications by authenticating and encrypting each IP packet of a data stream.
Data integrity	• HMAC–MD5, SHA–1, • Authentication and key management.
IKE features	• Perfect Forward Secrecy, • Diffie–Hellman Group 1,2,5, • DPD for constant connection, • NAT Traversal, • Send Initial Contact,

	• IP Payload Compression Protocol.
IPSec keepalive	Keepalive messages for IPSec tunnel state detecting.
IPSec IKE failover	Defines number of failed IKE negotiation attempts before failover.
IPSec tunnel failover	Switches to another provider because of poor tunnel performance.
IPSec – max. number of tunnels	5
OpenVPN	OpenVPN site to site graphical user interface (GUI) implementation allows connecting two remote networks via point–to–point encrypted tunnel. OpenVPN implementation offers a cost–effective simply configurable alternative to other VPN technologies.
OpenVPN – max. number of tunnels	5
GSM/UMTS features	
Dual SIM support	For operator backup.
SIM card detection	Status of active SIM card.
PIN enabler	Enable locking of SIM card with PIN code.
SIM Failover	Automatic change of SIM card after defined number of failed attempts.
Advanced CHAT script settings	Advanced chat settings for ppp connection.
Auto–reconnect or manual	Selection between automatic and manual re–connection.
GSM/UMTS keepalive	Keepalive messages for link state detecting.
Management	
User–friendly WEB GUI	HTTP based.
CLI: • **SSH** • **telnet** • **serial**	 Remote management over SSH. Remote management over Telnet.
Traffic and event log	Log tracing.
Maintenance	
Diagnostic	Ping utility.
Settings backup	Export of configuration.
Factory default settings	External taster and configuration application.

Table 2 – GWR Router features

Product Overview

Front panel

On the front panel (*Figure 2*) the following connectors are located:

- one RJ45 connector – Ethernet port for connection into local computer network,
- one RJ45 connector for RS232 serial communication,
- reset button,
- one USB connector for connection of additional device,
- Power supply connector.

Ethernet connector LED:

- ACT (yellow) on – Network traffic detected (off when no traffic detected),
- Network Link (green LED) on – Ethernet activity or access point engaged.

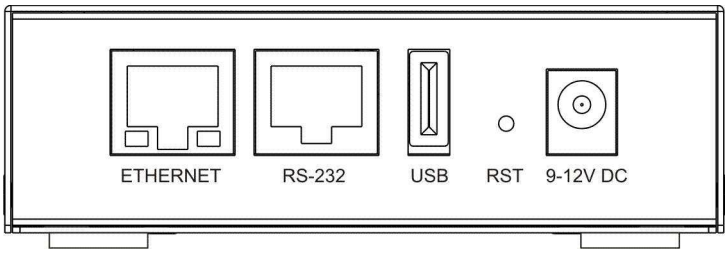


Figure 2 – GWR Router front panel

The Reset button can be used for a warm reset or a reset to factory defaults.

Warm reset: If the GWR Router is having problem connecting to the Internet, press and hold the reset button for a second using the tip of a pen.

Reset to Factory Defaults: To restore the default settings of the GWR Router, hold the RESET button pressed for a few seconds. Restoration of the default configuration will be signaled by blinks of the first and last signal strength LED on the top panel. This will restore the factory defaults and clear all custom settings of the GWR Router. You can also reset the GWR Router to factory defaults using the Maintenance > Default Settings screen.

Back panel

On the back panel of device (*Figure 3* and *Figure 4*) the following connectors are located:

- slot for SIM cards,
- SMA connector for connection of the GSM/UMTS antenna.

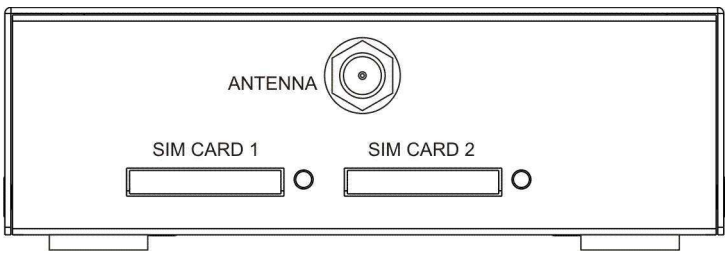


Figure 3 – GWR Router back panel (GPRS and EDGE)

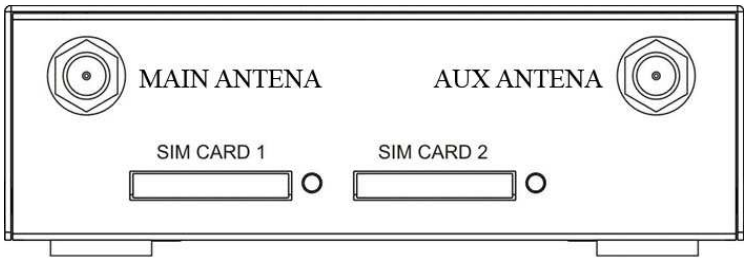


Figure 4 – GWR Router back panel (HSPA)

Top Panel

There is a sequence of 8 LED indicators on the top of this device by which the indication of the system current state, device power supply and presence of GSM/UMTS network as well as signal level is performed.

Figure 5 – GWR Router top panel side

LED Indicator Description:

1. Reset (red LED) on – the GWR Router reset state.
2. Power status (green LED) on – Power supply. Power status LED will blink when the GWR Router is in initializing state.
3. Link (red LED) will blink when connection is active.

4. Signal strength LED indicator:
   - –107 or less dBm = Unacceptable (1 LED),
   - –107 to –98 dBm = Weak (2 LED),
   - –98 to –87 dBm = Moderate (3 LED),
   - –87 to –76 dBm = Good (4 LED),
   - –76 or better dBm = Excellent (5 LED).
   - 0 is not known or not detectable (running LED).

   Signal strength LED will blink when GPRS/EDGE/HSPA/HSPA+/LTE connection is not active. When connection is active Signal strength LED is on. Reset condition will be indicated by blinks of the first and last Signal strength LED. When signal quality is not known or not detectable there will be running LED indication.

Putting Into Operation

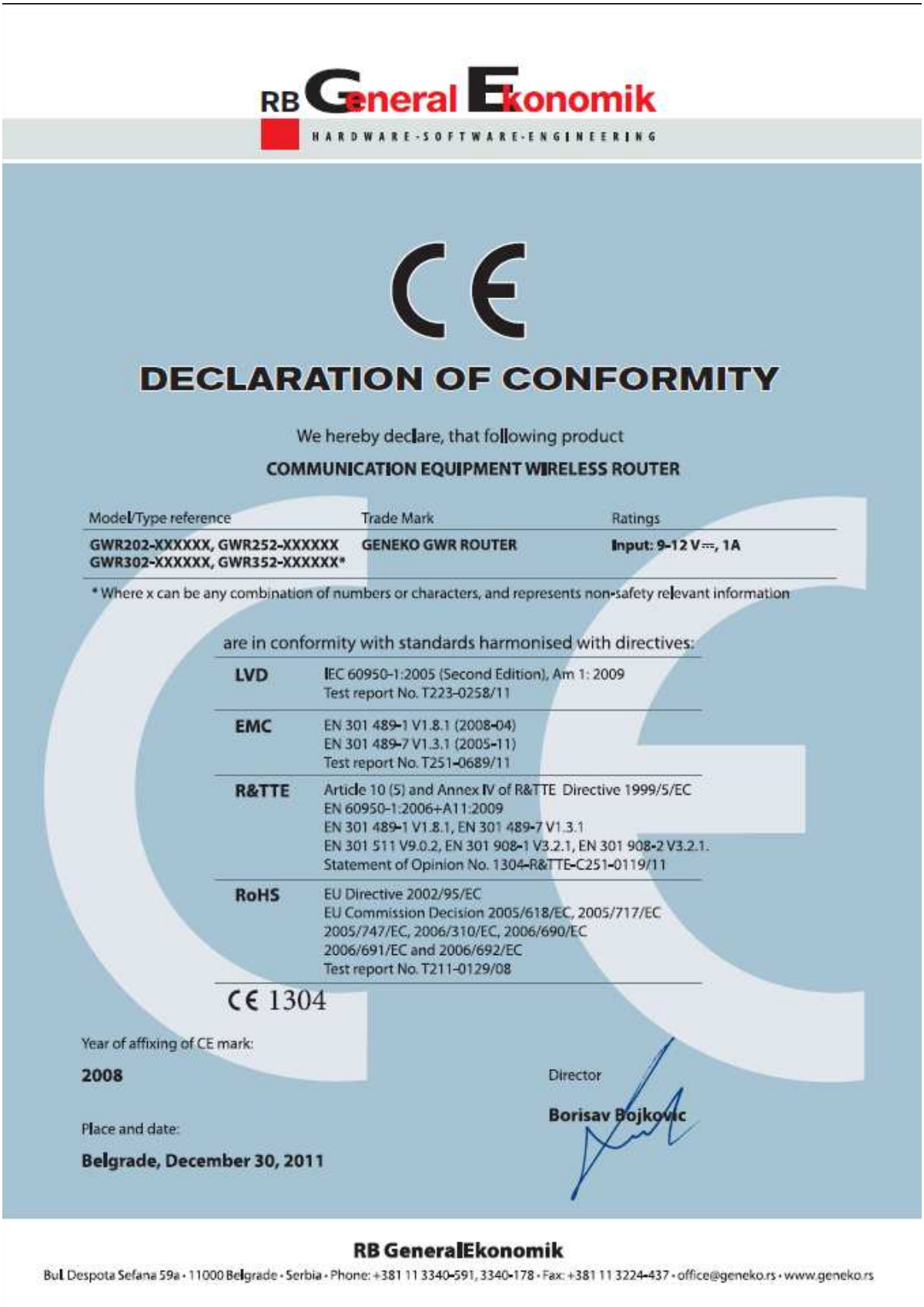
Before putting the GWR Router in operation it is necessary to connect all components needed for the operation:

- GSM antenna,
- Ethernet cable and
- SIM card must be inserted.

And finally, device should have powered up using power supply adaptor.
Power consumption of GWR router is 2W in standby and 3W in burst mode.

SIM card must not be changed, installed or taken out while device operates. This procedure is performed when power supply is not connected.

Declaration of conformity



RB General Ekonomik

HARDWARE-SOFTWARE-ENGINEERING

CE

DECLARATION OF CONFORMITY

We hereby declare, that following product

COMMUNICATION EQUIPMENT WIRELESS ROUTER

Model/Type reference	Trade Mark	Ratings
GWR202-XXXXXX, GWR252-XXXXXX GWR302-XXXXXX, GWR352-XXXXXX*	**GENEKO GWR ROUTER**	**Input: 9-12 V⎓, 1A**

* Where x can be any combination of numbers or characters, and represents non-safety relevant information

are in conformity with standards harmonised with directives:

LVD	IEC 60950-1:2005 (Second Edition), Am 1: 2009 Test report No. T223-0258/11
EMC	EN 301 489-1 V1.8.1 (2008-04) EN 301 489-7 V1.3.1 (2005-11) Test report No. T251-0689/11
R&TTE	Article 10 (5) and Annex IV of R&TTE Directive 1999/5/EC EN 60950-1:2006+A11:2009 EN 301 489-1 V1.8.1, EN 301 489-7 V1.3.1 EN 301 511 V9.0.2, EN 301 908-1 V3.2.1, EN 301 908-2 V3.2.1. Statement of Opinion No. 1304-R&TTE-C251-0119/11
RoHS	EU Directive 2002/95/EC EU Commission Decision 2005/618/EC, 2005/717/EC 2005/747/EC, 2006/310/EC, 2006/690/EC 2006/691/EC and 2006/692/EC Test report No. T211-0129/08

CE 1304

Year of affixing of CE mark:

2008

Director

Borisav Bojkovic

Place and date:

Belgrade, December 30, 2011

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Figure 6 – Declaration of conformity

Device Configuration

There are two methods which can be used to configure the GWR Router. Administrator can use following methods to access router:

- Web browser,
- Command line interface.

Default access method is by web interface. This method provides administrator full set of privileges for configuring and monitoring the router. Configuration, administration and monitoring of the GWR Router can be performed through the web interface. The default IP address of the router is 192.168.1.1. Another method is by command line interface. This method has limited options for configuring the GWR Router but still represents a very powerful tool when it comes to router setup and monitoring. Another document deals with CLI commands and instructions.

Device configuration using web application

The GWR Router's web–based utility allows you to set up the Router and perform advanced configuration and troubleshooting. This chapter will explain all of the functions in this utility.

For local access to the GWR Router's web–based utility, launch your web browser, and enter the Router's default IP address, 192.168.1.1, in the address field. A login screen prompts you for your User name and Password. Default administration credentials are admin/admin.

If you want to use web interface for router administration please enter IP address of router into web browser. Please disable *Proxy server* in web browser before proceed.

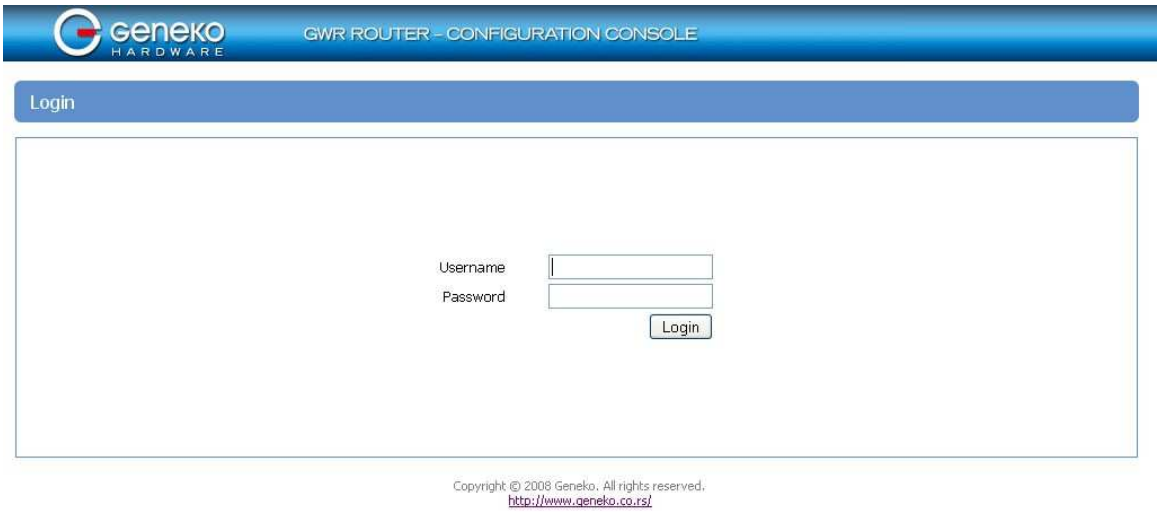


Figure 7 – User authentication

After successfully finished process of authentication of *Username/Password* you can access ***Main Configuration Menu***.

You can set all parameters of the GWR Router using web application. All functionalities and parameters are organized within few main tabs (windows).

Add/Remove/Update manipulation in tables

To ***Add*** a new row (new rule or new parameter) in the table please do following:

- Enter data in fields at the bottom row of the table (separated with a line).
- After entering data in all fields click ***Add*** link.

To ***Update*** the row in the table:

- Change data directly in fields you want to change.

To ***Remove*** the row from the table:

- Click ***Remove*** link to remove selected row from the table.

Save/Reload changes

To save all the changes in the form press ***Save*** button. By clicking ***Save*** data are checked for validity. If they are not valid, error message will be displayed. To discard changes press the ***Reload*** button. By clicking **Reload**, previous settings will be loaded in the form.

Status Information

The GWR Router's Status menu provides general information about router as well as real–time network information. Status information is divided into following categories:

- General Information,
- Network Information (LAN),
- DHCP,
- WAN Information,
- Firewall

Status – General

General Information Tab provides general information about device type, device firmware version, kernel version, CPU vendor, Up Time since last reboot, hardware resources utilization and MAC address of LAN port. Screenshot of General Router information is shown at *Figure 8*. Data in Status menu are read only and cannot be changed by user. If you want to refresh screen data press ***Refresh*** button.

SIM Card detection is performed only at time booting the system, and you can see the status of SIM slot by checking the Enable SIM Card Detection option.

Figure 8 – General router information

Status – Network Information

Network Information Tab provides information about Ethernet port and Ethernet traffic statistics in bytes) Screenshot of Network Router information is shown in *Figure 9*.

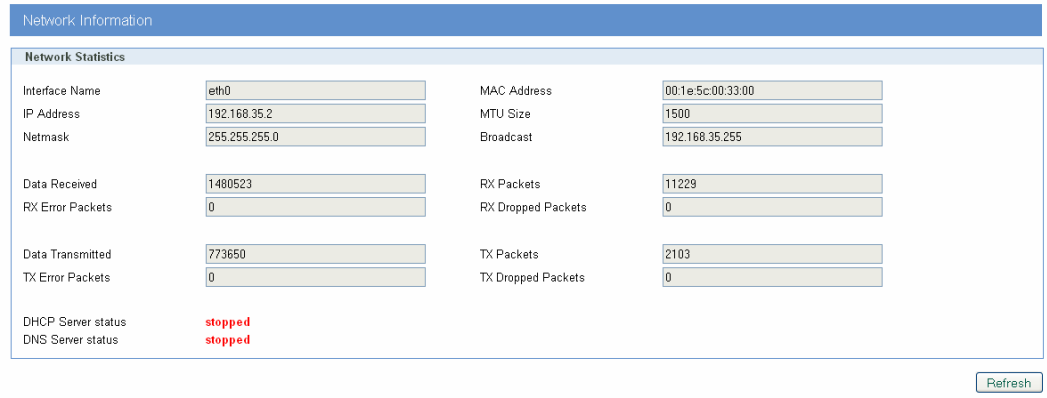


Figure 9 – Network Information

Status – DHCP

DHCP Information Tab provides information about DHCP clients with IP addresses gained from DHCP server, MAC addresses, expiration period, and lease status.

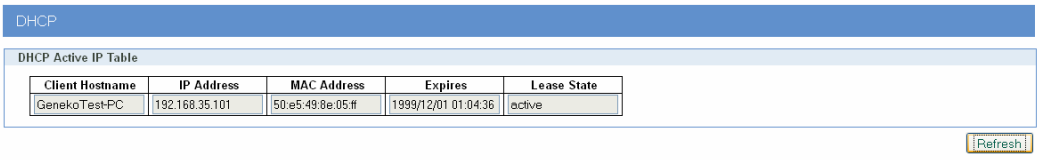


Figure 10 – DHCP Information

Status – WAN Information

WAN Information Tab provides information about GPRS/EDGE/HSPA/HSPA+/LTE connection and traffic statistics. *WAN information menu* has three submenus which provide information about:

- GPRS/EDGE/HSPA/HSPA+/LTE mobile module(manufacturer and model),
- Mobile operator and signal quality,
- Mobile traffic statistics (in bytes)

Screenshot of WAN information from the router is shown in *Figure 11*.

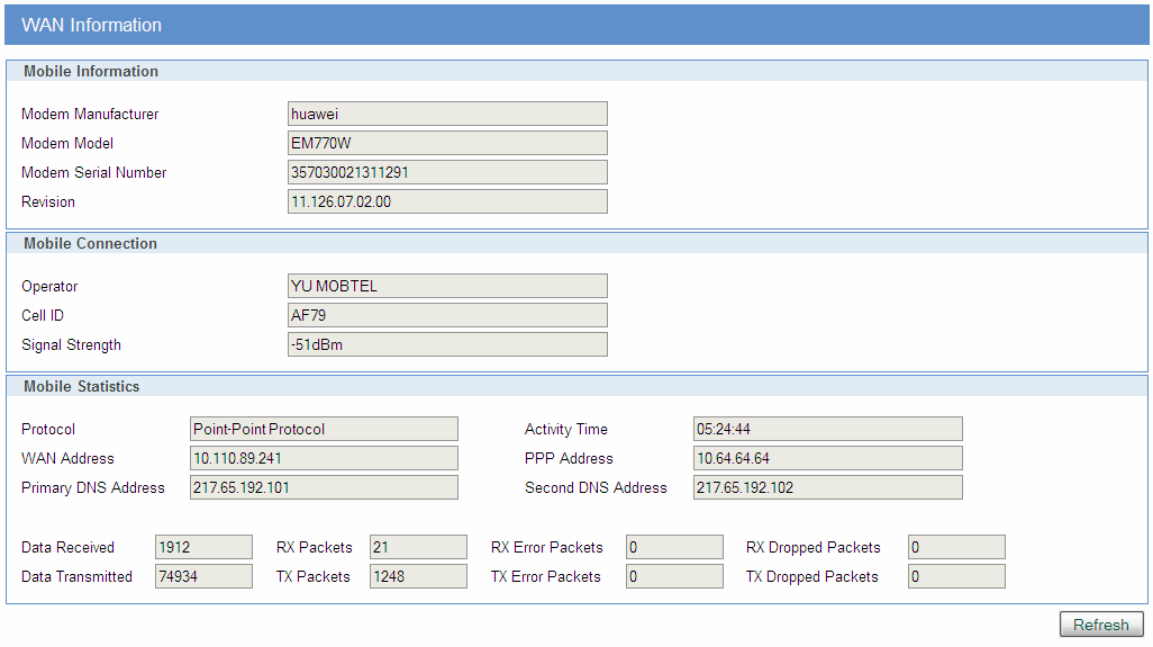


Figure 11 – WAN Information

As a primary and secondary DNS are always displayed DNS servers assigned by provider. They are not necessarily used by the router. If Local DNS is configured it has priority to those DNS servers.

Status – Firewall

Firewall Information Tab provides information about active firewall rules divided in three groups: INPUT, FORWARD and OUTPUT chain. Each of these groups has packet counter which can be cleared with one of three displayed button: Reset INPUT, Reset FORWARD and Reset OUTPUT.

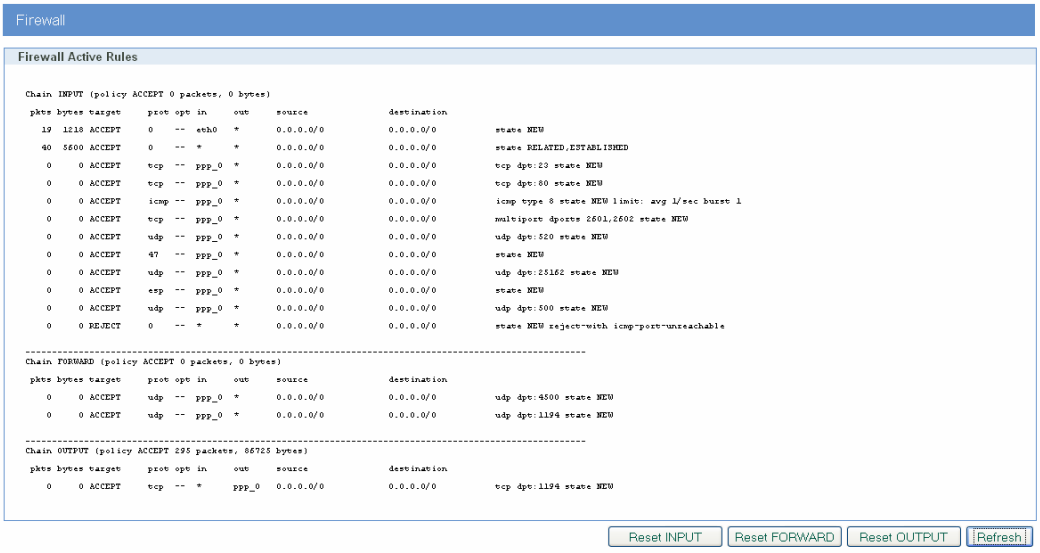


Figure 12 – Firewall Information

Settings – Network

Click ***Network*** Tab, to open the LAN network screen. Use this screen to configure LAN TCP/IP settings.

Network Tab Parameters	
Label	**Description**
Use the following IP address	Choose this option if you want to manually configure TCP/IP parameters of Ethernet port.
IP Address	Type the IP address of your GWR Router in dotted decimal notation. 192.168.1.1 is the factory default IP address.
Subnet Mask	The subnet mask specifies the network number portion of an IP address. The GWR Router support sub–netting. You must specified subnet mask for your LAN TCP/IP settings.
Primary Local DNS	IP address of your primary local DNS server
Secondary local DNS	IP address of your secondary local DNS server
Local Gateway	All incoming packets are forwarded to IP address defined in this field
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** button to save your changes back to the GWR Router. Whether you make changes or not, router will reboot every time you click ***Save***.

Table 3 – Network parameters

In the *Figure 13* you can see screenshot of ***Network*** Tab configuration menu.

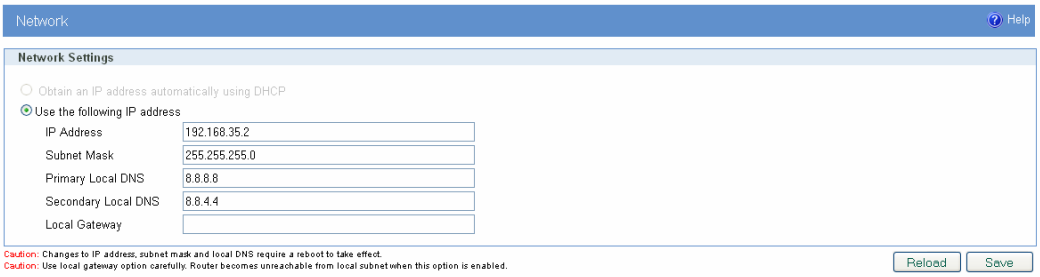


Figure 13 – Network parameters configuration page

Settings – DHCP Server

The GWR Router can be used as a DHCP (Dynamic Host Configuration Protocol) server on your network. A DHCP server automatically assigns available IP addresses to computers on your network. If you choose to enable the DHCP server option, all of the computers on your LAN must be set to obtain an IP address automatically from a DHCP server. (By default, Windows computers are set to obtain an IP automatically.)

To use the GWR Router as your network's DHCP server, click ***DHCP Server*** Tab for DHCP Server setup. The GWR Router has built–in DHCP server capability that assigns IP addresses and DNS servers to systems that support DHCP client capability.

DHCP Server Parameters	
Label	**Description**
Enable DHCP Server	DHCP (Dynamic Host Configuration Protocol) allows individual clients (workstations) to obtain TCP/IP configuration at startup from a server. When configured as a server, the GWR Router provides TCP/IP configuration for the clients. To activate DHCP server, click check box ***Enable DHCP Server***. To setup DHCP server fill in the IP Starting Address and IP Ending Address fields. Uncheck ***Enable DHCP Server*** check box to stop the GWR Router from acting as a DHCP server. When Unchecked, you must have another DHCP server on your LAN, or else the computers must be manually configured.
IP Starting Address (From)	This field specifies the first of the contiguous addresses in the IP address pool.
IP Ending Address (To)	This field specifies last of the contiguous addresses in the IP address pool.
Lease Duration	This field specifies DHCP session duration time.
Primary DNS, Secondary DNS	This field specifies IP addresses of DNS server that will be assigned to systems that support DHCP client capability. Select ***None*** to stop the DHCP Server from assigning DNS server IP address. When you select None, computers must be manually configured with proper DNS IP address. Select ***Used by ISP*** to have the GWR Router assign DNS IP address to DHCP clients. DNS address is provided by ISP (automatically obtained from WAN side). This option is available only if GSM connection is active. Please establish GSM connection first and then choose this option. Select ***Used Defined*** to have the GWR Router assign DNS IP address to DHCP clients. DNS address is manually configured by user.
Static Lease Reservation	This field specifies IP addresses that will be dedicated to specific DHCP Client based on MAC address. DHCP server will always assign same IP address to appropriate client.
Address Exclusions	This field specifies IP addresses that will be excluded from the pool of DHCP IP address. DHCP server will not assign this IP to DHCP clients.
Add	Click ***Add*** to insert (add) new item in table to the GWR Router.
Remove	Click ***Remove*** to delete selected item from table.
Save	Click ***Save*** to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 4 – DHCP Server parameters

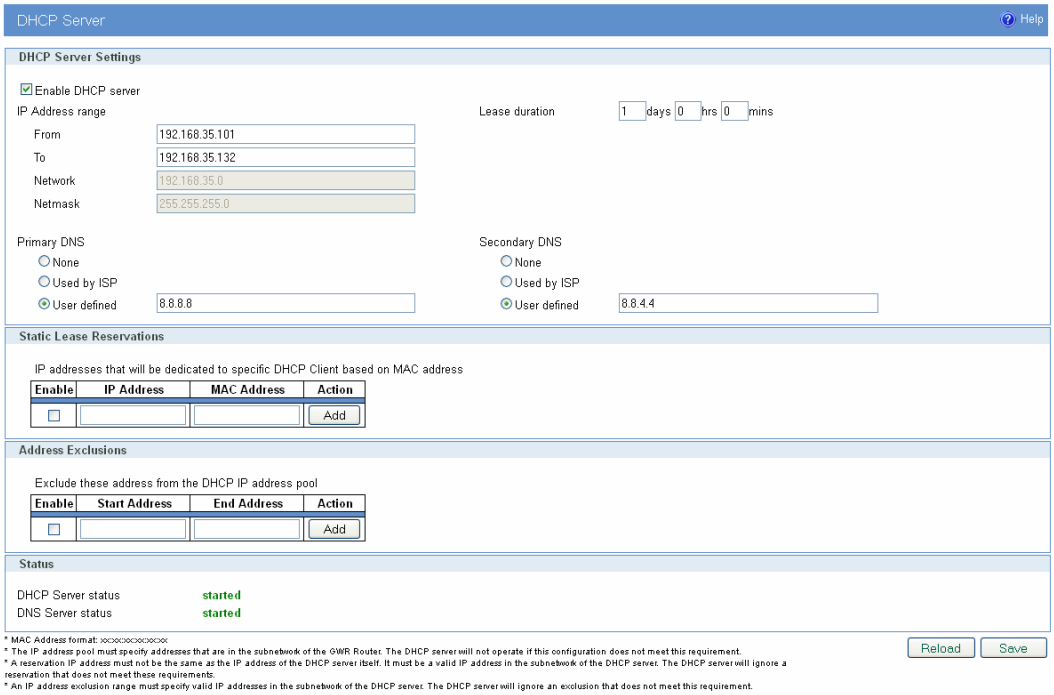


Figure 14 – DHCP Server configuration page

Settings – WAN Setting

Click ***WAN Settings*** Tab, to open the Wireless screen. Use this screen to configure the GWR Router GPRS/EDGE/HSPA/HSPA+/LTE parameters *(Figure 15)*.

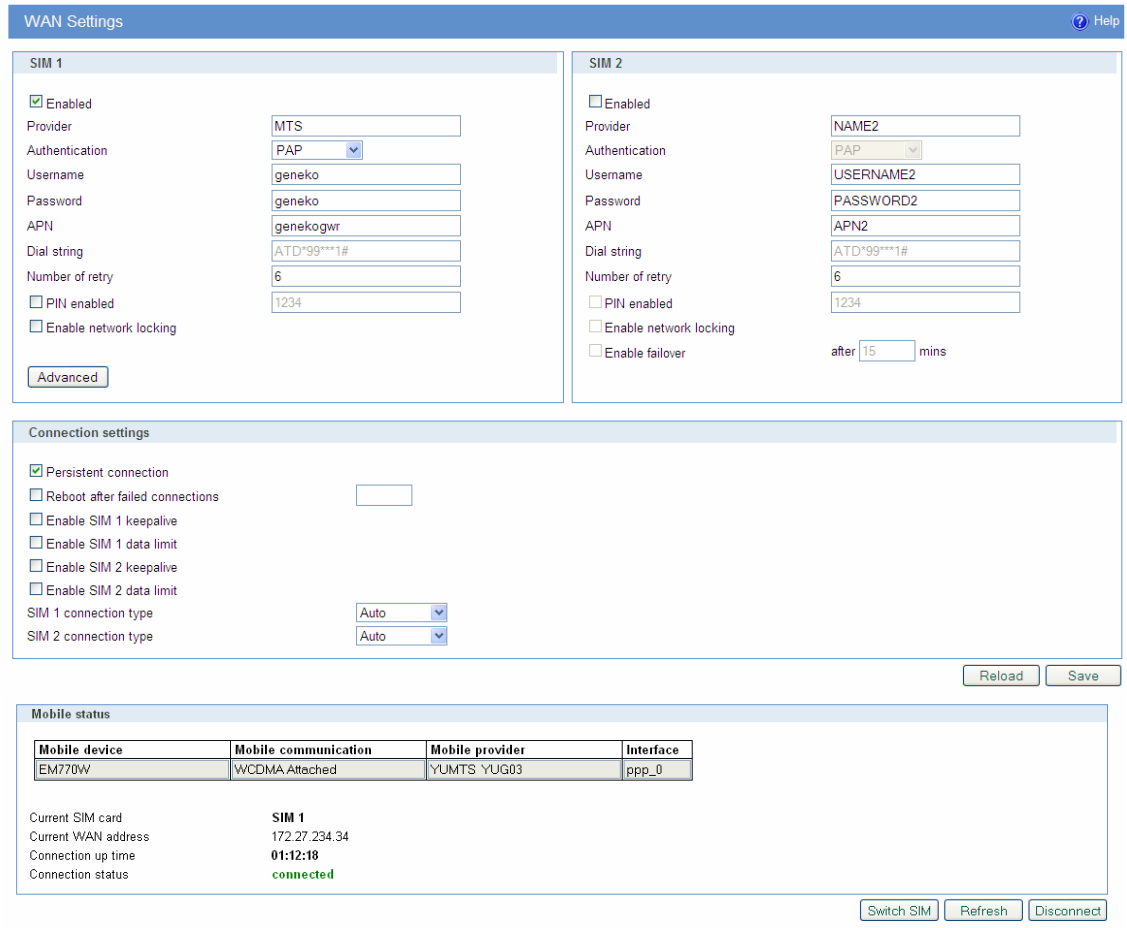


Figure 15 – WAN Settings configuration page

WAN Settings	
Label	**Description**
Provider	This field specifies name of GSM/UMTS ISP. You can setup any name for provider.
Authentication	This field specifies password authentication protocol. Select the appropriate protocol from drop down list. (PAP, CHAP, PAP – CHAP).
Username	This field specifies Username for client authentication at GSM/UMTS network. Mobile provider will assign you specific username for each SIM card.
Password	This field specifies Password for client authentication at GSM/UMTS network. Mobile provider will assign you specific password for each SIM card.
APN	This field specifies APN.

Dial String	This field specifies Dial String for GSM/UMTS modem connection initialization. In most cases you have to change only APN field based on parameters obtained from Mobile Provider. This field cannot be altered.
Number of retry	Number of unsuccessful connection attempts after which router switches to second SIM
PIN enabled	Option used when SIM card is locked with PIN code
Enable network locking	Option that allows a user to lock a SIM card for a desired operator by specifying PLMN id of the operator. This option is very useful in border areas since you can avoid roaming expenses.
Enable Failover	Check this field in order to enable failover feature. This feature is used when both SIM are enabled. You specify the amount of time after which Failover feature brings down current WAN connection (SIM2) and brings up previous WAN connection (SIM1).
Persistent connection	Keep connection alive, after Do not exit after a connection is terminated. Instead try to reopen the connection.
Reboot after failed connections	Reboot after n consecutive failed connection attempts.
Enable SIM1/SIM2 keepalive	Make some traffic periodically in order to maintain connection active. You can set keepalive interval value in minutes.
Ping target	This field specifies the target IP address for periodical traffic generated using ping in order to maintain the connection active.
Ping interval	This field specifies ping interval for keepalive option.
Advanced ping interval	This field specifies the time interval of advanced ping proofing.
Advanced ping wait for a response	This field specifies the timeout for advanced ping proofing.
Maximum number of failed packets	This field specifies maximum number of failed packets in percent before keepalive action is performed.
Keepalive action	This menu provides a choice between two possible keepalive actions in case maximum number of failed packets is exceeded. If Switch SIM option is selected router will try to establish the connection using the other SIM card after the maximum number of failed packets is exceeded. If Current SIM option is selected router will only restart the PPP connection.
Enable SIM1/SIM2 data limit	Enable traffic data limit per SIM.
Traffic limit	Defines maximum data amount transferred over SIM card. When traffic limit is reached SIM card cannot be longer used for network connection. Traffic limit can be defined in units of KB (from 1 to 1024), MB (from 1 to 1024) or GB (from 1 to 1024).
SIM1/SIM2 data limit action	In case of reaching defined data traffic limit one of two possible actions will be performed: 1) Switch SIM – switches network connection from the SIM card on which data traffic limit has been reached to another SIM card, 2) Disconnect – disconnects network connection over the SIM card on which data traffic limit has been reached.
Current traffic	Displays amount of traffic that has been transferred over SIM card from the moment of enabling "SIM data limit" option.

	In order to refresh the displayed value in the "Current traffic" field please click on ***Refresh***.
Reset current traffic value	Click on ***Reset*** resets a value of the current traffic to zero.
Reset current traffic value on specified day of the month	Every month, on the specified day, a value of the current traffic will be reset to zero. The day of reset is specified by ordinal number.
Connection type	Specifies the type of connection router will try to establish. There are three available options: only GSM, only UMTS and AUTO. For example, if you select Only GSM option, router will not try to connect to UMTS, instead router will automatically try to connect to GSM. By selecting AUTO option, router will first try to establish UMTS connection and if it fails, router will go for GSM connection.
Mobile status	Displays data related to mobile connection. (current WAN address, uptime, connection status…)
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** to save your changes back to the GWR Router.
Switch SIM	Click Switch SIM try to establish the connection using the other SIM card.
Refresh	Click ***Refresh*** to see updated mobile network status.
Connect/ Disconnect	Click ***Connect/Disconnect*** to connect or disconnect from mobile network.

Table 5 – WAN parameters

Figure 15 shows screenshot of GSM/UMTS tab configuration menu. GSM/UMTS menu is divided into two parts.

- Upper part provides all parameters for configuration GSM/UMTS connection. These parameters can be obtained from Mobile Operator. Please use exact parameters given from Mobile Operator.
- Bottom part is used for monitoring status of GSM/UMTS connection (create/maintain/destroy GSM/UMTS connection). Status line show real–time status: connected/disconnected.

If your SIM Card credit is too low, the GWR Router will performed periodically connect/disconnect actions.

WAN Settings(advanced)	
Label	**Description**
Enable	This field specifies if Advanced WAN settings is enabled at the GWR Router.
Accept Local IP Address	With this option, pppd will accept the peer's idea of our local IP address, even if the local IP address was specified in an option.
Accept Remote IP Address	With this option, pppd will accept the peer's idea of its (remote) IP address, even if the remote IP address was specified in an option.
Idle time before disconnect (sec)	Specifies that pppd should disconnect if the link is idle for *n* seconds. The link is idle when no data packets are being sent or received.
Refuse PAP	With this option, pppd will not agree to authenticate itself to the peer using PAP.

Require PAP	Require the peer to authenticate using PAP (Password Authentication Protocol) authentication.
Refuse CHAP	With this option, pppd will not agree to authenticate itself to the peer using CHAP.
Require CHAP	Require the peer to authenticate using CHAP (Challenge Handshake Authentication Protocol) authentication.
Max. CHAP challenge transmissions	Set the maximum number of CHAP challenge transmissions to *n* (default 10).
CHAP restart interval sec	Set the CHAP restart interval (retransmission timeout for challenges) to *n* seconds (default 3).
Refuse MS–CHAP	With this option, pppd will not agree to authenticate itself to the peer using MS–CHAP.
Refuse MS–CHAPv2	With this option, pppd will not agree to authenticate itself to the peer using MS–CHAPv2.
Refuse EAP	With this option, pppd will not agree to authenticate itself to the peer using EAP.
Connection debugging	Enables connection debugging facilities. If this option is selected, pppd will log the contents of all control packets sent or received in a readable form.
Maximum Transmit Unit (bytes)	Set the MTU (Maximum Transmit Unit) value to *n*. Unless the peer requests a smaller value via MRU negotiation, pppd will request that the kernel networking code send data packets of no more than *n* bytes through the PPP network interface.
Maximum Receive Unit (bytes)	Set the MRU (Maximum Receive Unit) value to *n*. Pppd will ask the peer to send packets of no more than *n* bytes. The value of *n* must be between 128 and 16384; the default is 1500.
VJ–Compression	Disable Van Jacobson style TCP/IP header compression in both directions.
VJ–Connection–ID Compression	Disable the connection–ID compression option in Van Jacobson style TCP/IP header compression. With this option, pppd will not omit the connection–ID byte from Van Jacobson compressed TCP/IP headers.
Protocol Field Compression	Disable protocol field compression negotiation in both directions.
Address/Control Compression	Disable Address/Control compression in both directions.
Predictor–1 Compression	Disable or enable accept or agree to Predictor–1 compression.
BSD Compression	Disable or enable BSD–Compress compression.
Deflate Compression	Disable or enable Deflate compression.
Compression Control Protocol negotiation	Disable CCP (Compression Control Protocol) negotiation. This option should only be required if the peer is buggy and gets confused by requests from pppd for CCP negotiation.
Magic Number negotiation	Disable magic number negotiation. With this option, pppd cannot detect a looped–back line. This option should only be needed if the peer is buggy.
Passive Mode	Enables the "passive" option in the LCP. With this option, pppd will attempt to initiate a connection; if no reply is received from the peer, pppd will then just wait passively for a valid LCP packet from the peer, instead of exiting, as it would without this option.
Silent Mode	With this option, pppd will not transmit LCP packets to initiate a connection until a valid LCP packet is received from the peer (as for the "passive" option

	with ancient versions of pppd).
Append domain name	Append the domain name *d* to the local host name for authentication purposes.
Show PAP password in log	When logging the contents of PAP packets, this option causes pppd to show the password string in the log message.
Time to wait before re–initiating the link (sec)	Specifies how many seconds to wait before re–initiating the link after it terminates. The holdoff period is not applied if the link was terminated because it was idle.
LCP–Echo–Failure	If this option is given, pppd will presume the peer to be dead if *n* LCP echo–requests are sent without receiving a valid LCP echo–reply. If this happens, pppd will terminate the connection. This option can be used to enable pppd to terminate after the physical connection has been broken (e.g., the modem has hung up) in situations where no hardware modem control lines are available.
LCP–Echo–Interval	If this option is given, pppd will send an LCP echo–request frame to the peer every *n* seconds. Normally the peer should respond to the echo–request by sending an echo–reply. This option can be used with the *lcp–echo–failure* option to detect that the peer is no longer connected.
Use Peer DNS	With this option enabled, router resolves addresses using ISP's DNS servers.
Modem Initialization String	This field provides an option to directly specify AT commands.
Roaming Mode	By enabling this option router will be able to connect to roaming network.
Reset Location Information	By enabling this option router will erase LOCI Elementary File in SIM card. This will cause SIM card to scan all available networks when registering.

Table 6 – Advanced WAN Settings

Settings – Routing

The static routing function determines the path that data follows over your network before and after it passes through the GWR Router. You can use static routing to allow different IP domain users to access the Internet through the GWR Router. Static routing is a powerful feature that should be used by advanced users only. In many cases, it is better to use dynamic routing because it enables the GWR Router to automatically adjust to physical changes in the network's layout.

The GWR Router is a fully functional router with static routing capability. *Figure 16* shows screenshot of Routing page.

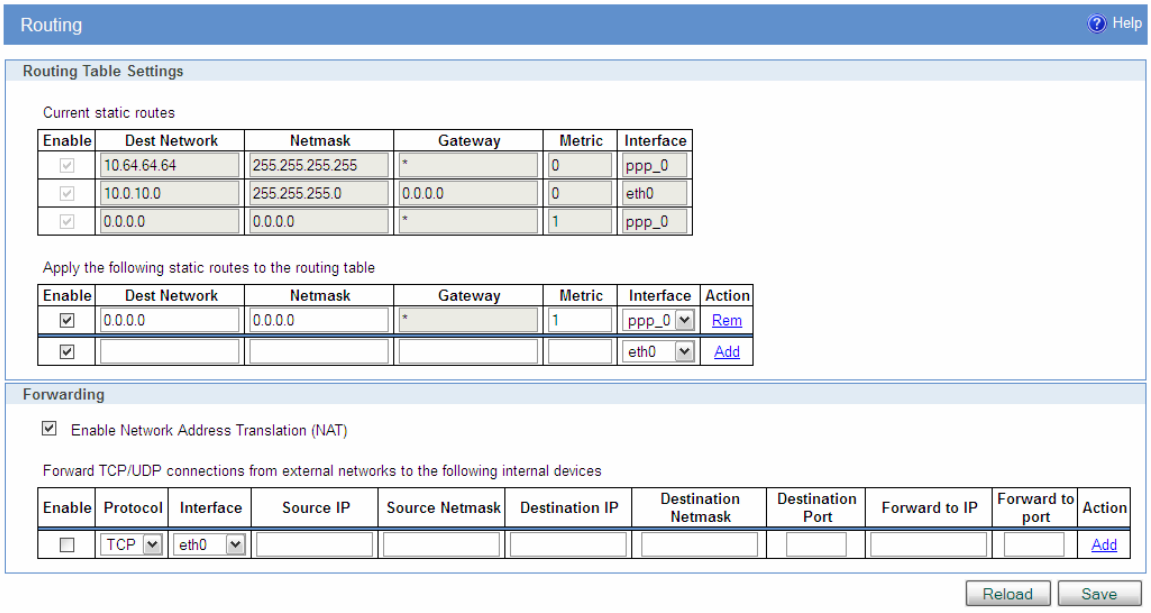


Figure 16 – Routing configuration page

Use this menu to setup all routing parameters. Administrator can perform following operations:

- Create/Edit/Remove routes (including default route),
- Port translation – Reroute TCP and UPD packets to desired destination inside the network.

Routing Settings	
Label	**Description**
Routing Table	
Enable	This check box allows you to activate/deactivate this static route.
Source IP	Source IP address from which portforwarding is allowed, all other traffic is denied.
Source Netmask	Subnet mask for allowed IP subnet.
Dest Network	This parameter specifies the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
Netmask	This parameter specifies the IP netmask address of the final destination.

Gateway	This is the IP address of the gateway. The gateway is a router or switch (next hope) on the same network segment as the device's LAN or WAN port. The gateway helps forward packets to their final destinations. For every routing rule enter the IP address of the gateway. Please notice that *ppp0* interface has only one default gateway (provided by Mobile operator) and because of that that there is no option for gateway when you choose *ppp0* interface.
Metric	Metric represents the "cost" of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. Enter a number that approximates the cost for this link. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Interface	Interface represents the "exit" of transmission for routing purposes. In this case *Eth0* represents LAN interface and *ppp0* represents GSM/UMTS mobile interface of the GWR Router.
TCP/UDP Traffic forwarding	
Enable	This check box allows you to activate/deactivate this static port translation.
Protocol	Choose between TCP and UDP protocol.
Destination IP	This field specifies IP address of the incoming traffic.
Destination Netmask	This field specifies netmask for the previous address.
Destination Port	This is the TCP/UDP port of application.
Forward to IP	This filed specifies IP address where packets should be forwarded.
Forward to port	Specify TCP/UDP port on which the traffic is going to be forwarded.
Interface	Select interface where portforwarding is done. Portforwarding from outside (WAN) interface to inside (LAN) interface is done on PPP, and in reverse direction on Ethernet interface.
Add	Click ***Add*** to insert (add) new item in table to the GWR Router.
Remove	Click Remove to delete selected item from table.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** to save your changes back to the GWR Router. After pressing ***Save*** *button* it make take more than 10 seconds for router to save parameters and become operational again.

Table 7 – Routing parameters

Port translation

For incoming data, the GWR Router forwards IP traffic destined for a specific port, port range or GRE/IPsec protocol from the cellular interface to a private IP address on the Ethernet "side" of the GWR Router.

Settings – Dynamic Routing Protocol

Dynamic routing performs the same function as static routing except it is more robust. Static routing allows routing tables in specific routers to be set up in a static manner so network routes for packets are set. If a router on the route goes down the destination may become unreachable. Dynamic routing allows routing tables in routers to change as the possible routes change.

Routing Information Protocol (RIP)

The Routing Information Protocol (RIP) is a dynamic routing protocol used in local and wide area networks. As such it is classified as an interior gateway protocol (IGP) using the distance–vector routing algorithm. The Routing Information Protocol provides great network stability, guaranteeing that if one network connection goes down the network can quickly adapt to send packets through another connection.

Click ***RIP*** Tab, to open the Routing Information Protocol screen. Use this screen to configure the GWR Router RIP parameters (*Figure 17*).

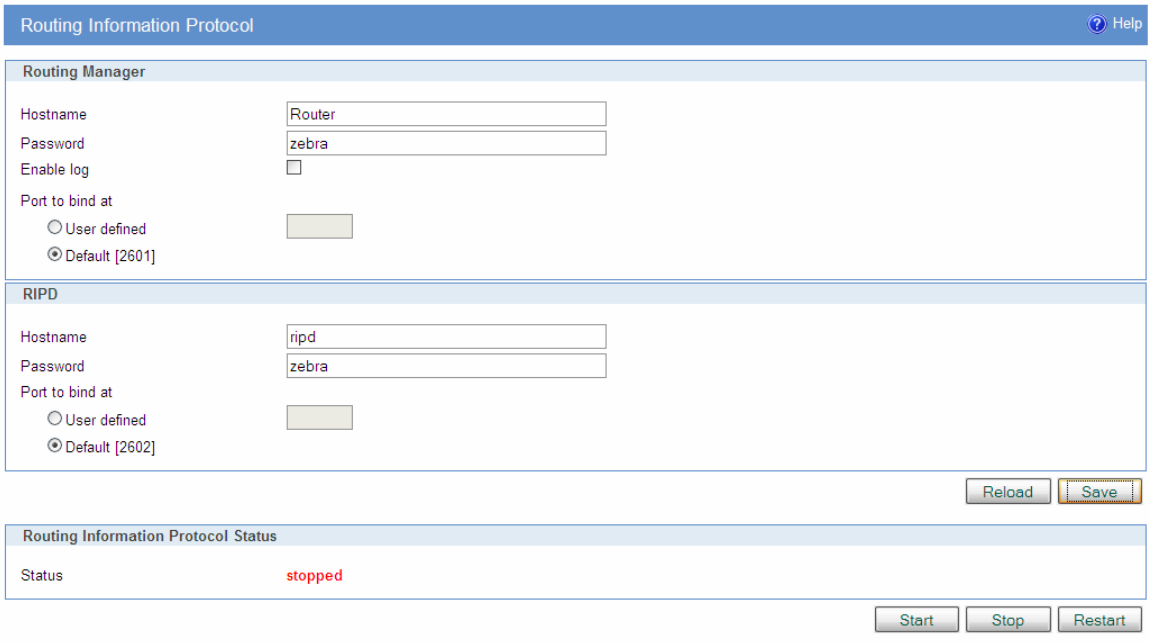


Figure 17 – RIP configuration page

RIP Settings	
Label	**Description**
Routing Manager	
Hostname	Prompt name that will be displayed on telnet console.
Password	Login password.
Enable log	Enable log file.
Port to bind at	Local port the service will listen to.
RIPD	
Hostname	Prompt name that will be displayed on telnet console of the Routing Information Protocol Manager.
Password	Login password.
Port to bind at	Local port the service will listen to.
Routing Information Protocol Status	
Start	Start RIP.
Stop	Stop RIP.
Restart	Restart RIP.
Save	Click ***Save*** to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 8 – RIP parameters

RIP routing engine for the GWR Router

Use telnet to enter in global configuration mode.

```
telnet 192.168.1.1 2602    // telnet to eth0 at TCP port 2602///
```

To enable RIP, use the following commands beginning in global configuration mode:

```
router# router rip
```

To associates a network with a RIP routing process, use following commans:

```
router# network [A.B.C.D/Mask]
```

By default, the GWR Router receives RIP version 1 and version 2 packets. You can configure the GWR Router to receive an send only version 1. Alternatively, you can configure the GWR Router to receive and send only version 2 packets. To configure GWR Router to send and receive packets from only one version, use the following command:

```
router# rip version [1|2]      // Same as other router //
```

Enable route redistribution:

```
router# redistribute kernel    //  Redistribute routes defined on WEB interface //
router# redistribute static    //  Redistribute routes defined locally in RIP configuration //
router# redistribute connected // Redistribute directly connected routes //
```

Disable RIP update (optional):

```
router# passive-interface ppp_0
router# no passive-interface ppp_0
```

RIP is commonly used over Ethernet interface and PPP interface should be set up as passive.

Routing protocols use several timer that determine such variables as the frequency of routing updates, the length of time before a route becomes invalid, an other parameters. You can adjust these timer to tune routing protocol performance to better suit your internetwork needs. Use following command to setup RIP timer:

```
router# timers basic [UPDATE-INTERVAL] [INVALID] [TIMEOUT] [GARBAGE-COLLECT]
router# no timers basic
```

Configure interface for RIP protocol

```
router# interface greX
router# ip rip send version [VERSION]
router# ip rip receive version [VERSION]
```

Disable rip authentication at all interface.

```
Router(interface)# no ip rip authentication mode [md5|text]
```

Debug commands:

```
router# debug rip
router# debug rip events
router# debug rip packet
router# terminal monitor
```

Settings – VPN Settings

Virtual private network (VPN) is a communications network tunneled through another network and dedicated to a specific network. One common application of VPN is secure communication through the public Internet, but a VPN need not have explicit security features, such as authentication or content encryption. VPNs, for example, can be used to separate the traffic of different user communities over an underlying network with strong security features.

A VPN may have best–effort performance, or may have a defined Service Level Agreement (SLA) between the VPN customer and the VPN service provider. Generally, a VPN has a topology more complex than point–to–point. The distinguishing characteristics of VPNs are not security or performance, but that they overlay other network(s) to provide a certain functionality that is meaningful to a user community.

Generic Routing Encapsulation (GRE)

Originally developed by Cisco, generic routing encapsulation (GRE) is now a standard, defined in RFC 1701, RFC 1702, and RFC 2784. GRE is a tunneling protocol used to transport packets from one network through another network.

If this sounds like a virtual private network (VPN) to you, that's because it theoretically is: Technically, a GRE tunnel is a type of a VPN — but it isn't a secure tunneling method. However, you can encrypt GRE with an encryption protocol such as IPSec to form a secure VPN. In fact, the point–to–point tunneling protocol (PPTP) actually uses GRE to create VPN tunnels. For example, if you configure Microsoft VPN tunnels, by default, you use PPTP, which uses GRE.

Solution where you can use GRE protocol:

- You need to encrypt multicast traffic. GRE tunnels can carry multicast packets — just like real network interfaces — as opposed to using IPSec by itself, which can't encrypt multicast traffic. Some examples of multicast traffic are OSPF, EIGRP. Also, a number of video, VoIP, and streaming music applications use multicast.
- You have a protocol that isn't routable, such as NetBIOS or non–IP traffic over an IP network. You could use GRE to tunnel IPX/AppleTalk through an IP network.
- You need to connect two similar networks connected by a different network with different IP addressing.

Click ***VPN Settings*** Tab, to open the VPN configuration screen. In the *Figure 18* you can see screenshot of ***GRE*** Tab configuration menu.

VPN Settings / GRE Tunneling Parameters	
Label	**Description**
Enable	This check box allows you to activate/deactivate VPN/GRE traffic.
Local Tunnel Address	This field specifies IP address of virtual tunnel interface.
Local Tunnel Netmask	This field specifies the IP netmask address of virtual tunnel. This field is unchangeable, always 255.255.255.252
Tunnel Source	This field specifies IP address or hostname of tunnel source.
Tunnel Destination	This field specifies IP address or hostname of tunnel destination.
Interface	This field specifies GRE interface. This field gets from the GWR Router.
KeepAlive Enable	Check for keepalive enable.
Period	Defines the time interval (in seconds) between transmitted keepalive packets. Enter a number from 3 to 60 seconds.

Retries	Defines the number of retries when failed keepalives are detected before determining that the tunnel endpoint is down. Enter a number from 1 to 10 times.
Add	Click ***Add*** insert new item in table.
Remove	Click ***Remove*** to delete selected item from table.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** to save your changes back to the GWR Router.

Table 9 – GRE parameters

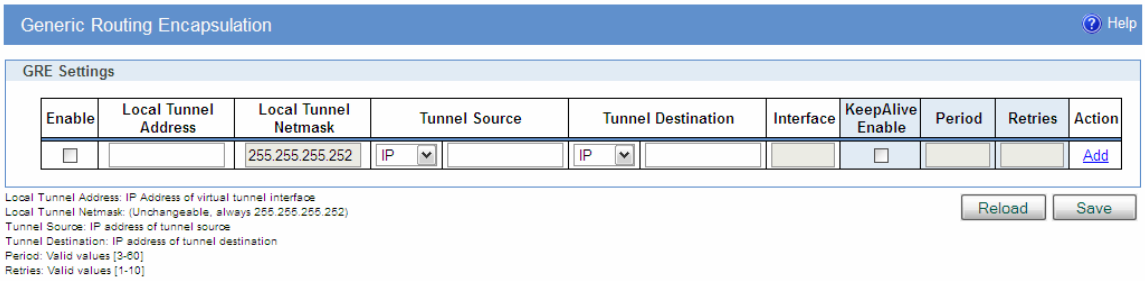


Figure 18 – GRE tunnel parameters configuration page

GRE Keepalive

GRE tunnels can use periodic status messages, known as keepalives, to verify the integrity of the tunnel from end to end. By default, GRE tunnel keepalives are disabled. Use the keepalive check box to enable this feature. Keepalives do not have to be configured on both ends of the tunnel in order to work; a tunnel is not aware of incoming keepalive packets. You should define the time interval (in seconds) between transmitted keepalive packets. Enter a number from 1 to 60 seconds, and the number of times to retry after failed keepalives before determining that the tunnel endpoint is down. Enter a number from 1 to 10 times.

Internet Protocol Security (IPSec)

Internet Protocol Security (IPSec) is a protocol suite for securing Internet Protocol communication by authenticating and encrypting each IP packet of a data stream.

Click ***VPN Settings - IPSec,*** to open the VPN configuration screen. At the *Figure 19 – IPSec Summary screen* you can see IPSec Summary. This screen gathers information about settings of all defined IPSec tunnels. Up to 5 IPSec tunnels can be defined on GWR router.

If you cannot use IP address as a peer identifier at one side of the tunnel (private IP subnet) aggressive mode has to be utilized.

IPSec Summary and IPSec Settings are briefly displayed in following figures and tables.

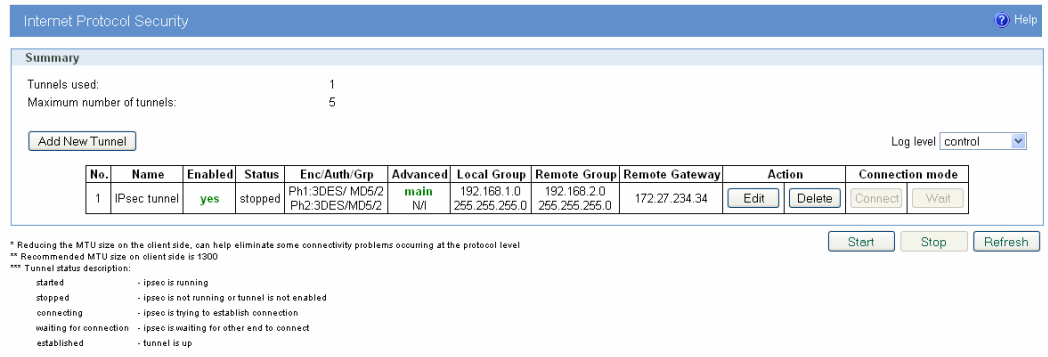


Figure 19 – IPSec Summary screen

VPN Settings / IPSec Summary	
Label	**Description**
Tunnels Used	This is the number of defined IPSec tunnels.
Maximum number of tunnels	This is the maximum number of tunnels which can be defined.
No	This filed indicates the number of the IPSec tunnel.
Name	Field shows the Tunnel Name that you gave to the IPSec tunnel.
Enabled	This field shows if tunnel is enabled or disabled. After clicking on ***Start*** button, only enabled tunnels will be started.
Status	Field indicates status of the IPSec tunnel. Click on ***Refresh*** button to see current status of defined IPSec tunnels.
Enc/Auth/Grp	This field shows both Phase 1 and Phase 2 details, Encryption method (DES/3DES/AES), Authentication method (MD5/SHA1), and DH Group number (1/2/5) that you have defined in the IPSec Setup section.
Advanced	Field shows the chosen mode of IPSec and options from IPSec Advanced section by displaying the first letters of enabled options.
Local Group	Field shows the IP address and subnet mask of the Local Group.
Remote Group	Field displays the IP address and subnet mask of the Remote Group.
Remote Gateway	Field shows the IP address of the Remote Device.
Action - Edit	This link opens screen where you can change the tunnel's settings.
Action - Delete	Click on this link to delete the tunnel and all settings for that particular tunnel
Connection mode	Field displays connection mode of the current tunnel. ***Connect –*** IPSec tunnel initiating side in negotiation process. ***Wait –*** IPSec tunnel responding side in negotiation process.
Log level	Set IPSec log level.

Add New Tunnel	Click on this button to add a new Device–to–Device IPSec tunnel. After you have added the tunnel, you will see it listed in the Summary table.
Start	This button starts the IPSec negotiations between all defined and enabled tunnels. If the IPSec is already started, Start button is replaced with Restart button.
Stop	This button will stop all IPSec started negotiations.
Refresh	Click on this button to refresh the Status field in the Summary table.

Table 10 – IPSec Summary

To create a tunnel click Add New Tunnel button. Depending on your selection, the Local Group Setup and Remote Group Setup settings will differ. Proceed to the appropriate instructions for your selection.

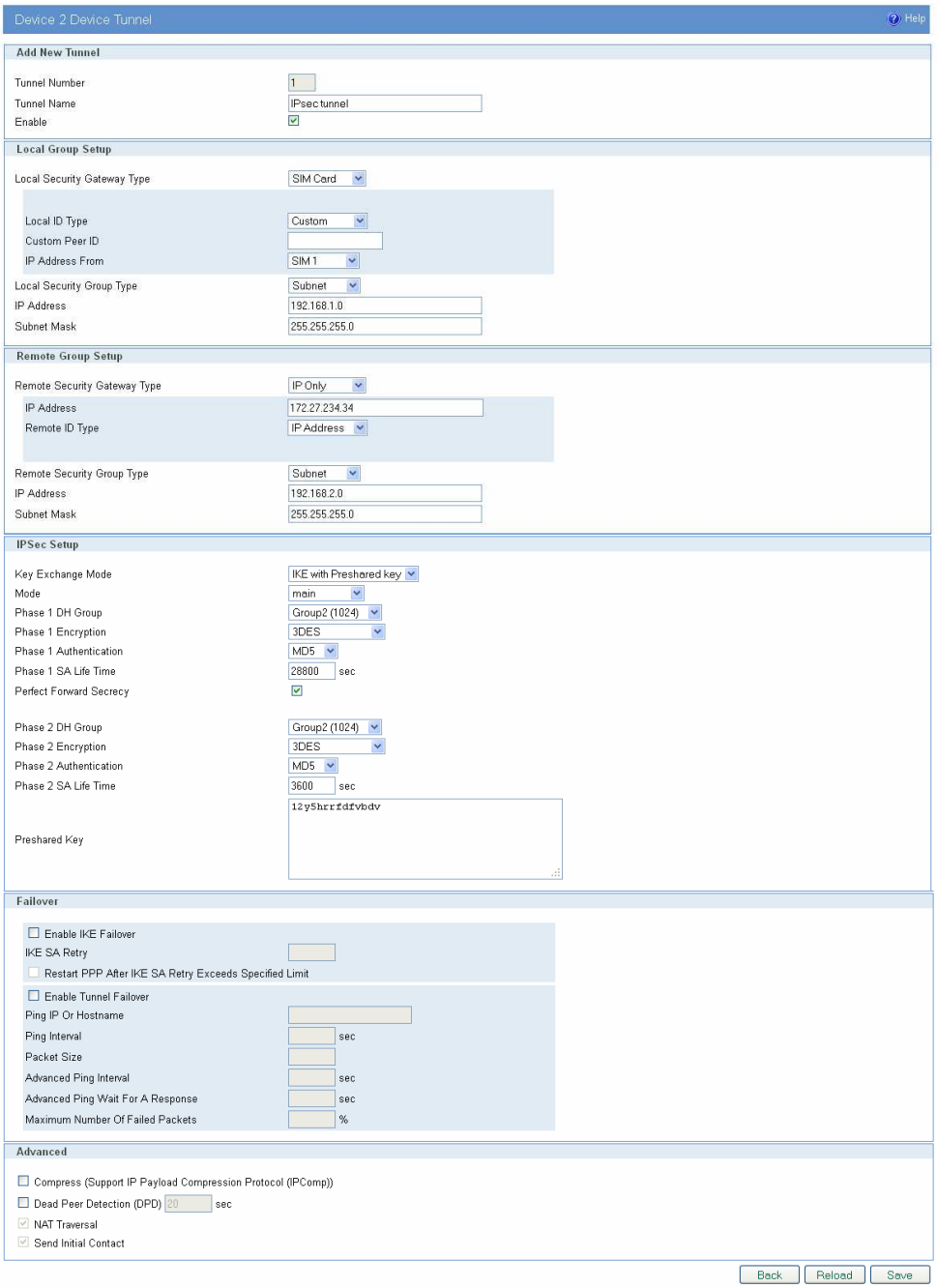


Figure 20 – IPSec Settings

VPN Settings / IPSec Settings	
Label	**Description**
Tunnel Number	This number will be generated automatically and it represents the tunnel number.
Tunnel Name	Enter a name for the IPSec tunnel. This allows you to identify multiple tunnels and does not have to match the name used at the other end of the tunnel.
Enable	Check this box to enable the IPSec tunnel.
Local Security gateway type	When **SIM Card** is selected the WAN (or Internet) IP address of the Router automatically appears. If the Router is not yet connected to the GSM/UMTS network this field is without IP address.
Local ID Type	Authentication identity for one of the participant. Can be an IP address or fully-qualified domain name preceded by @.
IP Address From	Select SIM card over which the tunnel is established.
Local Security Group Type	Select the local LAN user(s) behind the Router that can use this IPSec tunnel. Select the type you want to use: IP or Subnet. *NOTE: The Local Security Group Type you select should match the Remote Security Group Type selected on the IPSec device at the other end of the tunnel.*
IP Address	Only the computer with a specific IP address will be able to access the tunnel.
Subnet Mask	Enter the subnet mask.
Remote Security Gateway Type	Select the remote IP address behind the Router at the other end that can use this IPSec tunnel. Select the type you want to use: IP or Subnet
IP Address	Only the computer with a specific IP address will be able to access the tunnel.
Remote ID Type	Authentication identity for one of the participant. Can be an IP address or fully-qualified domain name preceded by @.
Remote Security Group Type	Select the remote IP address/hostname behind the Router at the other end that can use this IPSec tunnel. Select the type you want to use: IP Only or hostname. *NOTE: The Remote Security Group Type you select should match the Local Security Group Type selected on the IPSec device at the other end of the tunnel.*
IP Address	Only the computer with a specific IP address will be able to access the tunnel.
Subnet Mask	Enter the subnet mask.
IPSec Setup	In order to establish an encrypted tunnel, the two ends of an IPSec tunnel must agree on the methods of encryption, decryption and authentication. This is done by sharing a key to the encryption code. For key management, the Router uses only IKE with Preshared Key mode.
Key Exchange mode	**IKE with Preshared Key** IKE is an Internet Key Exchange protocol used to negotiate key material for Security Association (SA). IKE uses the Preshared Key to authenticate the remote IKE peer. Both ends of IPSec tunnel must use the same mode of key management.
Mode	One of following IPSec modes can be choosed: MAIN or AGGRESSIVE
Phase 1 DH Group	Phase 1 is used to create the SA. DH (Diffie-Hellman) is a key exchange protocol used during Phase 1 of the authentication process to establish pre-shared keys. There are three groups of different prime key lengths. Group 1 is 768 bits, Group 2 is 1024 bits and Group 5 is 1536 bits long. If network speed is preferred, select Group 1. If network security is preferred, select Group 5.
Phase 1 Encryption	Select a method of encryption: DES (56-bit), 3DES (168-bit) or AES-128 (128-bit).

	The method determines the length of the key used to encrypt or decrypt ESP packets. AES–128 is recommended because it is the most secure. Make sure both ends of the IPSec tunnel use the same encryption method.
Phase 1 Authentication	Select a method of authentication: MD5 or SHA1. The authentication method determines how the ESP packets are validated. MD5 is a one–way hashing algorithm that produces a 128–bit digest. SHA1 is a one–way hashing algorithm that produces a 160–bit digest. SHA1 is recommended because it is more secure. Make sure both ends of the IPSec tunnel use the same authentication method.
Phase 1 SA Life Time	Configure the length of time IPSec tunnel is active in Phase 1. The default value is 28800 seconds. Both ends of the IPSec tunnel must use the same Phase 1 SA Life Time setting.
Perfect Forward Secrecy	If the Perfect Forward Secrecy (PFS) feature is enabled, IKE Phase 2 negotiation will generate new key material for IP traffic encryption and authentication, so hackers using brute force to break encryption keys will not be able to obtain future IPSec keys. Both ends of the IPSec tunnel must enable this option in order to use the function.
Phase 2 DH Group	If the Perfect Forward Secrecy feature is disabled, then no new keys will be generated, so you do not need to set the Phase 2 DH Group. There are three groups of different prime key lengths. Group 1 is 768 bits, Group 2 is 1024 bits, and Group 5 is 1536 bits long. If network speed is preferred, select Group 1. If network security is preferred, select Group 5. You do not have to use the same DH Group that you used for Phase 1, but both ends of the IPSec tunnel must use the same Phase 2 DH Group.
Phase 2 Encryption	Phase 2 is used to create one or more IPSec SAs, which are then used to key IPSec sessions. Select a method of encryption: NULL, DES (56–bit), 3DES (168–bit) or AES–128 (128–bit). It determines the length of the key used to encrypt or decrypt ESP packets. AES–128 is recommended because it is the most secure. Both ends of the IPSec tunnel must use the same Phase 2 Encryption setting. *NOTE: If you select a NULL method of encryption, the next Phase 2 Authentication method cannot be NULL and vice versa.*
Phase 2 Authentication	Select a method of authentication: NULL, MD5 or SHA1. The authentication method determines how the ESP packets are validated. MD5 is a one–way hashing algorithm that produces a 128–bit digest. SHA1 is a one–way hashing algorithm that produces a 160–bit digest. SHA1 is recommended because it is more secure. Both ends of the IPSec tunnel must use the same Phase 2 Authentication setting. *NOTE: If you select a NULL method of authentication, the previous Phase 2 Encryption method cannot be NULL.*
Phase 2 SA Life Time	Configure the length of time an IPSec tunnel is active in Phase 2. The default is 3600 seconds. Both ends of the IPSec tunnel must use the same Phase 2 SA Life Time setting.
Preshared Key	This specifies the pre–shared key used to authenticate the remote IKE peer. Enter a key of keyboard and hexadecimal characters, e.g., Ay_%4222 or 345fa929b8c3e. This field allows a maximum of 1023 characters and/or hexadecimal values. Both ends of the IPSec tunnel must use the same Preshared Key. *NOTE: It is strongly recommended that you periodically change the Preshared Key to maximize security of the IPSec tunnels.*
Enable IKE failover	Enable IKE failover option which try periodically to □eestablish security association.

IKE SA retry	Number of IKE retries, before failover.
Restart PPP After IKE SA Retry Exceeds Specified Limit	With this option enabled PPP connection is restarted when IKE SA retry reaches defined number of failed attempts. After restart SIM1 is used for connection.
Enable tunnel failover	Enable tunnel failover. If there is more than one tunnel defined, this option will failover to other tunnel in case that selected one fails to established connection.
Ping IP or Hostname	IP address/Hostname at remote side of tunnel which will be pinged in order to determine current state.
Ping interval	Specify time period in seconds between two ping.
Packet size	Specify packet size for ping message.
Advanced Ping Interval	Time interval between advanced ping packets.
Advanced Ping Wait For A Response	Advanced ping proofing timeout.
Maximum number of failed packets	Set percentage of failed packets until failover action is performed.
Compress (IP Payload Compression Protocol (IP Comp))	IP Payload Compression is a protocol that reduces the size of IP datagram. Select this option if you want the Router to propose compression when it initiates a connection.
Dead Peer Detection (DPD)	When DPD is enabled, the Router will send periodic HELLO/ACK messages to check the status of the IPSec tunnel (this feature can be used only when both peers or IPSec devices of the IPSec tunnel use the DPD mechanism). Once a dead peer has been detected, the Router will disconnect the tunnel so the connection can be re–established. Specify the interval between HELLO/ACK messages (how often you want the messages to be sent). The default interval is 20 seconds.
NAT Traversal	Both the IPSec initiator and responder must support the mechanism for detecting the NAT router in the path and changing to a new port, as defined in RFC 3947. *NOTE: NAT–T function is enabled by default and cannot be disabled. The default interval for keep–alive packets is 20 seconds.*
Send initial contact	The initial–contact status message may be used when one side wishes to inform the other that this is the first SA being established with the remote system. The receiver of this Notification Message might then elect to delete any existing SA's it has for the sending system under the assumption that the sending system has rebooted and no longer has access to the original SA's and their associated keying material. *NOTE: Send initial contact function is enabled by default and cannot be disabled.*
Back	Click ***Back*** to return on IPSec Summary screen.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** to save your changes back to the GWR Router. After that router automatically goes back and begin negotiations of the tunnels by clicking on the ***Start***.

Table 11 – IPSec Parameters

OpenVPN

OpenVPN site to site allows connecting two remote networks via point–to–point encrypted tunnel. OpenVPN implementation offers a cost–effective simply configurable alternative to other VPN technologies. OpenVPN allows peers to authenticate each other using a pre–shared secret key, certificates, or username/password. When used in a multiclient–server configuration, it allows the server to release an authentication certificate for every client, using signature and Certificate authority. It uses the OpenSSL encryption library extensively, as well as the SSLv3/TLSv1 protocol, and contains many security and control features. The server and client have almost the same configuration. The difference in the client configuration is the remote endpoint IP or hostname field. Also the client can set up the keepalive settings. For successful tunnel creation a static key must be generated on one side and the same key must be uploaded on the opposite side.

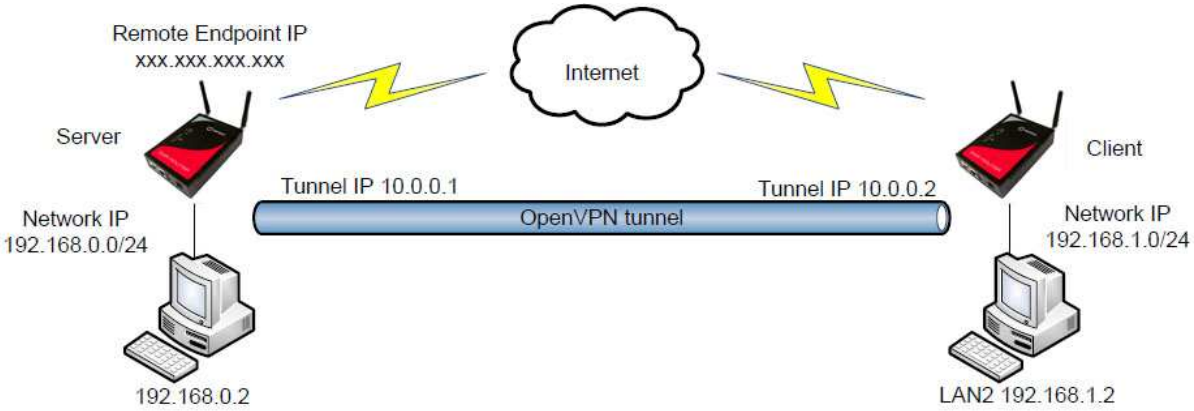


Figure 21 – OpenVPN example

Click ***VPN Settings -OpenVPN***, to open the VPN configuration screen. At the *Figure 19 – IPSec Summary screen* you can see OpenVPN Summary. This screen gathers information about settings of all defined OpenVPN tunnels. Up to 5 OpenVPN tunnels can be defined on GWR router.

OpenVPN Summary and OpenVPN Settings are briefly displayed in following figures and tables.

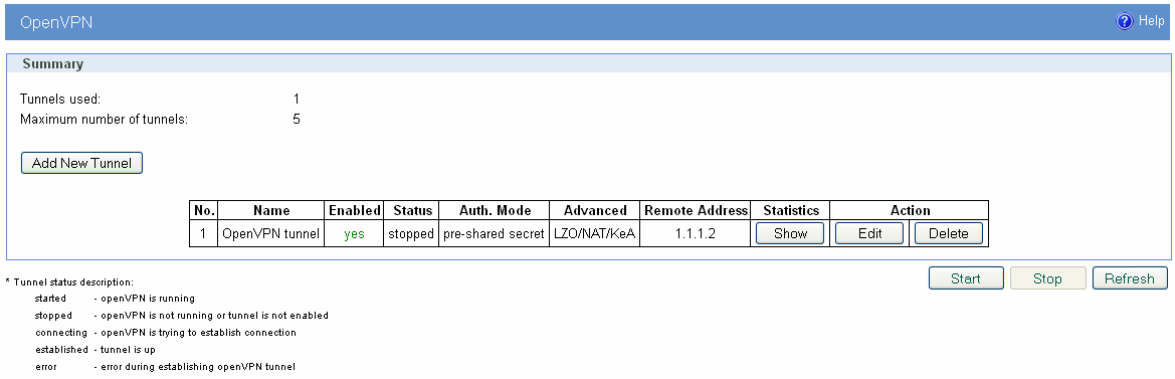


Figure 22 – OpenVPN Summary screen

OpenVPN	
Label	**Description**
IP Filtering	
Tunnel Number	Automatically assigned number of the tunnel.
Tunnel Name	This field specifies tunnel name.
Enable	Check this setting in order to enable OpenVPN tunnel.
Allow access from the following devices	
Interface Type	There are two modes of OpenVPN tunnel, routed and bridged mode. For routed mode select option TUN, and for bridged TAP
Authenticate Mode	Choose one of the following options: • none (Select this option if you do not want to use any kind of authentication), • pre-shared secret (Select this option if you want to use PSK as a authentication method), • username/password (Select this option if you want to use username/password along with CA Certificate as a authentication method), • X.509 cert. (client) (Select this option if you want to use X.509 certificates as a authentication method in client mode), • X.509 cert. (server) (Select this option if you want to use X.509 certificates as a authentication method in server mode).
Encryption Cipher	Encrypt packets with cipher algorithm. The default is BF-CBC, an abbreviation for Blowfish in Cipher Block Chaining mode. Blowfish has the advantages of being fast, very secure, and allowing key sizes of up to 448 bits. Blowfish is designed to be used in situations where keys are changed infrequently. OpenVPN supports the CBC cipher mode.
Hash Algorithm	Authenticate packets with HMAC using message digest algorithm. The default is SHA1. HMAC is a commonly used message authentication algorithm (MAC) that uses a data string, a secure hash algorithm, and a key, to produce a digital signature. OpenVPN's usage of HMAC is to first encrypt a packet, then HMAC the resulting ciphertext. In TLS mode, the HMAC key is dynamically generated and shared between peers via the TLS control channel. If OpenVPN receives a packet with a bad HMAC it will drop the packet. HMAC usually adds 16 or 20 bytes per packet. Set none to disable authentication.
NOTE: Depending on the options selected in the previous steps, some of the following options will be available for configuration.	
Protocol	Selection between TCP in server or client mode and UDP protocol in connect or wait mode.
TCP/UDP port	Depending on the selected protocol, port number should be specified.
LZO Compression	Check the box to enable fast adaptive LZO compression.
NAT Rules	Enables NAT through the tunnel.

Keep Alive	Check the box if you want to use keepalive.
Ping Interval	This field specifies the target IP address for periodical traffic generated using ping in order to maintain the connection active.
Ping Timeout	This field specifies ping interval for keepalive option.
Pre–shared Secret	Generate or Paste the Pre–shared Secret. You have an additional option to Export the PSK.
Max Fragment Size	If you select UDP protocol whether in connect or wait mode you must specify Max Fragment Size (default is 1300 bytes). If you prefer to keep fragmentation disabled enter 0
Renegotiate interval	Specify renegotiate interval if username/password is selected as authentication method.
CA Certificate	Specify the CA Certificate.
Username	Specify the username.
Password	Specify the password.
Local Certificate	Specify the local certificate.
Local Private Key	Specify the local private key.
DH Group	Choose the DH Group from the following: 786 bits, 1024 bits, 1536 bits, 2048 bits.
Remote Host or IP Address	Specify server IP address or hostname.
Redirect Gateway	This option allows usage of OpenVPN tunnel as a default route.
Tunnel Interface Configuration	Pull tunnel interface configuration from server side.
Manual configuration	
Local Interface IP Address	Specify the IP address of the local VPN tunnel endpoint.
Remote Interface IP Address	Specify the IP address of the remote VPN tunnel endpoint.
Pull from server	
Network Topology	Specify topology of OpenVPN interfaces – NET30, P2P or SUBNET
Back	Click Back to return on IPSec Summary screen.
Reload	Click Reload to discard any changes and reload previous settings.
Save	Click Save to save your changes back to the GWR Router. After that router automatically goes back and begin negotiations of the tunnels by clicking on the Start button.

Table 12 – OpenVPN parameters

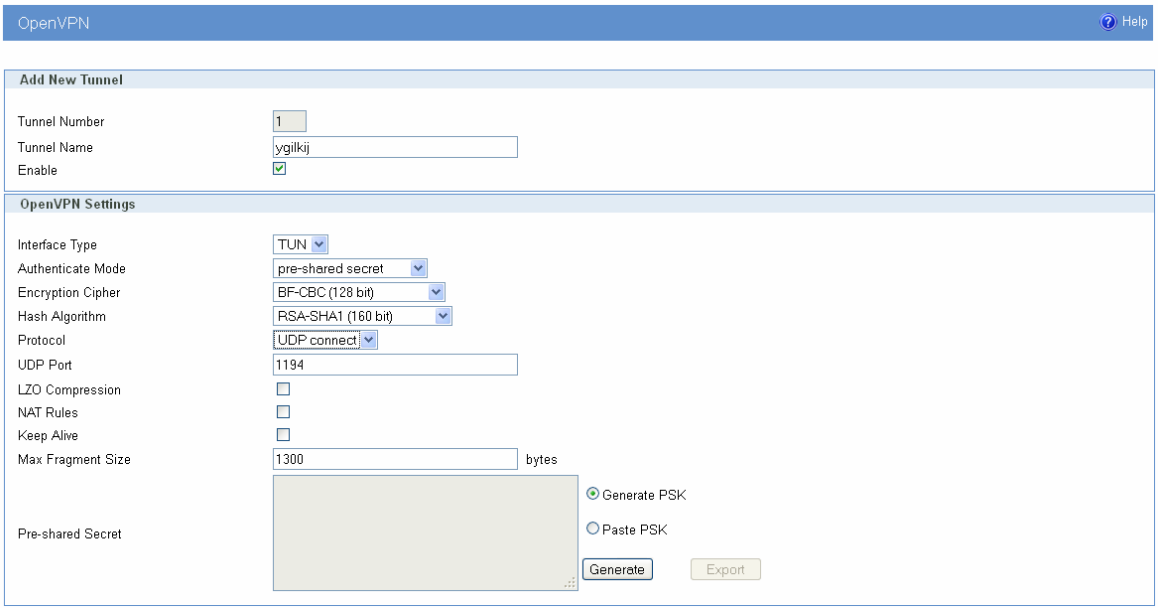


Figure 23 – OpenVPN configuration page

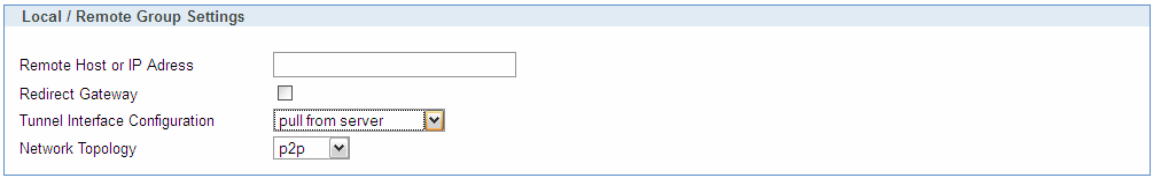


Figure 24 – OpenVPN network topology

Settings – Firewall – IP Filtering

TCP/IP traffic flow is controlled over IP address and port number through router's interfaces in both directions. With firewall options it is possible to create rule which exactly matches traffic of interest. Traffic can be blocked or forward depending of action selected. It is important when working with firewall rules to have in mind that traffic for router management should always be allowed to avoid problem with unreachable router. Firewall rules are checked by priority from the first to the last. Rules which are after matching rule are skipped.

Firewall	
Label	**Description**
Firewall General Settings	
Enable	This field specifies if Firewall is enabled at the router
Add New Rule	Applies configured rules to router
Firewall rules	
Priority	Firewall rules are evaluated from the top down. The first rule to match is executed immediately and the rest are skipped
Name	Description of applied rule
Enabled	This field specifies if rule is enabled in the firewall
Chain	There are three options available in this section: INPUT (for traffic going to the interface), OUTGOING (for traffic originated at the router going out of the interface) and FORWARD (for traffic routed from one interface to another, originated outside the router)
Service	Predefined list of well-known ports and Custom option for user defined services
Protocol	Type of protocol – TCP, UDP, UDPLITE, AH, SCTP, ESP, ICMP, Custom
Port	Number of port. Four options are available (FULL/UNDEF-all port numbers, RANGE -for range of ports, CSV multiport - for defining more than one noncontinuous port numbers, CUSTOM-for single port)
ICMP-type (ICMP protocol is selected)	List of ICMP packet types are displayed. ICMP is filtered in general or by specific type.
Protocol number (Custom protocol is selected)	Protocol number is chosen between 1 and 255
Input Interface	Selection of firewall input inspection interface (when OUTPUT chain is selected this field cannot be chosen)
Output Interface	Selection of firewall output inspection interface (when INPUT chain is selected this field cannot be chosen)
Source address	This field specifies packets with source IP address on which firewall rule is applied
Destination address	This field specifies packets with destination IP address on which firewall rule is applied
Inverted destination	For defined IP address in Source or Destination IP address inverts logic of the

address rule logic	filter. Instead of applying firewall rule on defined IP addresses all IP addresses EXCEPT defined are covered by firewall rule.
Packet state	Selection of traffic by packet state. INVALID is for unrecognized packet state traffic
Policy	Options for firewall rule action: ACCEPT (forward traffic), REJECT (deny traffic with ICMP error returned), DROP (drop traffic)
Reject-with	Select the reject type of the rule. The default error message is to send a port-unreachable to the host. This field is visible only if selected policy is REJECT.
Distributed DoS	
Enable	This box enables Distributed DOS
Maximum average matching rate	Maximum average matching rate: specified as a number, with an optional time unit: second, minute, hour, or day; the default is 3/hour
Maximum initial number of packets to match	Maximum initial number of packets to match: this number gets recharged by one every time the limit specified above is not reached, up to this number; the default is 5
Action	
Back	Click ***Back*** to return on firewall home page
Reload	Click ***Reload*** to discard any changes and reload previous settings
Save	Click ***Save*** to save your changes back to the GWR Router
Add New Rule	New rule to firewall table is added
Apply Rules	Save changes to table of firewall rules

Table 13 – Firewall parameters

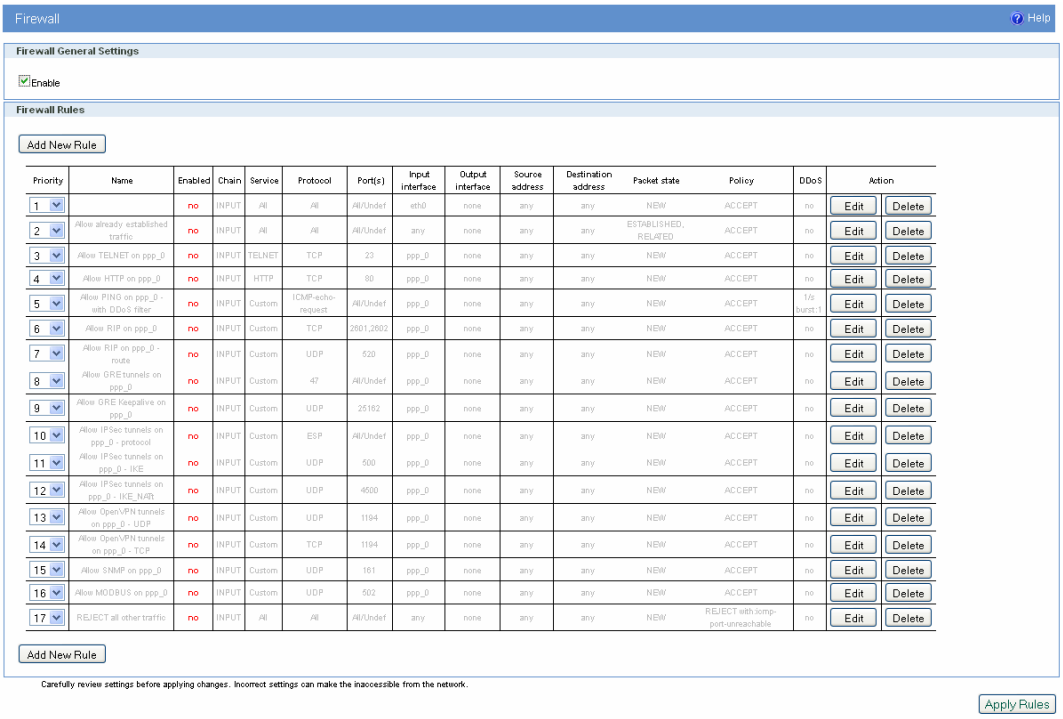


Figure 25 – Firewall configuration page

Settings – Firewall – MAC Filtering

MAC filtering can be used to restrict which Ethernet devices can send packets to the router. If MAC filtering is enabled, only Ethernet packets with a source MAC address that is configured in the MAC Filter table will be allowed. If the source MAC address is not in the MAC Filter table, the packet will dropped.

MAC Filtering Settings	
Label	**Description**
Enable MAC Filtering	This field specifies if MAC Filtering is enabled at the router
Enable	Enable MAC filtering for a specific MAC address
Name	Field shows the Rule Name that is given to the MAC filtering rule
MAC address	The Ethernet MAC source address to allow
Reload	Click **Reload** to discard any changes and reload previous settings
Save	Click **Save** to save changes back to the GWR router

Table 14 - MAC filtering parameters

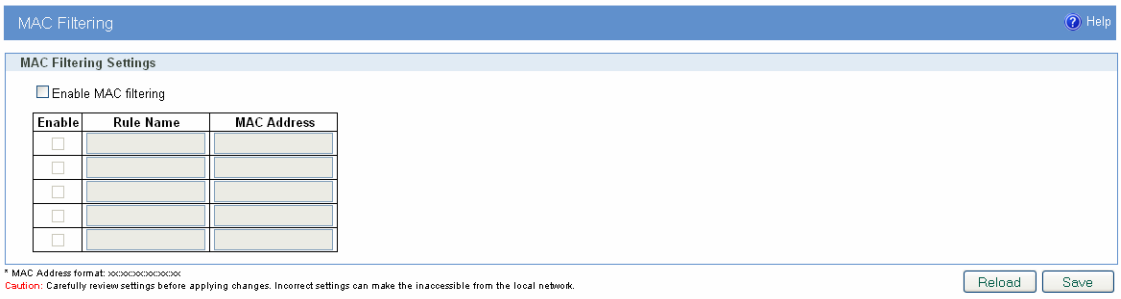


Figure 26 – MAC filtering configuration page

DMZ Host

Demilitarized Zone (DMZ) allows one IP Address to be exposed to the Internet. Because some applications require multiple TCP/IP ports to be open, DMZ provides this function by forwarding all the ports to one computer at the same time. In the other words, this setting allows one local user to be exposed to the Internet to use a special-purpose services such as Internet gaming, Video-conferencing and etc. It is recommended that you set your computer with a static IP if you want to use this function.

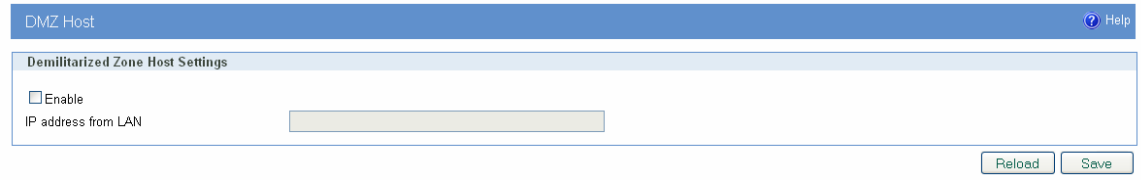


Figure 27 – DMZ Host configuration page

Settings – DynDNS

Dynamic DNS is a domain name service allowing to link dynamic IP addresses to static hostname. To start using this feature firstly you should register to DDNS service provider. Section of the web interface where you can setup DynDNS parameters is shown in *Figure 28*.

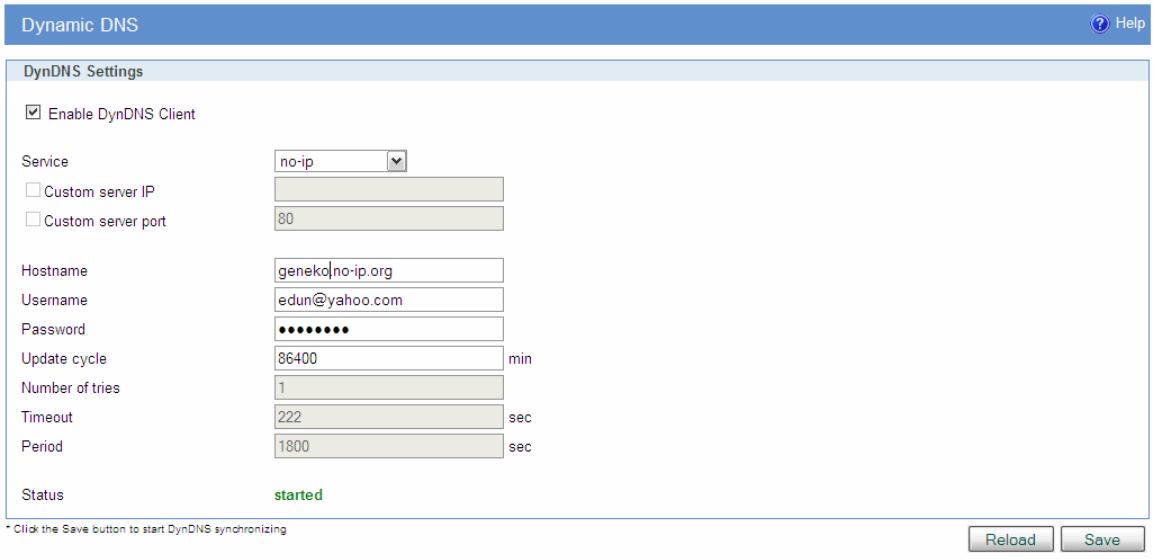


Figure 28 – DynDNS settings

DynDNS	
Label	**Description**
Enable DynDNS Client	Enable DynDNS Client.
Service	The type of service that you are using, try one of: no–ip, dhs, pgpow, dyndns, dyndns–static, dyndns–custom, ods, easydns, dyns, justlinux and zoneedit.
Custom Server IP	The server IP to connect to.
Custom Server port	The server port to connect to.
Hostname	String to send as host parameter.
Username	User ID

Password	User password.
Update cycle	Defines interval between updates of the DynDNS client. Default and minimum value for all DynDNS services, except No–IP service, is 86400 seconds. Update cycle value for No–IP service is represented in minutes and minimum is 1 minute.
Number of tries	Number of tries (default: 1) if network problem.
Timeout	The amount of time to wait on I/O (network problem).
Period	Time between update retry attempts, default value is 1800.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** to save your changes back to the GWR Router.

Table 15 – DynDNS parameters

Settings – Serial Port

Using the router's serial port it is possible to perform serial–to–ethernet conversion (Serial port over TCP/UDP) and ModbusRTU–to–TCP conversion (Modbus gateway). Initial Serial Port Settings page is shown in figure bellow. By default above described features are disabled. Selecting one of two possible applications of Serial port opens up additional options available for configuration.

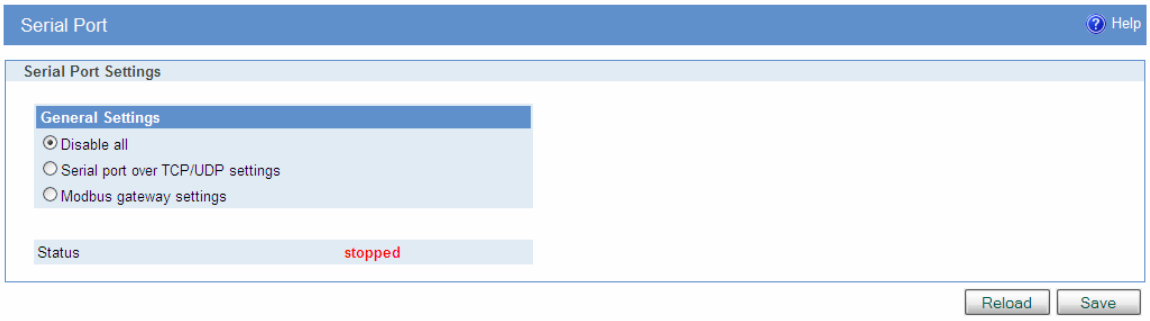


Figure 29 – Serial Port Settings initial menu

Serial port over TCP/UDP settings

The GWR Router provides a way for a user to connect from a network connection to a serial port. It provides all the serial port setup, a configuration file to configure the ports, a control login for modifying port parameters, monitoring ports, and controlling ports. The GWR Router supports RFC 2217 (remote control of serial port parameters).

Serial Port over TCP/UDP Settings	
Label	**Description**
Bits per second	The unit and attached serial device, such as a modem, must agree on a speed or baud rate to use for the serial connection. Valid baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200.
Data bits	Indicates the number of bits in a transmitted data package.
Parity	Checks for the parity bit. None is the default.
Stop bits	The stop bit follows the data and parity bits in serial communication. It indicates the end of transmission. The default is 1.
Flow control	Flow control manages data flow between devices in a network to ensure it is processed efficiently. Too much data arriving before a device is prepared to manage it causes lost or retransmitted data. None is the default.
Protocol	Choose which protocol to use [TCP/UDP].
Mode	Select server mode in order to listen for incoming connection, or client mode to establish one.
Bind to TCP/UDP port	Number of the TCP/UDP port to accept connections for this device. (Only on server side)

Server IP address	Specify server IP address. (Only on client side).
Connect to TCP/UDP port	Number of the TCP/UDP port to accept connections from this device. (Only on client side).
Type of socket	Either *raw or telnet*. Raw enables the port and transfers all data like between the port and the log. Telnet enables the port and runs the telnet protocol on the port to set up telnet parameters.
Enable local echo	Enable the local echo feature.
Enable timeout	After defined period of inactivity port is closed, default is 1 hour
Check TCP connection	Enable connection checking.
Keepalive idle time	Set keepalive idle time in seconds.
Keepalive interval	Set time period between checking.
Log level	Set importance level of log messages.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** button to save your changes back to the GWR Router and activate/deactivate serial to Ethernet converter.

Table 16 – Serial Port over TCP/UDP parameters

Click *Serial Port* Tab to open the Serial Port Configuration screen. Use this screen to configure the GWR Router serial port parameters (*Figure 30*).

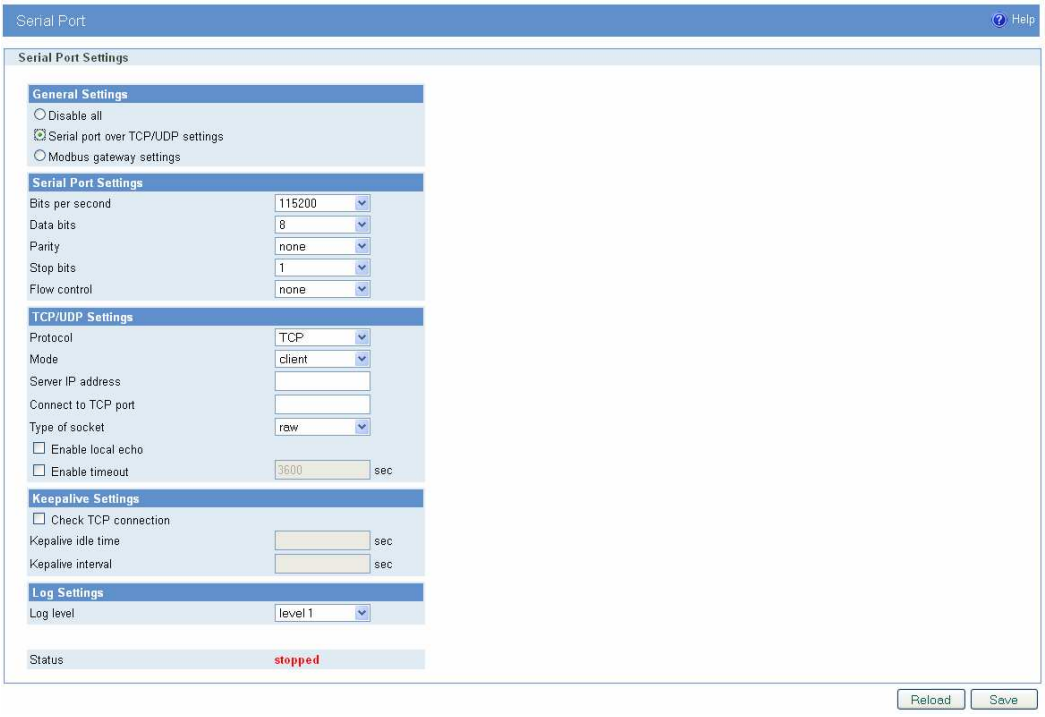


Figure 30 – Serial Port configuration page

Modbus Gateway settings

The serial server will perform conversion from Modbus/TCP to Modbus/RTU, allowing polling by a Modbus/TCP master. The Modbus Gateway carries out translation between Modbus/TCP and Modbus/RTU. This means that Modbus serial slaves can be directly attached to the unit's serial ports without any external protocol converters.

Click ***Serial Port*** Tab to open the Modbus Gateway configuration screen. Choose Modbus Gateway options to configure Modbus. At the *Figure 31* – Modbus gateway configuration page you can see screenshot of Modbus Gateway configuration menu.

Modbus Gateway Parameters	
Label	**Description**
Bits per second	The unit and attached serial device, such as a modem, must agree on a speed or baud rate to use for the serial connection. Valid baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200.
Data bits	Indicates the number of bits in a transmitted data package. Valid data bits are: 8 and 7.
Parity	Checks for the parity bit. Valid parity are: none, even and odd. None is the default.
Stop bits	The stop bit follows the data and parity bits in serial communication. It indicates the end of transmission. Valid stop bits are: 1 and 2. The default is 1.
Flow control	Flow control manages data flow between devices in a network to ensure it is processed efficiently. Too much data arriving before a device is prepared to manage it causes lost or retransmitted data. None is the default.
TCP accept port	This field determines the TCP port number that the serial server will listen for connections on. The value entered should be a valid TCP port number. The default Modbus/TCP port number is 502.
Connection timeout	When this field is set to a value greater than 0, the serial server will close connections that have had no network receive activity for longer than the specified period.
Transmission mode	Select RTU, based on the Modbus slave equipment attached to the port.
Response timeout	This is the timeout (in milliseconds) to wait for a response from a serial slave device before retrying the request or returning an error to the Modbus master.
Maximum number of retries	Should no valid response be received from a Modbus slave, the value in this field determines the number of times the serial server will retransmit request before giving up.
Log level	Set importance level of log messages.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** button to save your changes back to the GWR Router and activate/deactivate serial to Ethernet converter.

Table 17 – Modbus gateway parameters

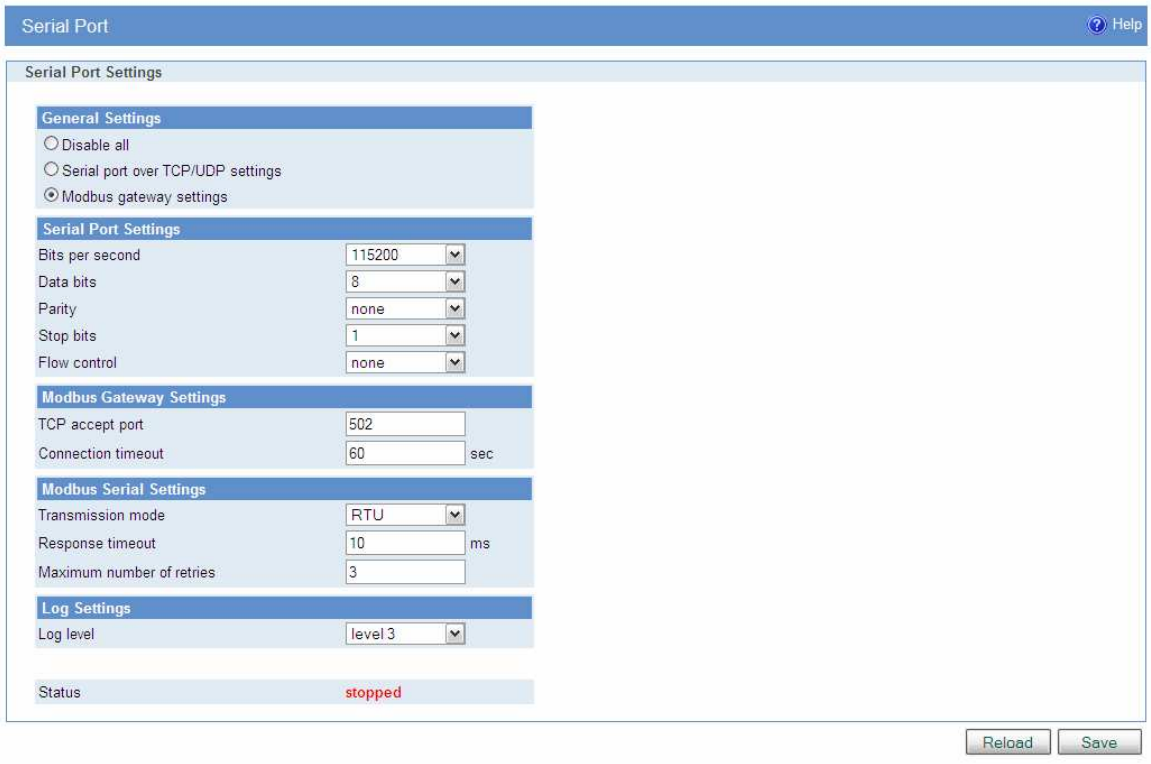


Figure 31 – Modbus gateway configuration page

SMS – SMS Remote Control

SMS remote control feature allows users to execute a short list of predefined commands by sending SMS messages to the router. GWR router series implement following predefined commands:

1. In order to establish PPP connection, user should send SMS containing following string:
   :PPP–CONNECT
   After the command is executed, router sends a confirmation SMS with "OK" if the command is executed without errors or "ERROR" if something went wrong during the execution of the command.

2. In order to disconnect the router from PPP, user should send SMS containing following string:
   :PPP–DISCONNECT
   After the command is executed, router sends a confirmation SMS with "OK" if the command is executed without errors or "ERROR" if something went wrong during the execution of the command.

3. In order to reestablish (reconnect the router) the PPP connection, user should send SMS containing following string:
   :PPP–RECONNECT
   After the command is executed, router sends a confirmation SMS with "OK" if the command is executed without errors or "ERROR" if something went wrong during the execution of the command.

4. In order to obtain the current router status, user should send SMS containing following string:
   :PPP–STATUS
   After the command is executed, router sends one of the following status reports to the user:
   – CONNECTING
   – CONNECTED, WAN_IP: {WAN IP address or the router**}**
   – DISCONNECTING
   – DISCONNECTED

5. In order to establish PPP connection over the other SIM card, user should send SMS containing following string:
   :SWITCH-SIM
   After the command is executed, router sends a confirmation SMS with "OK" if the command is executed without errors or "ERROR" if something went wrong during the execution of the command.

6. In order to restart whole router user should send SMS containing following string:
   :REBOOT
   After the command is executed, router sends a confirmation SMS with "OK" if the command is executed without errors or "ERROR" if something went wrong during the execution of the command.

Remote control configuration page is presented on the following figure. In order to use this feature, user must enable the SMS remote control and specify the list of SIM card numbers that will be used for SMS remote control. The SIM card number should be entered in the following format: {Country Code}{Mobile Operator Prefix}{Phone Number} (for example **+38164111222**). SMS service centre number can be obtained automatically (option "Use default SMSC is enabled") or manually by entering number under field "Custom SMSC".

As presented in the figure configuration should be performed separately for both SIM cards. After the configuration is entered, user must click on ***Save*** button in order to save the configuration.

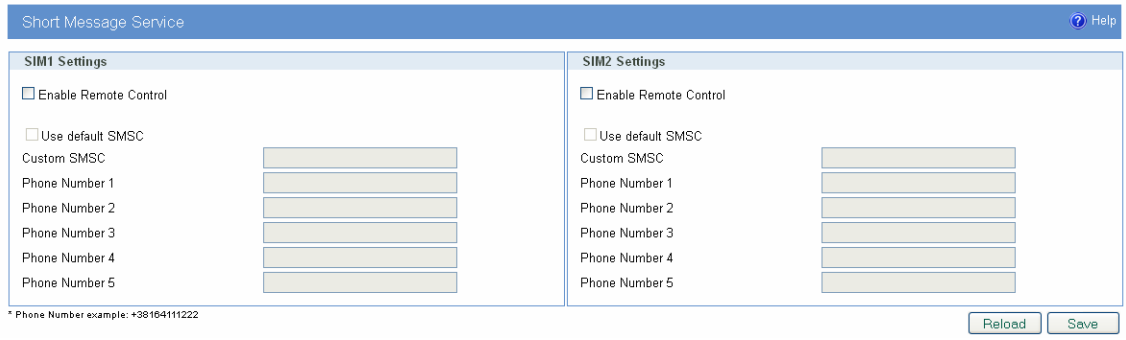


Figure 32 – SMS remote control configuration

SMS – Send SMS

SMS send feature allows users to send SMS message from WEB interface. In following picture is page from where SMS can be sent. There are two required fields on this page: Phone number and Message.

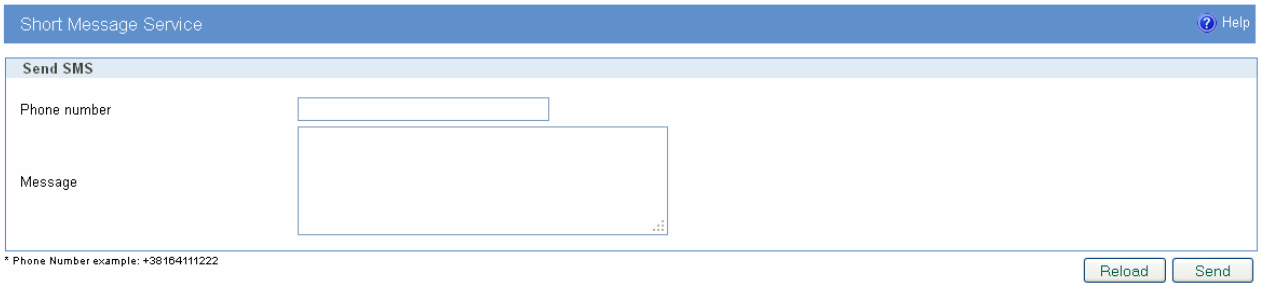


Figure 33 – Send SMS

SMS Gateway is used for sending SMS with GET query. Command format is following:

192.168.1.1/cgi/send_exec.lua?group=sms&phone=%2B**38164112233**&message="**hello world**"&auth="**YWRtaW46YWRtaW4=**"

Field marked with red are changeable . First field is phone number where is sent SMS to. Second field is message itself. Third field is authorization (username:password) encrypted in BASE64. Link for online BASE64 encryption is following http://www.base64encode.org. Username and password has to be written in format ***username:password***.

Maintenance

The GWR Router provides administration utilities via web interface. Administrator can setup basic router's parameters, perform network diagnostic, update software or restore factory default settings.

Maintenance – Device Identity Settings

Within ***Device Identity Settings Tab*** there is an option to define name, location of device and description of device function. These data are kept in device permanent memory. ***Device Identity Settings*** window is shown on *Figure 34*.

Device Identity Settings	
Label	**Description**
Name	This field specifies name of the GWR Router.
Description	This field specifies description of the GWR Router. Only for information purpose.
Location	This field specifies location of the GWR Router. Only for information purpose.
Save	Click ***Save*** button to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 18 – Device Identity parameters

Figure 34 – Device Identity Settings configuration page

Maintenance – Router Management

By ***Administrator Password*** Tab it is possible to activate and deactivates device access system through ***Username*** and ***Password*** mechanism. Within this menu change of authorization data Username/Password is also done. ***Administer Password*** Tab window is shown on *Figure 35*.

NOTE: The password cannot be recovered if it is lost or forgotten. If the password is lost or forgotten, you have to reset the Router to its factory default settings; this will remove all of your configuration changes.

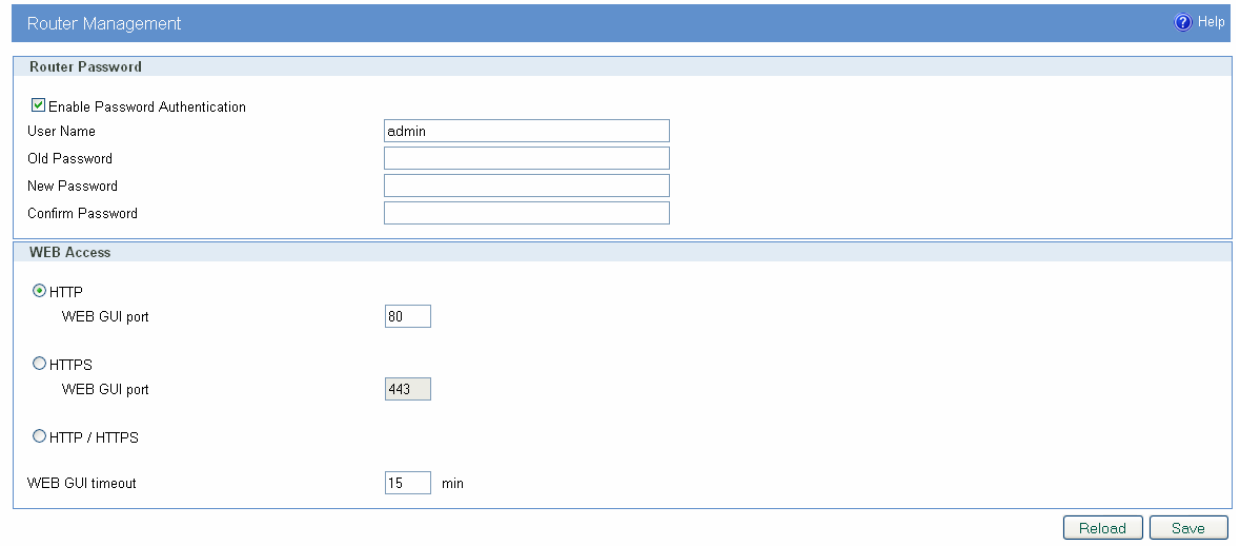


Figure 35 – Router Management configuration page

Administrator Password	
Label	**Description**
Enable Password Authentication	By this check box you can activate or deactivate function for authentication when you access to web/console application.
Username	This field specifies Username for user (administrator) login purpose.
Old Password	Enter the old password. The default is ***admin*** when you first power up the GWR Router.
New Password	Enter a new password for GWR Router. Your password must have 20 or fewer characters and cannot contain any space.
Confirm Password	Re–enter the new password to confirm it.
HTTP	Bind HTTP to specified port
HTTPS	Bind HTTPS to specified port
HTTP/HTTPS	Bind HTTP and HTTPS to specified port
WEB GUI Timeout	WEB session timeout
Save	Click ***Save*** button to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 19 – Router Management

Maintenance – Date/Time Settings

To set the local time, select ***Date/Time Settings*** using the Network Time Protocol (NTP) automatically or Set the local time manually. Date and time setting on the GWR Router are done through window Date/Time Settings.

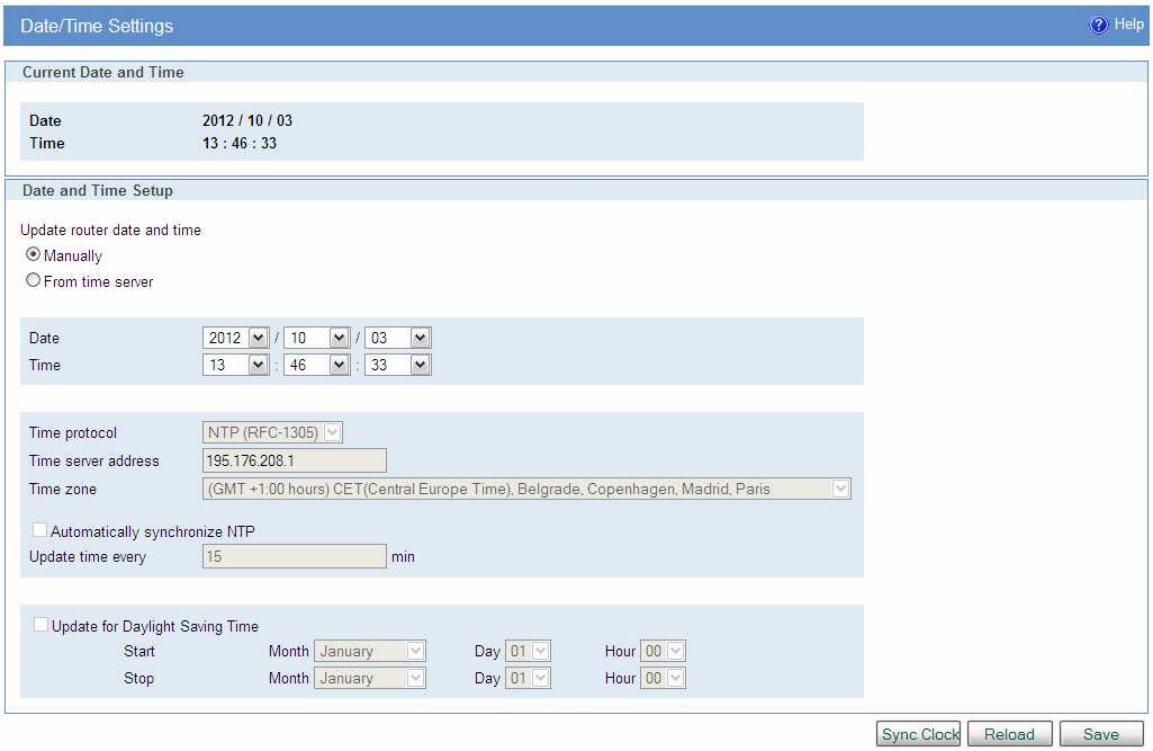


Figure 36 – Date/Time Settings configuration page

Date/Time Settings	
Label	**Description**
Manually	Sets date and time manually as you specify it.
From time server	Sets the local time using the Network Time Protocol (NTP) automatically.
Time/Date	This field species Date and Time information. You can change date and time by changing parameters.
Sync Clock With Client	Date and time setting on the basis of PC calendar.
Time Protocol	Choose the time protocol.
Time Server Address	Time server IP address.
Time Zone	Select your time zone.
Automatically synchronize NTP	Setup automatic synchronization with time server.
Update time every	Time interval for automatic synchronization.
Update for Daylight Saving Time	Enables daylight saving time. On the date specified as start date, clock on the GWR router will be adjusted for one hour in advance. On the date specified as stop date, clock on the GWR router will be adjusted for one hour backward.
Save	Click ***Save*** button to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 20 – Date/time parameters

Maintenance – Diagnostics

The GWR Router provide built–it tool, which is used for troubleshooting network problems. The ping test bounces a packet of machine on the Internet back to the sender. This test shows if the GWR Router is able to connect the remote host. If users on the LAN are having problems accessing service on the Internet, try to ping the DNS server or other machine on network.

Click ***Diagnostic*** tab to provide basic diagnostic tool for testing network connectivity. Insert valid IP address in ***Hostname*** box and click ***Ping***. Every time you click ***Ping*** router sends four ICMP packets to destination address.

Before using this tool make sure you know the device or host's IP address.

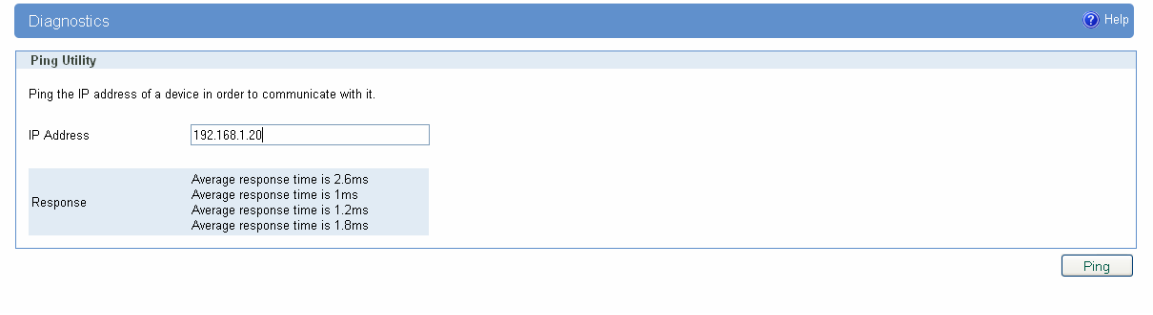


Figure 37 – Diagnostic page

Maintenance – Update Firmware

You can use this feature to upgrade the GWR Router firmware to the latest version. If you need to download the latest version of the GWR Router firmware, please visit Geneko support site. Follow the on–screen instructions to access the download page for the GWR Router.

If you have already downloaded the firmware onto your computer, click ***Browse*** button, on ***Update firmware*** Tab, to look for the firmware file. After selection of new firmware version through ***Browse*** button, mechanism the process of data transfer from firmware to device itself should be started. This is done by ***Upload*** button. The process of firmware transfer to the GWR device takes a few minutes and when it is finished the user is informed about transfer process success.

NOTE: The Router will take a few minutes to upgrade its firmware. During this process, do not power off the Router or press the Reset button.

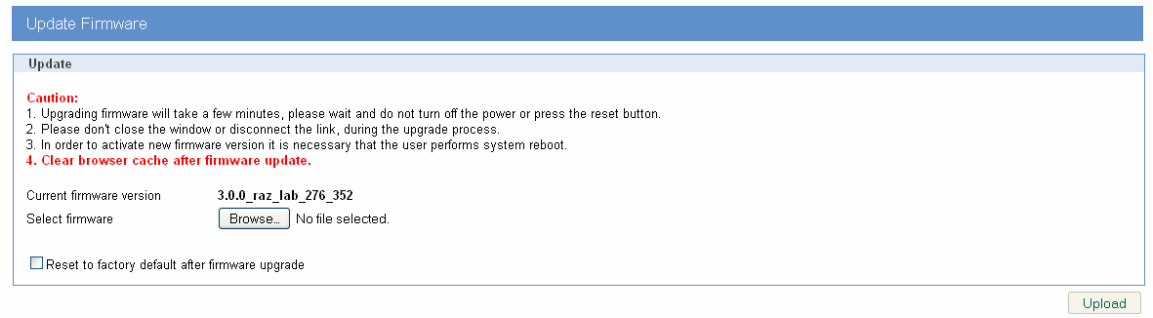


Figure 38 – Update Firmware page

In order to activate new firmware version it is necessary that the user performs system reset. In the process of firmware version change all configuration parameters are not changed and after that the system continues to operate with previous values.

Maintenance – Settings Backup

This feature allows you to make a backup file of complete configuration or some part of the configuration on the GWR Router. In order to backup the configuration, you should select the part of configuration you would like to backup. The list of available options is presented on the *Figure 39*. To use the backup file, you need to import the configuration file that you previously exported.

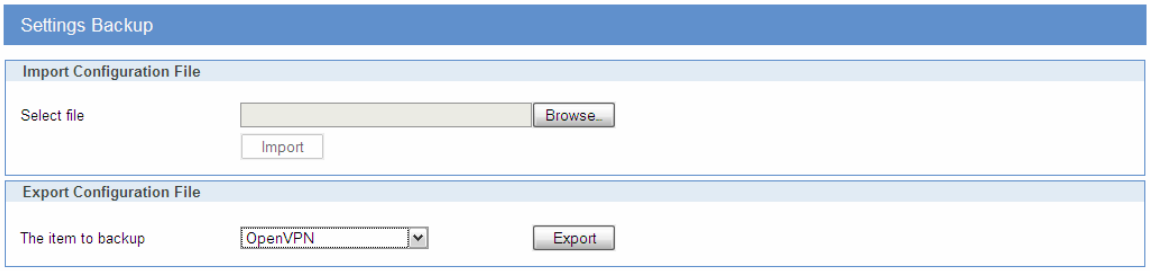


Figure 39 – Export/Import the configuration on the router

Import Configuration File

To import a configuration file, first specify where your backup configuration file is located. Click **Browse**, and then select the appropriate configuration file.

After you select the file, click Import. This process may take up to a minute. Restart the Router in order to changes will take effect.

Export Configuration File

To export the Router's current configuration file select the part of the configuration you would like to backup and click ***Export***.

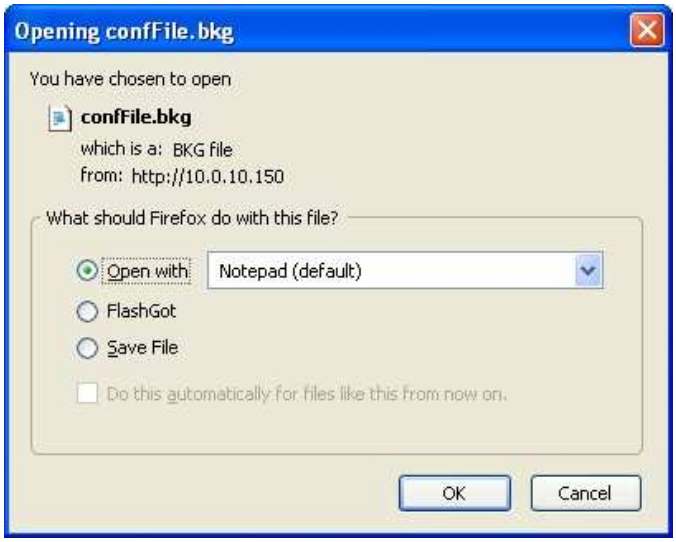


Figure 40 – File download

Select the location where you want to store your backup configuration file. By default, this file will be called ***confFile.bkg***, but you may rename it if you wish. This process may take up to a minute.

Maintenance – Default Settings

Use this feature to clear all of your configuration information and restore the GWR Router to its factory default settings. Only use this feature if you wish to discard all the settings and preferences that you have configured.

Click ***Default Setting*** to have the GWR Router with default parameters. ***Keep network settings*** check–box allows user to keep all network settings after factory default reset. System will be reset after pressing ***Restore*** button.

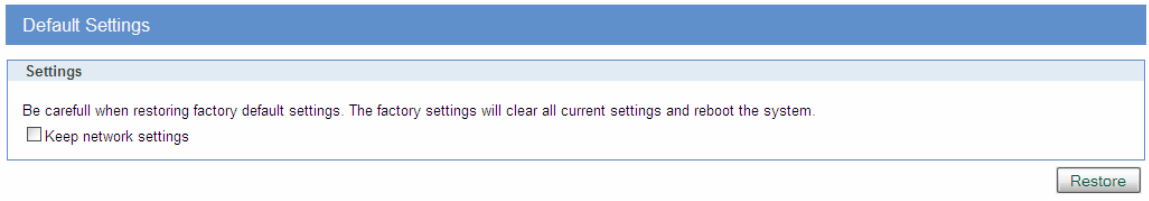


Figure 41 – Default Settings page

Maintenance – System Reboot

If you need to restart the Router, Geneko recommends that you use the Reboot tool on this screen. Click ***Reboot*** to have the GWR Router reboot. This does not affect the router's configuration.

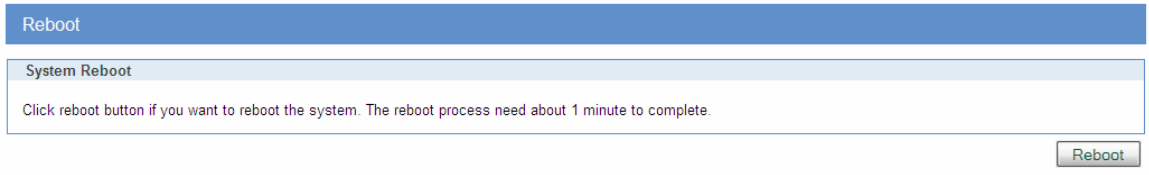


Figure 42 – System Reboot page

Management – Command Line Interface

CLI (command line interface) is a user text-only interface to a computer's operating system or an application in which the user responds to a visual prompt by typing in a command on a specified line and then receives a response back from the system.
In other words, it is a method of instructing a computer to perform a given task by "entering" a command. The system waits for the user to conclude the submitting of the text command by pressing the ***Enter*** or ***Return*** key. A command-line interpreter then receives, parses, and executes the requested user command.

On router's Web interface, in Management menu, click on Command Line Interface tab to open the Command Line Interface settings screen. Use this screen to configure CLI parameters *Figure 43 – Command Line Interface*.

Command Line Interface	
Label	**Description**
CLI Settings	
Enable	Enable or disable CLI
CLI on	Telnet, SSH, Serial
View Mode Username	Login name for View mode
View Mode Password	Password for View mode
Confirm Password	Confirm password for View mode
View Mode Timeout	Inactivity timeout for View mode in seconds. After timeout, user will be put in Main mode.
Edit Mode Timeout	Inactivity timeout for Edit mode in seconds. Note that Username and Password for Edit mode are the same as Web interface login parameters. After timeout, user will be put in Main mode.
Console Type	Windows, other.
Save	Click ***Save*** to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 21 – Command Line Interface parameters

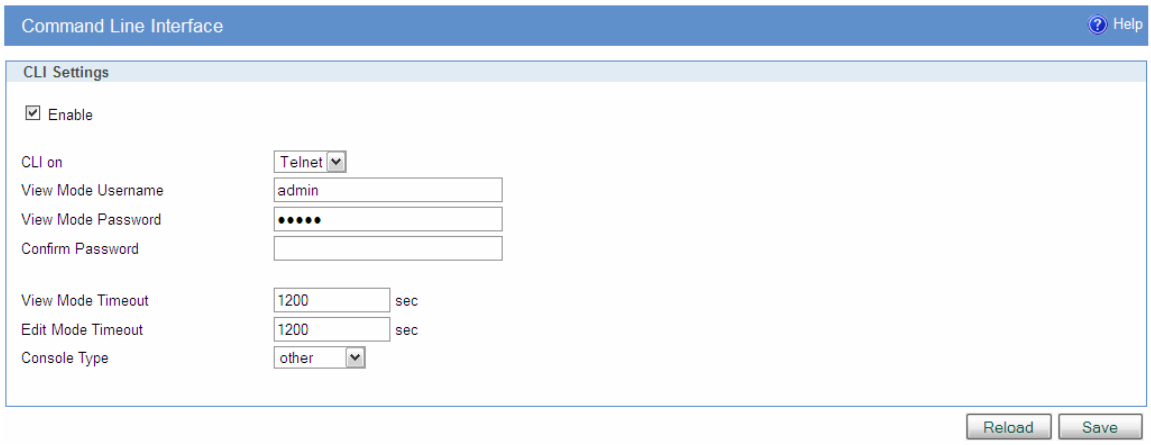


Figure 43 – Command Line Interface

Detailed instructions related to CLI are located in other document (Command_Line_Interface.pdf file on CD that goes with the router). You will find detailed specifications of all commands you can use to configure the router and monitor routers performance.

Management – Remote Management

Remote Management Utility is a standalone Windows application with many useful options for configuration and monitoring of GWR routers. More information about this utility can be found in other document (Remote_Management.pdf). In order to use this utility user has to enable Remote Management on the router *Figure 44*.

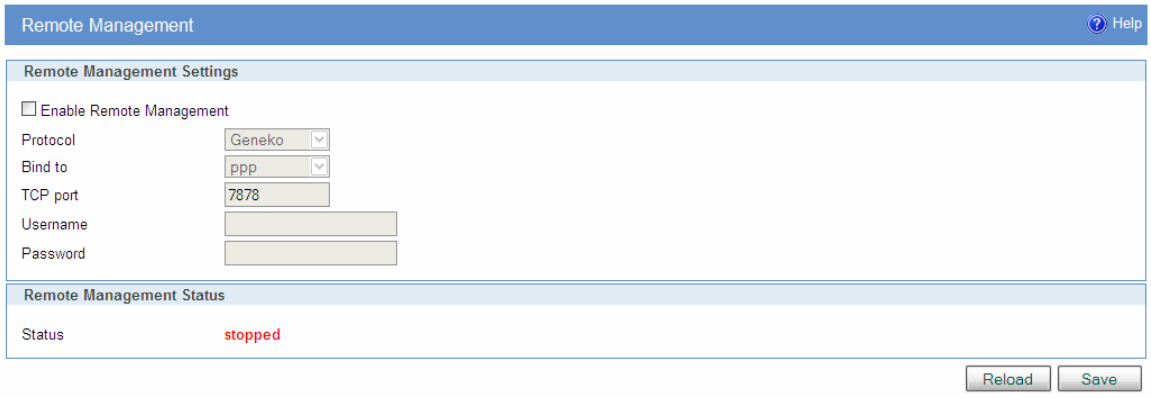


Figure 44 – Remote Management

Command Line Interface	
Label	**Description**
Enable Remote Management	Enable or disable Remote Management.
Protocol	Choose between Geneko and Sarian protocol.
Bind to	Specify the interface.
TCP port	Specify the TCP port.
Username	Specify the username.
Password	Specify the password.
Save	Click ***Save*** to save your changes back to the GWR Router.
Reload	Click ***Reload*** to discard any changes and reload previous settings.

Table 22 – Remote Management parameters

Management – Connection Manager

Enabling Connection Manager will allow Connection Wizard (located on setup CD that goes with the router) to guide you step–by–step through the process of device detection on the network and setup of the PC–to–device communication. Thanks to this utility user can simply connect the router to the local network without previous setup of the router. Connection Wizard will detect the device and allow you to configure some basic functions of the router. Connection Manager is enabled by default on the router and if you do not want to use it you can simply disable it *Figure 45*.

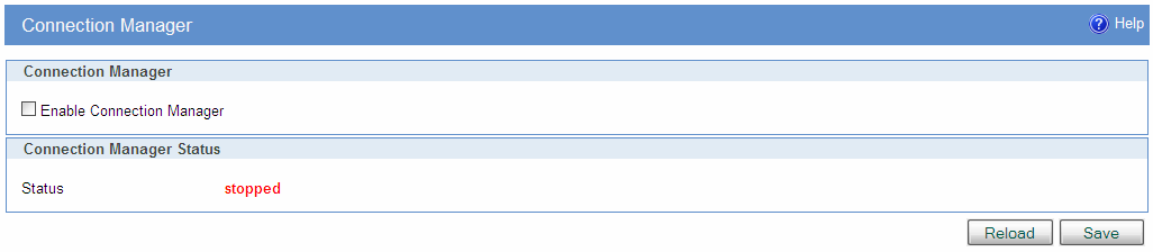


Figure 45 – Connection Manager

Getting started with the Connection Wizard

Connection Wizard is installed through few very simple steps and it is available immediately upon the installation. After starting the wizard you can choose between two available options for configuration:

- **GWR Router's Ethernet port** – With this option you can define LAN interface IP address and subnet mask.
- **GWR router's Ethernet port and GPRS/EDGE/HSPA/HSPA+/LTE network connection** – Selecting this option you can configure parameters for LAN and WAN interface

Figure 46 – Connection Wizard – Initial Step

Select one of the options and click ***Next***. On the next screen after Connection Wizard inspects the network (whole broadcast domain) you'll see a list of routers present in the network, with following information:

- Serial number,
- Model,
- Ethernet IP,
- Firmware version,
- Pingable (if Ethernet IP address of the router is in the same IP subnet as PC interface then this field will be marked, i.e. you can access router over web interface).

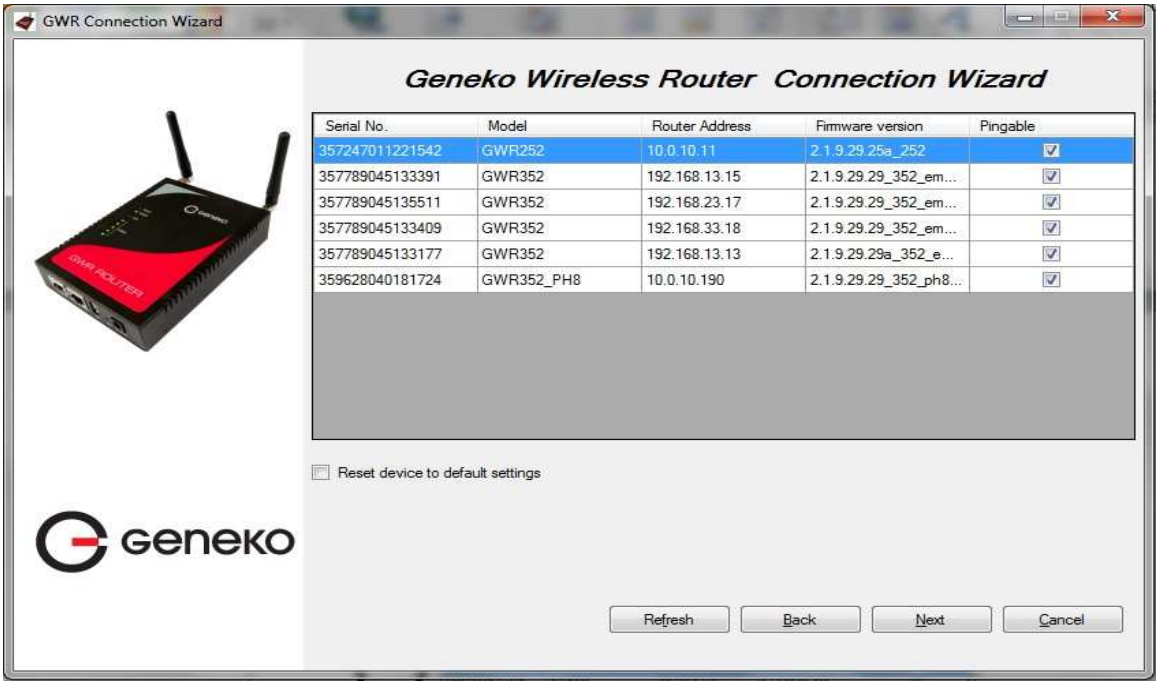


Figure 47 – Connection Wizard – Router Detection

When you select one of the routers from the list and click ***Next*** you will get to the following screen.

Figure 48 – Connection Wizard – LAN Settings

If you selected to configure LAN and WAN interface click, upon entering LAN information click *Next* and you will be able to setup WAN interface.

Figure 49 – Connection Wizard – WAN Settings

After entering the configuration parameters if you mark option *Establish connection* router will start with connection establishment immediately when you press ***Finish*** button. If not you have to start connection establishment manually on the router's web interface.

Management – Simple Management Protocol (SNMP)

SNMP, or Simple Network Management Protocol, is a network protocol that provides network administrators with the ability to monitor the status of the Router and receive notification of any critical events as they occur on the network. The Router supports SNMP v1/v2c and all relevant Management Information Base II (MIBII) groups. The appliance replies to SNMP Get commands for MIB II via any interface and supports a custom MIB for generating trap messages.

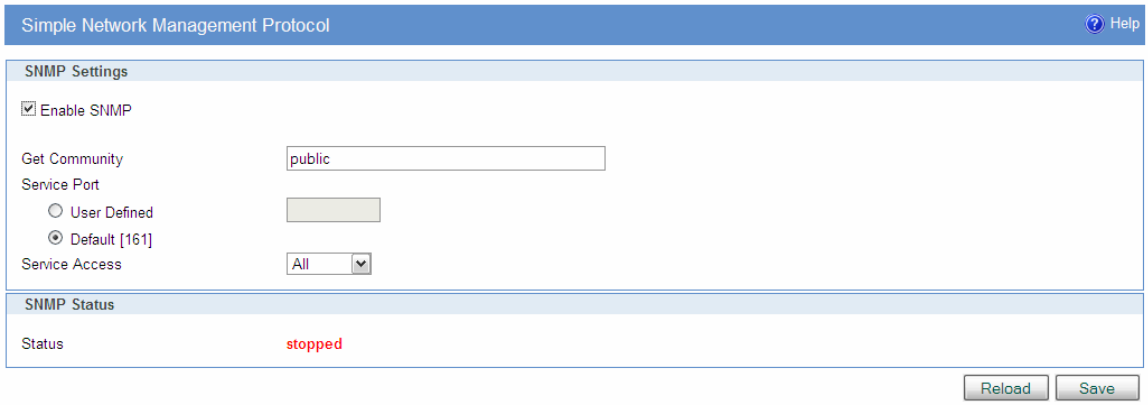


Figure 50 – SNMP configuration page

SNMP Settings	
Label	**Description**
Enable SNMP	SNMP is enabled by default. To disable the SNMP agent, click this option to unmark.
Get Community	Create the name for a group or community of administrators who can view SNMP data. The default is ***public***. It supports up to 64 alphanumeric characters.
Service Port	Sets the port on which SNMP data has been sent. The default is 161. You can specify port by marking on user defined and specify port you want SNMP data to be sent.
Service Access	Sets the interface enabled for SNMP traps. The default is Both.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** button to save your changes back to the GWR Router and enable/disable SNMP.

Table 23 – SNMP parameters

Management – Logs

Syslog is a standard for forwarding log messages in an IP network. The term "syslog" is often used for both the actual syslog protocol, as well as the application or library sending syslog messages.

Syslog is a client/server protocol: the syslog sender sends a small (less than 1KB) textual message to the syslog receiver. Syslog is typically used for computer system management and security auditing. While it has a number of shortcomings, syslog is supported by a wide variety of devices and receivers across multiple platforms. Because of this, syslog can be used to integrate log data from many different types of systems into a central repository.

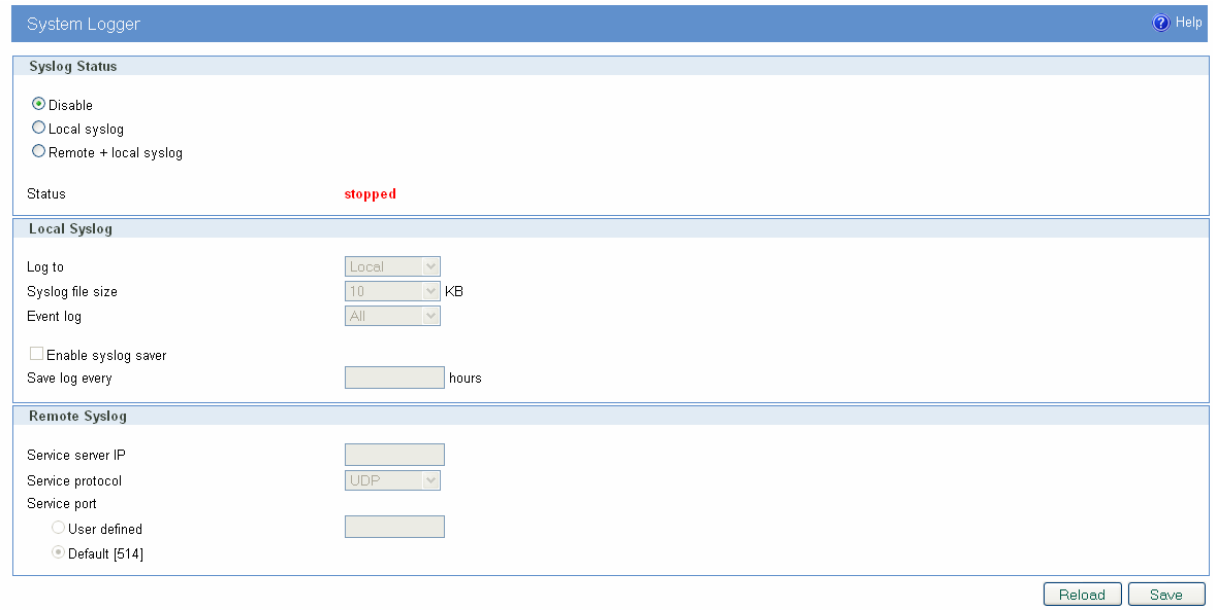


Figure 51 – Syslog configuration page

The GWR Router supports this protocol and can send its activity logs to an external server.

Syslog Settings	
Label	**Description**
Disable	Mark this option in order to disable Syslog feature.
Local syslog	Start logging facility locally.
Remote + local syslog	Mark this option in order to enable logging on remote machine.
Remote Syslog	
Service Server IP	The GWR Router can send a detailed log to an external Syslog server. The Router's Syslog captures all log activities and includes this information about all data transmissions: every connection source and destination IP address, IP service, and number of bytes transferred. Enter the Syslog server name or IP address.
Service Port	Sets the port on which Syslog data has been sent. The default is 514.

	You can specify port by marking on user defined and specify port you want Syslog data to be sent.
User defined	Set manually port number.
Default	Use standard port number for this service. [514]
Local syslog	
Log to	Local – Syslog file is stored locally on the router USB Flash – Syslog file is stored on flash memory attached to USB interface
Syslog file size	Set log size on one of the six predefined values. [10/20/50/100/200/500]kb
Event log	Choose which events to be stored. You can store System, Ipsec events or both of them.
Enable syslog saver	Save logs periodically on filesystem.
Save log every	Set time duration between two saves.
Reload	Click ***Reload*** to discard any changes and reload previous settings.
Save	Click ***Save*** button to save your changes back to the GWR Router and enable/disable Syslog.

Table 24 – Syslog parameters

Logout

The ***Logout*** tab is located on the down left–hand corner of the screen. Click this tab to exit the web–based utility. (If you ex it the web–based utility, you will need to re–enter your User Name and Password to log in and then manage the Router.)

Configuration Examples

GWR Router as Internet Router

The GWR Routers can be used as *Internet router* for a single user or for a group of users (entire LAN). NAT function is enabled by default on the GWR Router. The GWR Router uses Network Address Translation (NAT) where only the mobile IP address is visible to the outside world. All outgoing traffic uses the GWR Router mobile IP address.

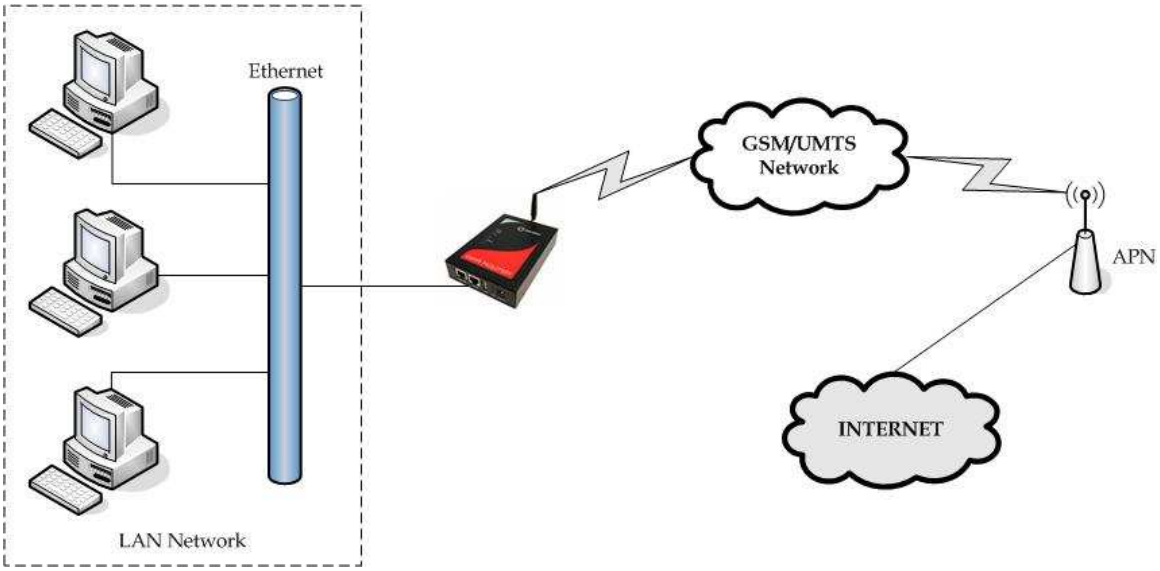


Figure 52 – GWR Router as Internet router

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.
  - IP address: 10.1.1.1,
  - Netmask: 255.255.255.0.
- Press ***Save*** to accept the changes.
- Use SIM card with a dynamic/static IP address, obtained from Mobile Operator. (Note the default gateway may show, or change to, an address such as 10.0.0.1; this is normal as it is the GSM/UMTS provider's network default gateway).
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be provided by your mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Check ***Routing*** Tab to see if there is default route (should be there by default).
- Router will automatically add default route via *ppp0* interface.
- Optionally configure IP Filtering and TCP service port settings to block any unwanted incoming traffic.
- Configure the GWR Router LAN address (10.1.1.1) as a default gateway address on your PCs. Configure valid DNS address on your PCs.

GRE Tunnel configuration between two GWR Routers

GRE tunnel is a type of a VPN tunnel, but it is not a secure tunneling method. Simple network with two GWR Routers is illustrated on the diagram below (*Figure 53*). Idea is to create GRE tunnel for LAN to LAN (site to site) connectivity.

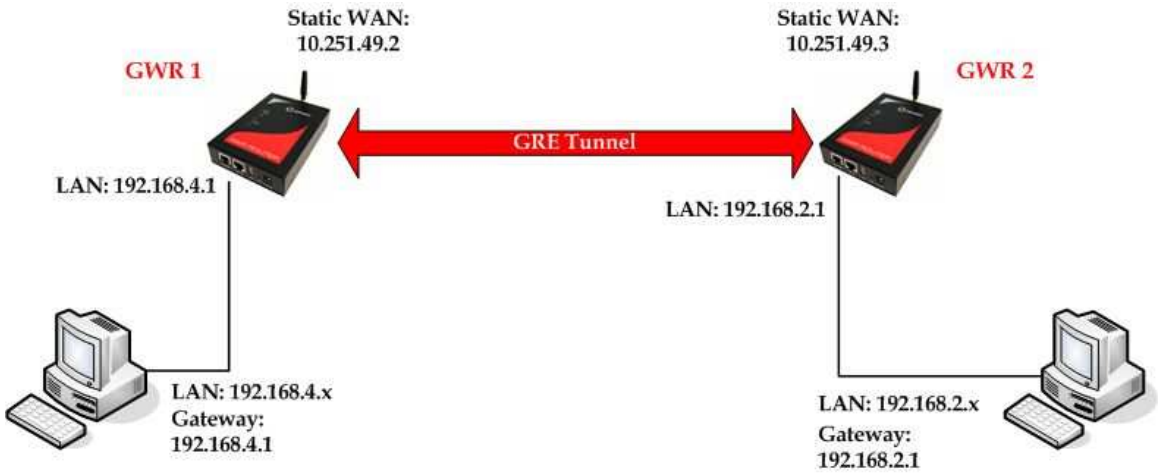


Figure 53 – GRE tunnel between two GWR Routers

The GWR Routers requirements:

- Static IP WAN address for tunnel source and tunnel destination address;
- Source tunnel address should have static WAN IP address;
- Destination tunnel address should have static WAN IP address;

GSM/UMTS APN Type: For GSM/UMTS networks GWR Router connections may require a Custom APN. A Custom APN allows for various IP addressing options, particularly static IP addresses, which are needed for most VPN connections. A custom APN should also support mobile terminated data that may be required in most site–to–site VPNs.

The GWR Router 1 configuration:

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.
  - IP Address: 192.168.4.1,
  - Subnet Mask: 255.255.255.0,
  - Press ***Save*** to accept the changes.

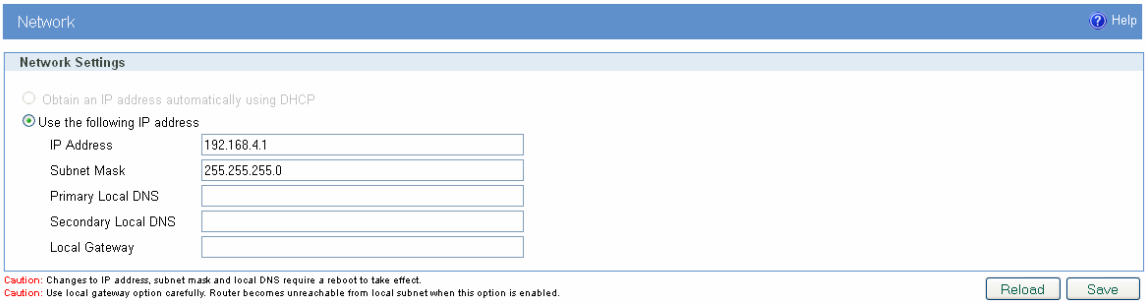


Figure 54 – Network configuration page for GWR Router 1

- Use SIM card with a static IP address, obtained from Mobile Operator. (Note the default gateway may show, or change to, an address such as 10.0.0.1; this is normal as it is the GSM/UMTS

provider's network default gateway).

- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > GRE*** to configure GRE tunnel parameters:
  - Enable: yes,
  - Local Tunnel Address: 10.10.10.1,
  - Local Tunnel Netmask: 255.255.255.252 (Unchangeable, always 255.255.255.252),
  - Tunnel Source: 10.251.49.2 (select HOST from drop down menu if you want to use host name as peer identifier),
  - Tunnel Destination: 10.251.49.3 (select HOST from drop down menu if you want to use host name as peer identifier),
  - KeepAlive enable: no,
  - Period:(none),
  - Retries:(none),
  - Press ADD to put GRE tunnel rule into GRE table.
  - Press ***Save*** to accept the changes.

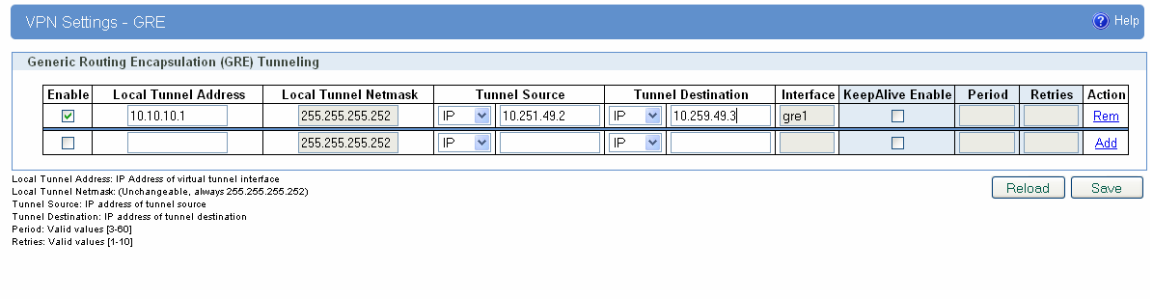


Figure 55 – GRE configuration page for GWR Router 1

- Click **Routing** on **Settings** Tab to configure GRE Route. Parameters for this example are:
  - Destination Network: 192.168.2.0,
  - Netmask: 255.255.255.0,
  - Interface: gre_x.

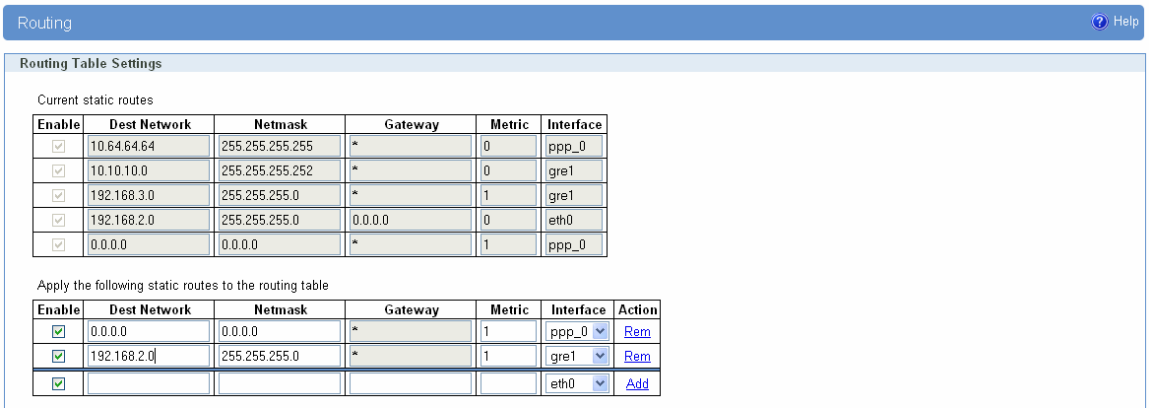


Figure 56 – Routing configuration page for GWR Router 1

- Optionally configure IP Filtering and TCP service port settings to block any unwanted incoming traffic.
- On the device connected on GWR router 1 setup default gateway 192.168.4.1

The GWR Router 2 configuration:

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP

settings. Configure IP address and Netmask.

- IP Address: 192.168.2.1,
- Subnet Mask: 255.255.255.0,
- Press ***Save*** to accept the changes.

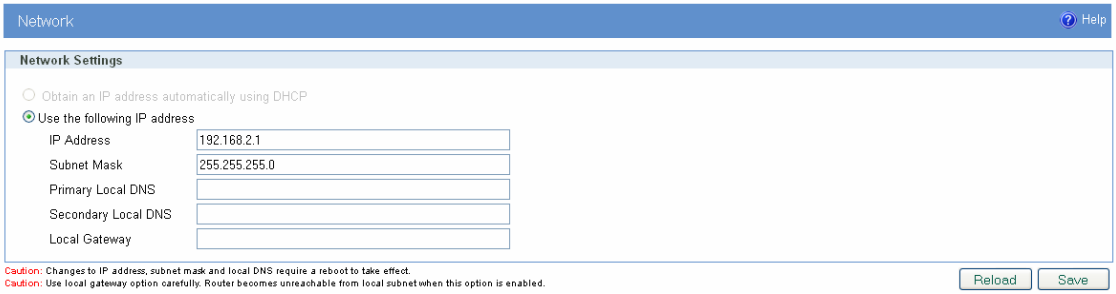


Figure 57 – Network configuration page for GWR Router 2

- Use SIM card with a static IP address, obtained from Mobile Operator. (Note the default gateway may show, or change to, an address such as 10.0.0.1; this is normal as it is the GSM/UMTS provider's network default gateway).
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > GRE*** to configure GRE tunnel parameters:
  - Enable: yes,
  - Local Tunnel Address: 10.10.10.2,
  - Local Tunnel Netmask: 255.255.255.252 (Unchangeable, always 255.255.255.252),
  - Tunnel Source: 10.251.49.3 (select HOST from drop down menu if you want to use host name as peer identifier),
  - Tunnel Destination: 10.251.49.2 (select HOST from drop down menu if you want to use host name as peer identifier),
  - KeepAlive enable: no,
  - Period:(none),
  - Retries:(none),
  - Press ADD to put GRE tunnel rule into GRE table,
  - Press ***Save*** to accept the changes.

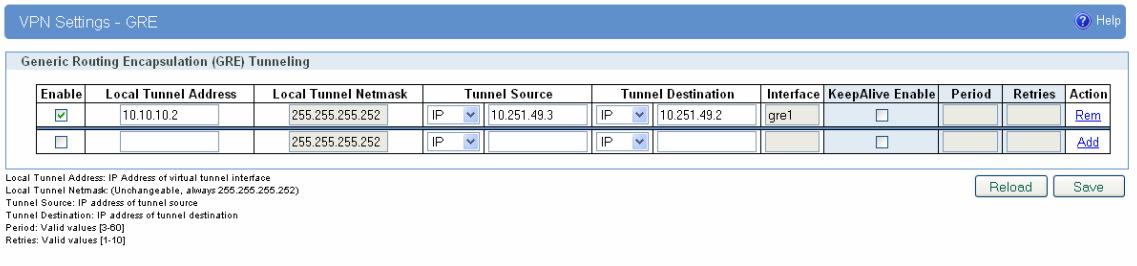


Figure 58 – GRE configuration page for GWR Router 2

- Configure GRE Route. Click ***Routing*** on ***Settings*** Tab. Parameters for this example are:
  - Destination Network: 192.168.4.0,
  - Netmask: 255.255.255.0.

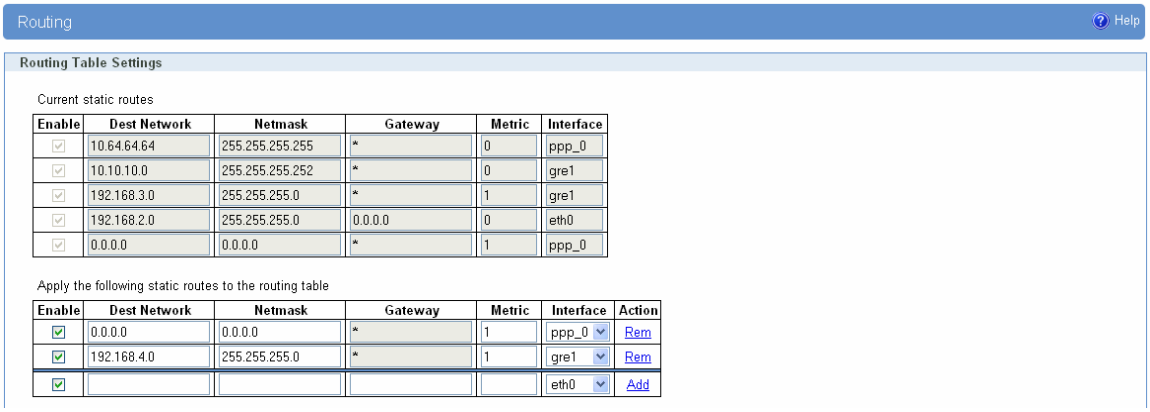


Figure 59 – Routing configuration page for GWR Router 2

- Optionally configure IP Filtering and TCP service port settings to block any unwanted incoming traffic.
- On the device connected on GWR router 2 setup default gateway 192.168.2.1.

GRE Tunnel configuration between GWR Router and third party router

GRE tunnel is a type of a VPN tunnels, but it isn't a secure tunneling method. However, you can encrypt GRE packets with an encryption protocol such as IPSec to form a secure VPN.

On the diagram below (*Figure 60*) is illustrated simple network with two sites. Idea is to create GRE tunnel for LAN to LAN (site to site) connectivity.

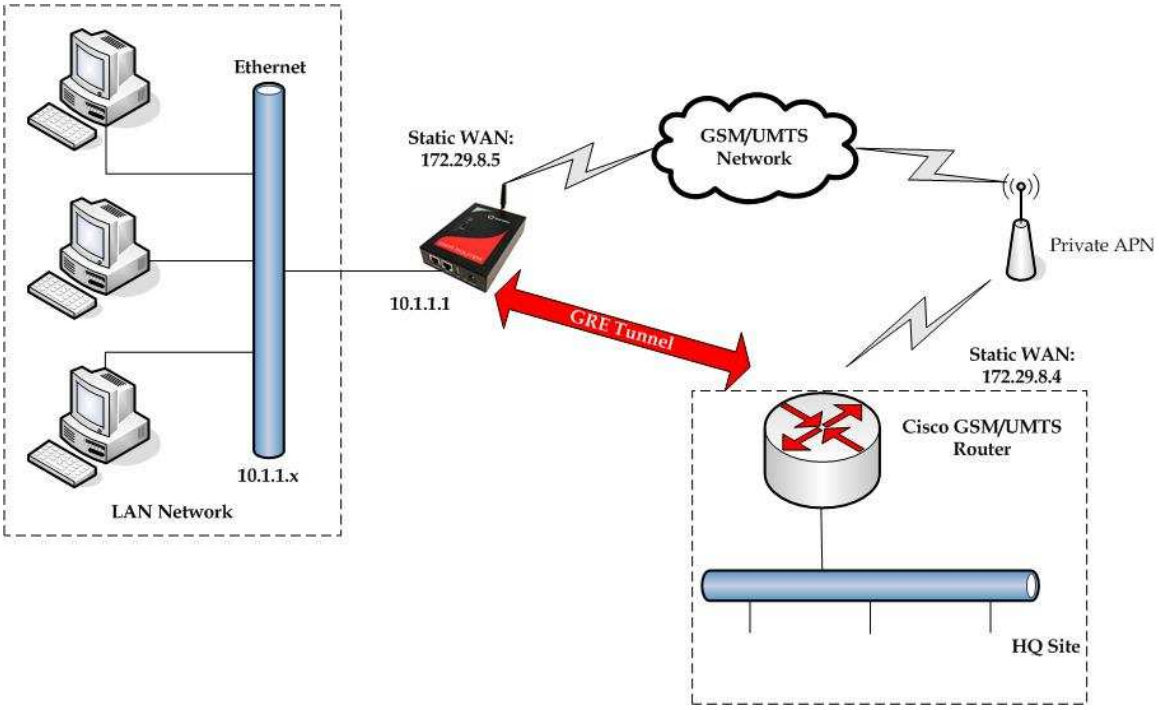


Figure 60 – GRE tunnel between Cisco router and GWR Router

GRE tunnel is created between Cisco router with GRE functionality on the HQ Site and the GWR Router on the Remote Network. In this example, it is necessary for both routers to create tunnel interface (virtual interface). This new tunnel interface is its own network. To each of the routers, it appears that it has two paths to the remote physical interface and the tunnel interface (running through the tunnel). This tunnel could then transmit unroutable traffic such as NetBIOS or AppleTalk.

The GWR Router uses Network Address Translation (NAT) where only the mobile IP address is visible to the outside. All outgoing traffic uses the GWR Router WAN/VPN mobile IP address. HQ Cisco router acts like gateway to remote network for user in corporate LAN. It also performs function of GRE server for termination of GRE tunnel. The GWR Router act like default gateway for Remote Network and GRE server for tunnel.

1. HQ router requirements:
   - HQ router require static IP WAN address,
   - Router or VPN appliance has to support GRE protocol,
   - Tunnel peer address will be the GWR Router WAN's mobile IP address. For this reason, a static mobile IP address is preferred on the GWR Router WAN (GPRS) side,
   - Remote Subnet is remote LAN network address and Remote Subnet Mask is subnet of remote LAN.

2. The GWR Router requirements:
   - Static IP WAN address,

- Peer Tunnel Address will be the HQ router WAN IP address (static IP address),
- Remote Subnet is HQ LAN IP address and Remote Subnet Mask is subnet mask of HQ LAN.

GSM/UMTS APN Type: For GSM/UMTS networks GWR Router connections may require a Custom APN. A Custom APN allows for various IP addressing options, particularly static IP addresses, which are needed for most VPN connections. A custom APN should also support mobile terminated data that may be required in most site–to–site VPNs.

Cisco router sample Configuration:

```
Interface FastEthernet 0/1
ip address 10.2.2.1 255.255.255.0
description LAN interface

interface FastEthernet 0/0
ip address 172.29.8.4 255.255.255.0
description WAN interface

interface Tunnel0
ip address 10.10.10.2 255.255.255.252
tunnel source FastEthernet0/0
tunnel destination 172.29.8.5

ip route 10.1.1.0 255.255.255.0 tunnel0
```

The GWR Router Sample Configuration:

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.
  - IP Address: 10.1.1.1,
  - Subnet Mask: 255.255.255.0,
  - Press ***Save*** to accept the changes.

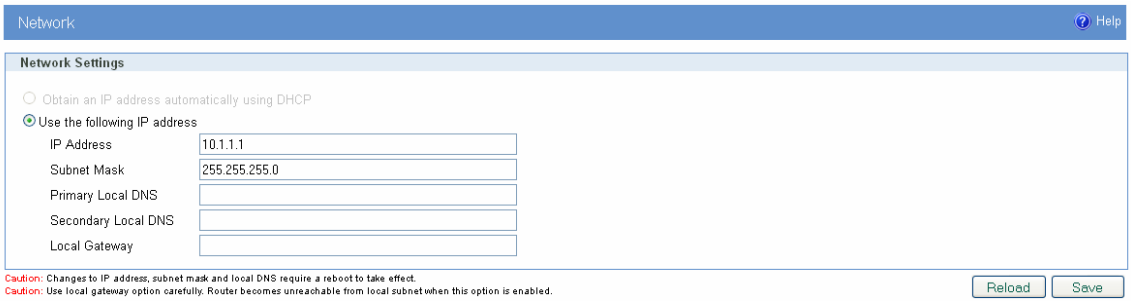


Figure 61 – Network configuration page

- Use SIM card with a dynamic/static IP address, obtained from Mobile Operator. (Note the default gateway may show, or change to, an address such as 10.0.0.1; this is normal as it is the GSM/UMTS provider's network default gateway).
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > GRE Tunneling*** to configure new VPN tunnel parameters:
  - Enable: yes,
  - Local Tunnel Address: 10.10.10.1,
  - Local Tunnel Netmask: 255.255.255.252 (Unchangeable, always 255.255.255.252),

- Tunnel Source: 172.29.8.5,
- Tunnel Destination: 172.29.8.4,
- KeepAlive enable: no,
- Period:(none),
- Retries:(none),
- Press ***ADD*** to put GRE tunnel rule into VPN table,
- Press ***Save*** to accept the changes.

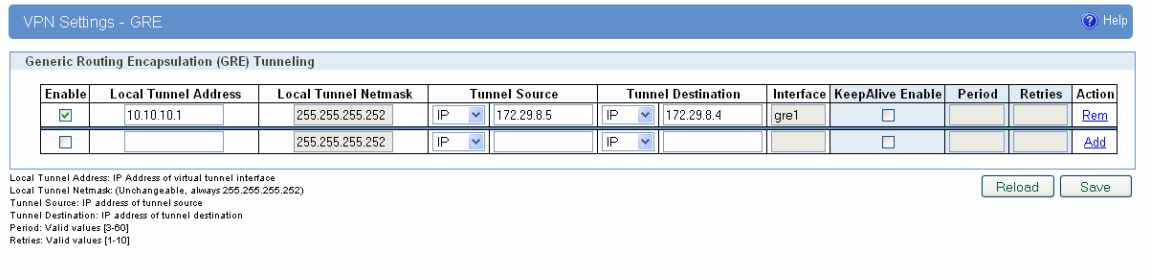


Figure 62 – GRE configuration page

- Configure GRE Route. Click ***Routing*** on ***Settings*** Tab. Parameters for this example are:
  - Destination Network: 10.2.2.0,
  - Netmask: 255.255.255.0.

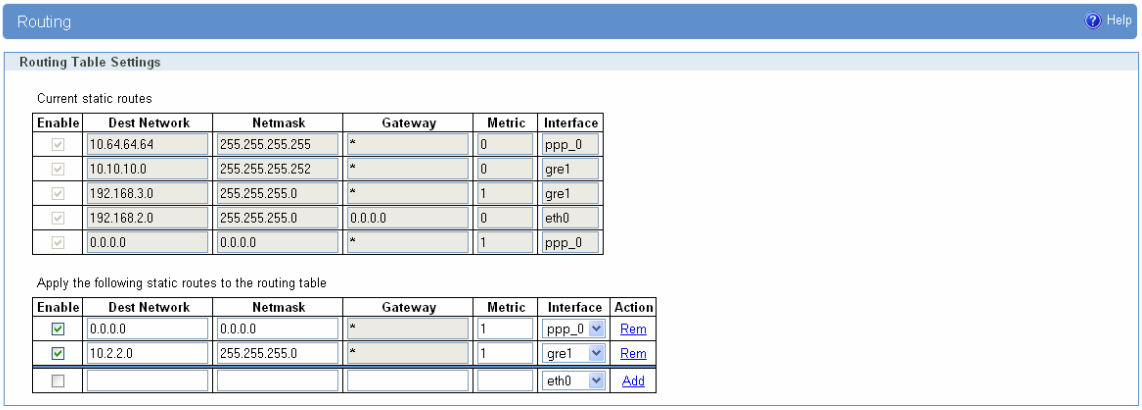


Figure 63 – Routing configuration page

- Optionally configure IP Filtering and TCP service port settings to block any unwanted incoming traffic.

User from remote LAN should be able to communicate with HQ LAN.

IPSec Tunnel configuration between two GWR Routers

IPSec tunnel is a type of a VPN tunnels with a secure tunneling method. Simple network with two GWR Routers is illustrated on the diagram below *Figure 64*. Idea is to create IPSec tunnel for LAN to LAN (site to site) connectivity.

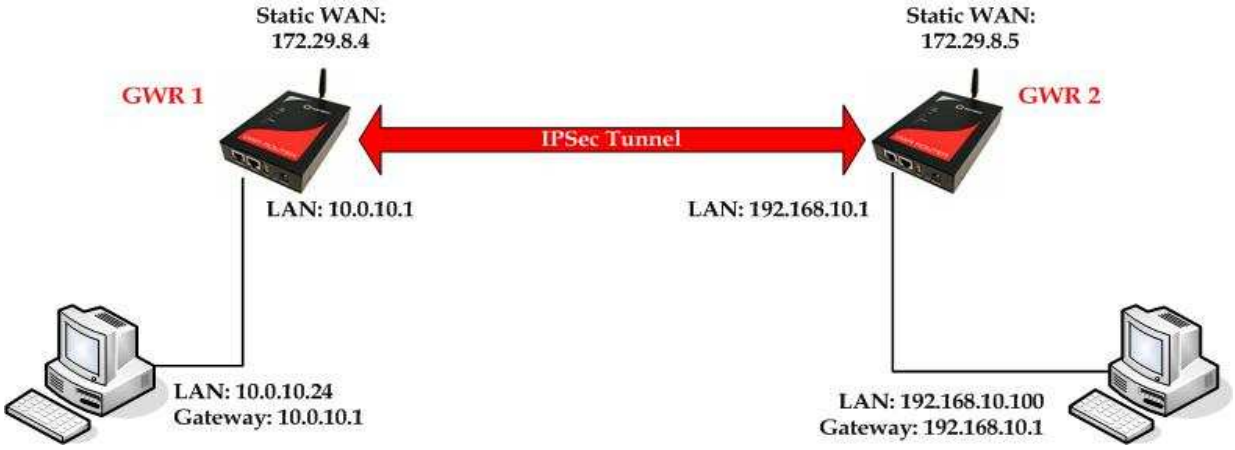


Figure 64 – IPSec tunnel between two GWR Routers

The GWR Routers requirements:

- Static IP WAN address for tunnel source and tunnel destination address,
- Dynamic IP WAN address must be mapped to hostname with DynDNS service (for synchronization with DynDNS server SIM card must have internet access),

GSM/UMTS APN Type: For GSM/UMTS networks GWR Router connections may require a Custom APN. A Custom APN allows for various IP addressing options, particularly static IP addresses, which are needed for most VPN connections. A custom APN should also support mobile terminated data that may be required in most site–to–site VPNs.

For the purpose of detailed explanation of IPSec tunnel configuration , two scenarios will be examined and network illustrated in the *Figure* 62 will be used for both scenarios.

Scenario #1

Router 1 and Router 2 , presented in the *Figure 64*, have firmware version that provides two modes of negotiation in IPSec tunnel configuration process:

- Aggressive,
- Main,

In this scenario, aggressive mode will be used. Configurations for Router 1 and Router 2 are listed below.
The GWR Router 1 configuration:

Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask:

- IP Address: 10.0.10.1,
- Subnet Mask: 255.255.255.0,
- Press ***Save*** to accept the changes.

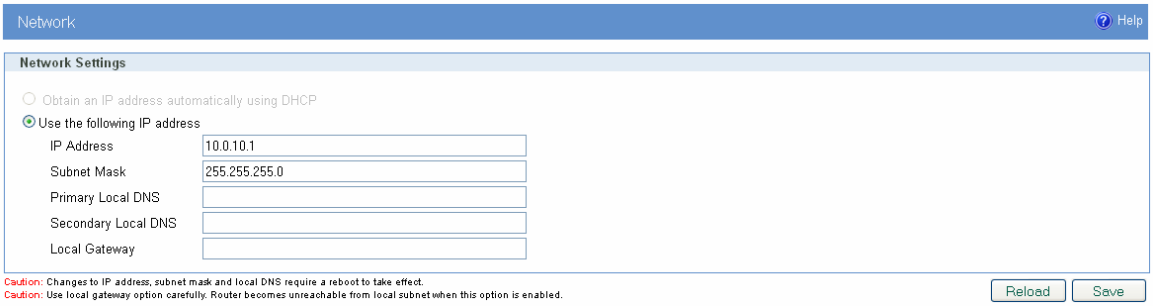


Figure 65 – Network configuration page for GWR Router 1

- Use SIM card with a static IP address, obtained from Mobile Operator.
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > IPSEC*** to configure IPSEC tunnel parameters. Click ***Add New Tunnel*** button to create new IPSec tunnel. Tunnel parameters are:
  - ***Add New Tunnel***
    - Tunnel Name: IPsec tunnel,
    - Enable: true,
  - ***Local Group Setup***
    - Local Security Gateway Type: SIM card,
    - Local ID Type: IP Address,
    - IP Address From: SIM 1 (WAN connection is established over SIM 1),
    - Local Security Group Type: Subnet,
    - IP Address: 10.0.10.0,
    - Subnet Mask: 255.255.255.0.
  - ***Remote Group Setup***
    - Remote Security Gateway Type: IP Only,
    - IP Address: 172.29.8.5,
    - Remote ID Type: IP Address,
    - Remote Security Group Type: IP,
    - IP Address: 192.168.10.1.

- *IPSec Setup*
  - Key Exchange Mode: IKE with Preshared key,
  - Mode: aggressive,
  - Phase 1 DH group: Group 2,
  - Phase 1 Encryption: 3DES,
  - Phase 1 Authentication: MD5,
  - Phase 1 SA Life Time: 28800,
  - Perfect Forward Secrecy: true,
  - Phase 2 DH group: Group 2,
  - Phase 2 Encryption: 3DES,
  - Phase 2 Authentication: MD5,
  - Phase 2 SA Life Time: 3600,
  - Preshared Key: 1234567890.
- *Failover*
  - Enable Tunnel Failover: false,
- *Advanced*
  - Compress(Support IP Payload Compression Protocol(IPComp)): false,
  - Dead Peer Detection(DPD): false,
  - NAT Traversal: true,
  - Send Initial Contact: true.

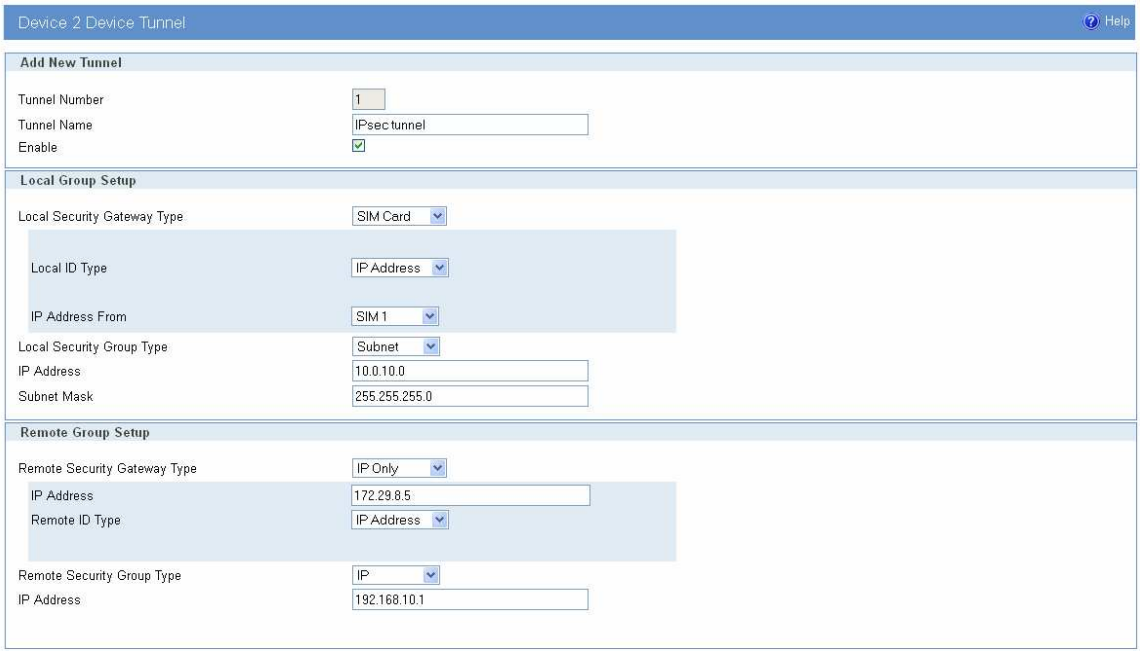


Figure 66 – IPSEC configuration page I for GWR Router 1

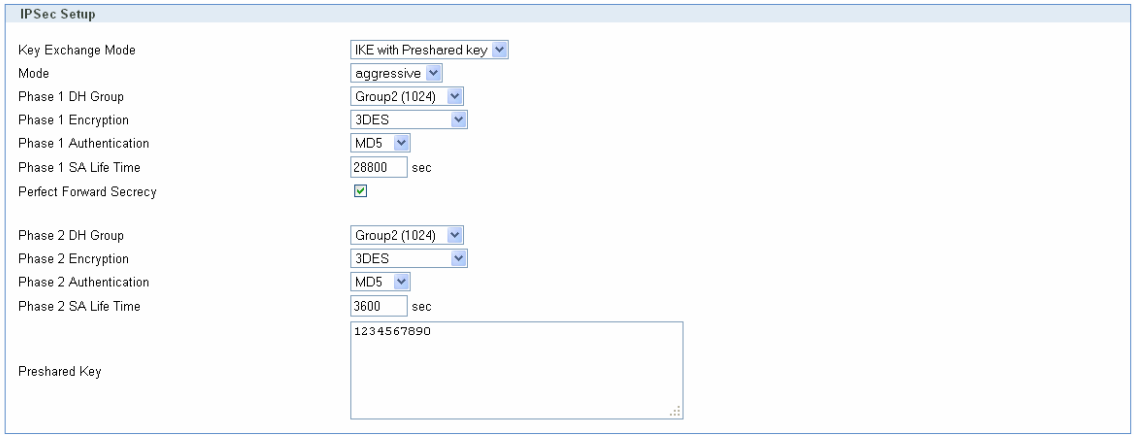


Figure 67 – IPSec configuration page II for GWR Router 1

NOTE : Options NAT Traversal and Send Initial Contact are predefined

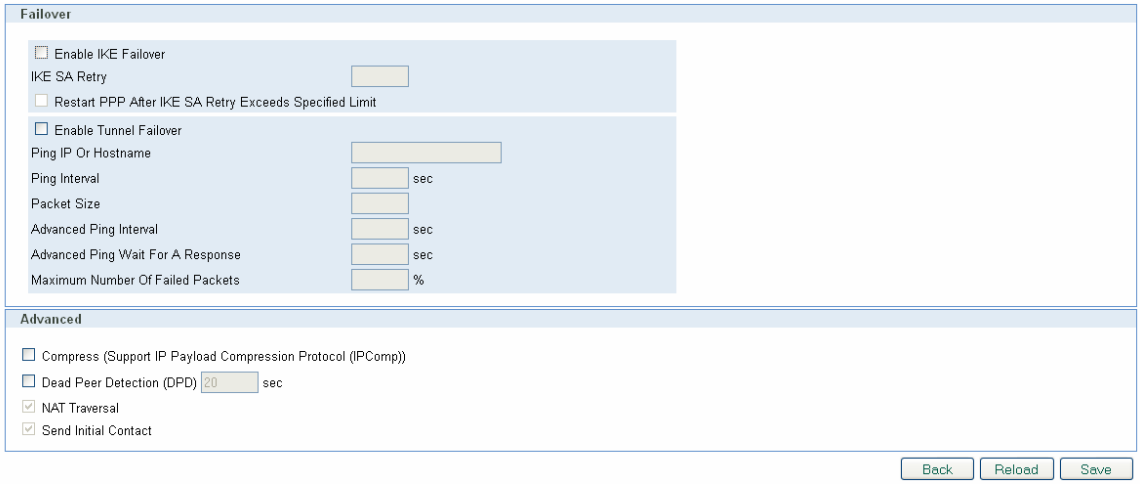


Figure 68 – IPSec configuration page III for GWR Router 1

Click ***Start*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel.

NOTE: Firmware version used in this scenario also provides options for Connection mode of IPSec tunnel.

If connection mode Connect is selected that indicates side of IPSec tunnel which sends requests for establishing of the IPSec tunnel.

If connection mode Wait is selected that indicates side of IPSec tunnel which listens and responses to IPSec establishing requests from Connect side.

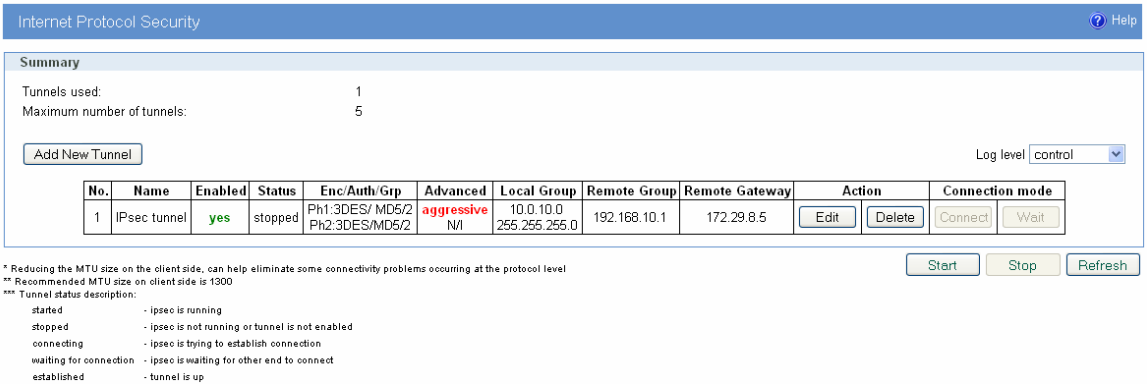


Figure 69 – IPSec start/stop page for GWR Router 1

Click **Start** button and after that **Connect** button on **Internet Protocol Security** page to initiate IPSEC tunnel

- On the device connected on GWR router 1 setup default gateway 10.0.10.1

The GWR Router 2 configuration:

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.
  - IP Address: 192.168.10.1,
  - Subnet Mask: 255.255.255.0,

  Press ***Save*** to accept the changes.

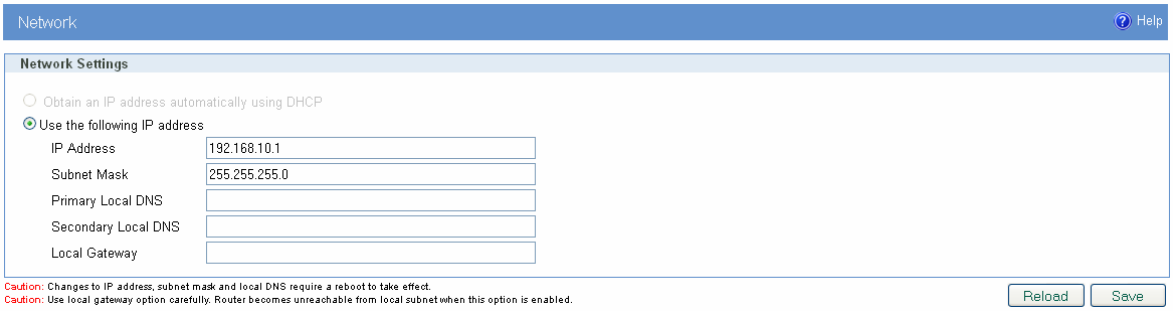


Figure 70 – Network configuration page for GWR Router 2

- Use SIM card with a static IP address, obtained from Mobile Operator.
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > IPSEC*** to configure IPSEC tunnel parameters. Click ***Add New Tunnel*** button to create new IPSec tunnel. Tunnel parameters are:
  - ***Add New Tunnel***
    - Tunnel Name: IPsec tunnel,
    - Enable: true.
  - ***Local Group Setup***
    - Local Security Gateway Type: SIM card,
    - Local ID Type: IP Address,
    - IP Address From: SIM 1 (WAN connection is established over SIM 1),
    - Local Security Group Type: IP,
    - IP Address: 192.168.10.1.
  - ***Remote Group Setup***
    - Remote Security Gateway Type: IP Only,
    - IP Address: 172.29.8.4,
    - Remote ID Type: IP Address,
    - Remote Security Group Type: Subnet,
    - IP Address: 10.0.10.0,
    - Subnet: 255.255.255.0.
  - ***IPSec Setup***
    - Keying Mode: IKE with Preshared key,
    - Mode: aggressive,
    - Phase 1 DH group: Group 2,
    - Phase 1 Encryption: 3DES,
    - Phase 1 Authentication: MD5,
    - Phase 1 SA Life Time: 28800,

- Perfect Forward Secrecy: true,
- Phase 2 DH group: Group 2,
- Phase 2 Encryption: 3DES,
- Phase 2 Authentication: MD5,
- Phase 2 SA Life Time: 3600,
- Preshared Key: 1234567890.

- ***Failover***
  - Enable Tunnel Failover: false.
- ***Advanced***
  - Compress(Support IP Payload Compression Protocol(IPComp)): false,
  - Dead Peer Detection(DPD): false,
  - NAT Traversal: true,
  - Send Initial Contact: true,

  Press ***Save*** to accept the changes.

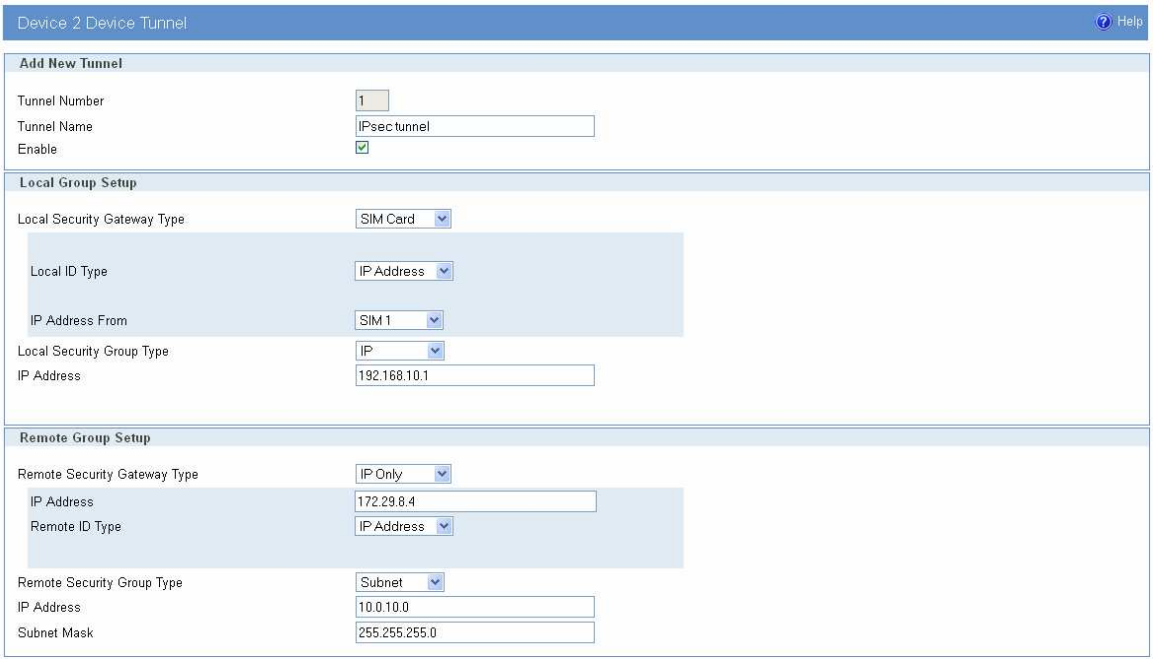


Figure 71 – IPSEC configuration page I for GWR Router 2

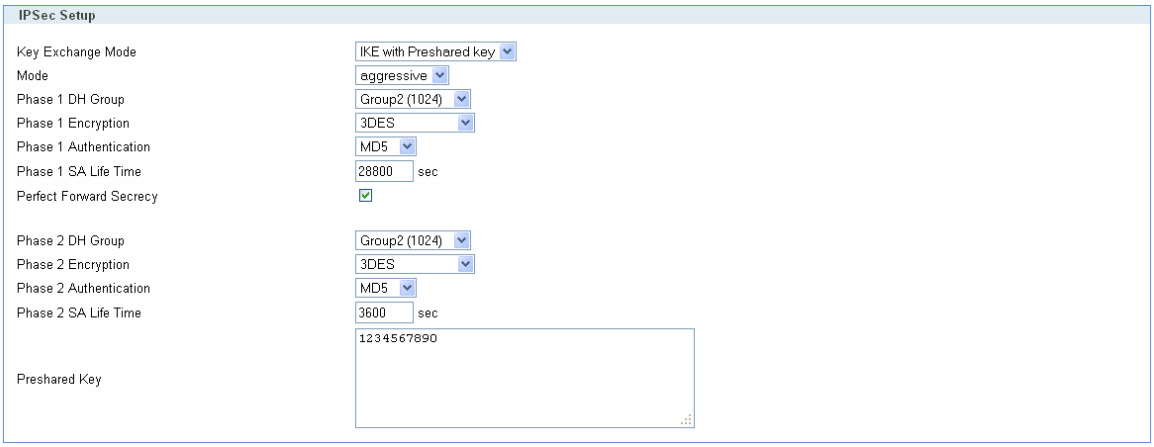


Figure 72 – IPSec configuration page II for GWR Router 2

NOTE : Options NAT Traversal and Send Initial Contact are predefined.

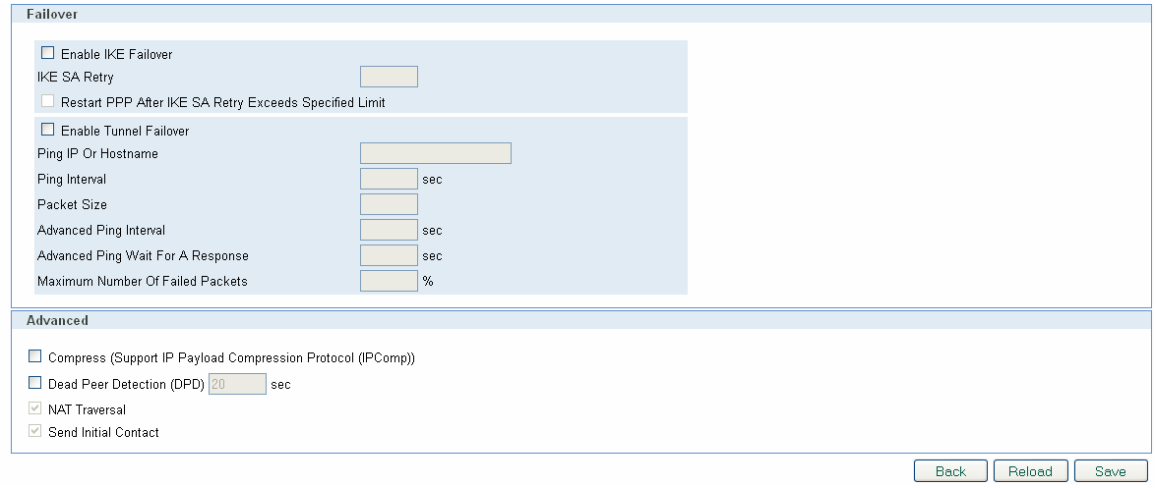


Figure 73 – IPSec configuration page III for GWR Router 2

Click ***Start*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel.

NOTE: Firmware version used in this scenario also provides options for Connection mode of IPSec tunnel. If connection mode Connect is selected that indicates side of IPSec tunnel which sends requests for establishing of the IPSec tunnel.

If connection mode Wait is selected that indicates side of IPSec tunnel which listens and responses to IPSec establishing requests from Connect side.

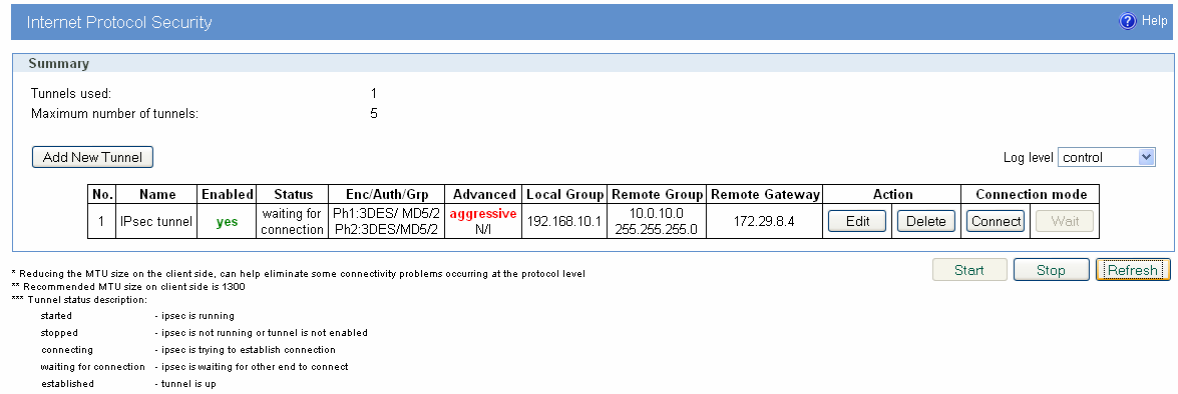


Figure 74 – IPSec start/stop page for GWR Router 2

Click ***Start*** button and after that ***Wait*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel.

- On the device connected on GWR router 2 setup default gateway 192.168.10.1.

Scenario #2

Router 1 and Router 2, presented in the *Figure 64*, are configured with IPSec tunnel in Main mode. Configurations for Router 1 and Router 2 are listed below.

The GWR Router 1 configuration:
Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask:

- IP Address: 10.0.10.1
- Subnet Mask: 255.255.255.0
- Press ***Save*** to accept the changes.

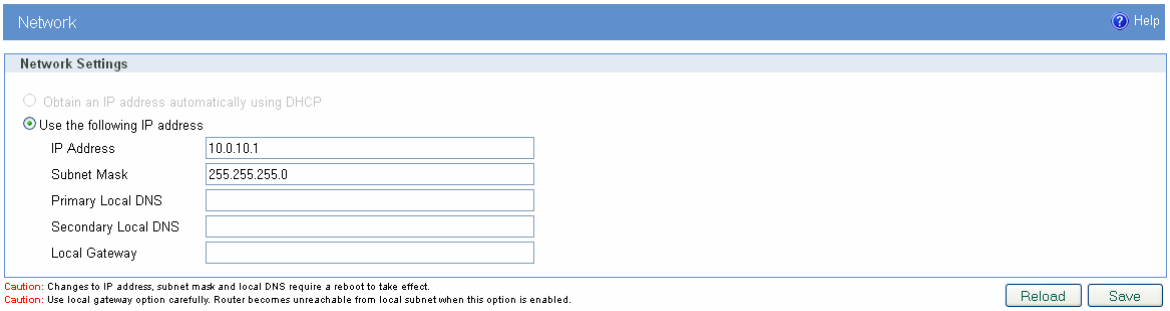


Figure 75 – Network configuration page for GWR Router 1

- Use SIM card with a static IP address, obtained from Mobile Operator.
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > IPSEC*** to configure IPSEC tunnel parameters. Click ***Add New Tunnel*** button to create new IPSec tunnel. Tunnel parameters are:
  - ***Add New Tunnel***
    - Tunnel Name: IPsec tunnel,
    - Enable: true.
  - ***IPSec Setup***
    - Keying Mode: IKE with Preshared key,
    - Mode: main
    - Phase 1 DH group: Group 2,
    - Phase 1 Encryption: 3DES,
    - Phase 1 Authentication: MD5,
    - Phase 1 SA Life Time: 28800,
    - Perfect Forward Secrecy: true,
    - Phase 2 DH group: Group 2,
    - Phase 2 Encryption: 3DES,
    - Phase 2 Authentication: MD5,
    - Phase 2 SA Life Time: 3600,
    - Preshared Key: 1234567890.
  - ***Local Group Setup***
    - Local Security Gateway Type: SIM card,
    - Local ID Type: IP Address
    - IP Address From: SIM 1 (WAN connection is established over SIM 1),

- Local Security Group Type: Subnet,
- IP Address: 10.0.10.0,
- Subnet Mask: 255.255.255.0.

- ***Remote Group Setup***
  - Remote Security Gateway Type: IP Only,
  - IP Address: 172.29.8.5,
  - Remote ID Type: IP Address
  - Remote Security Group Type: IP,
  - IP Address: 192.168.10.1.
- ***Failover***
  - Eanble IKE failover: false,
  - Enable Tunnel Failover: false.
- ***Advanced***
  - Compress(Support IP Payload Compression Protocol(IPComp)): false,
  - Dead Peer Detection(DPD): false,
  - NAT Traversal: true,
  - Send Initial Contact: true.

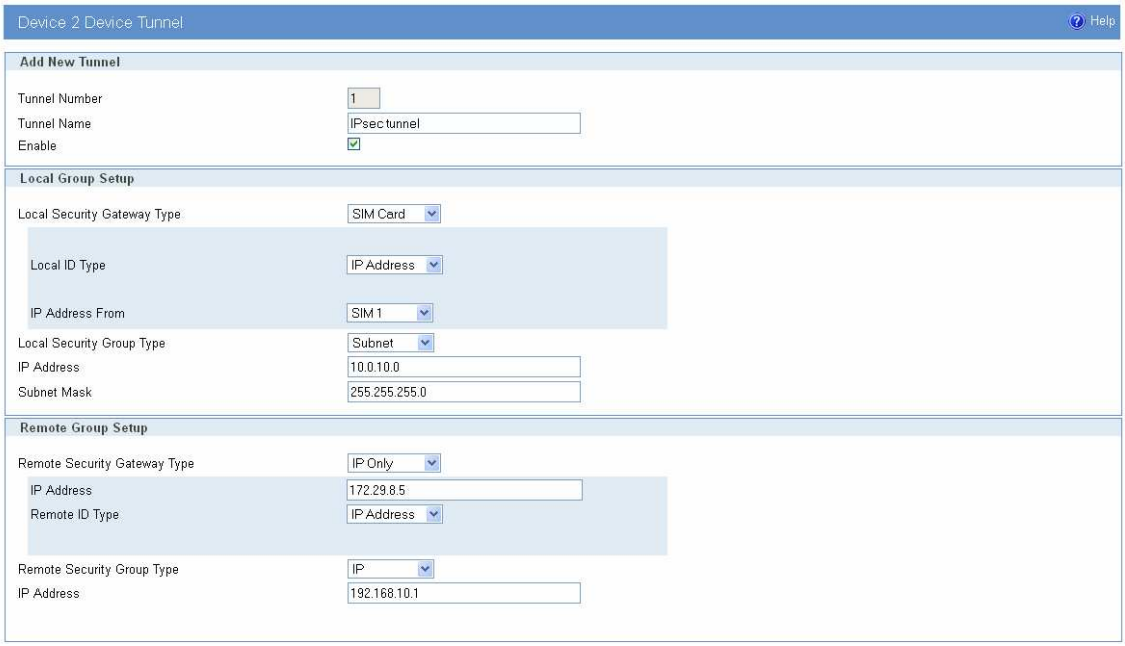


Figure 76 – IPSEC configuration page I for GWR Router 1

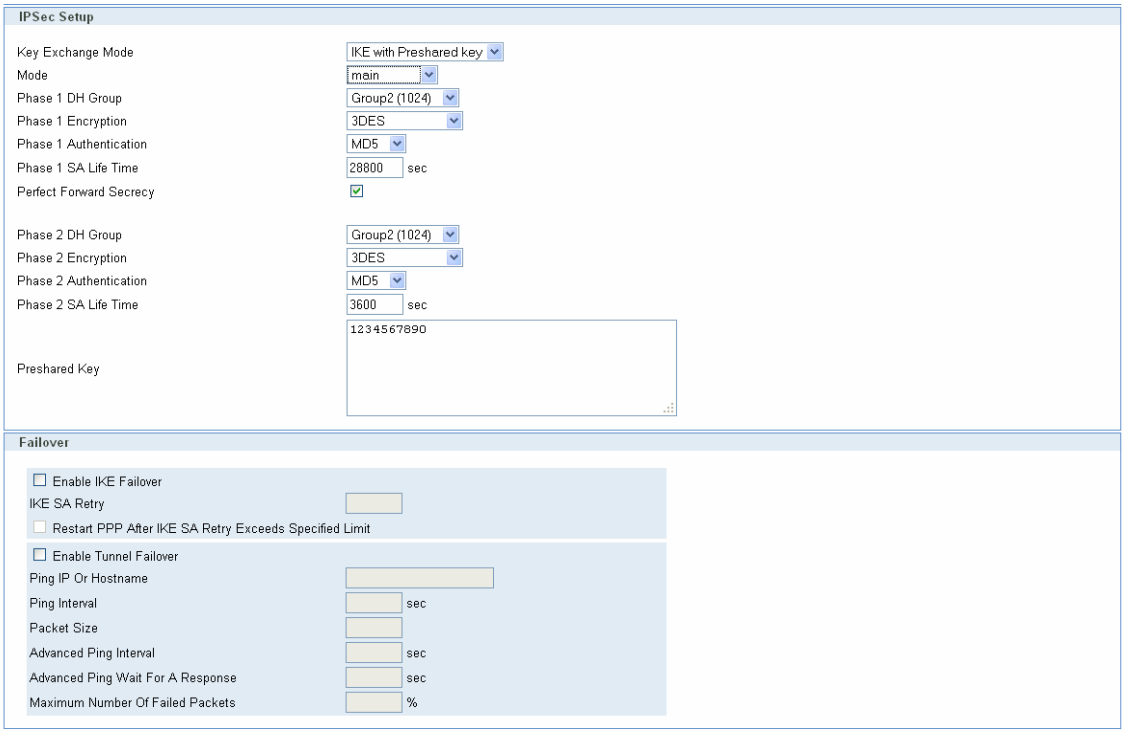


Figure 77 – IPSEC configuration page II for GWR Router 1

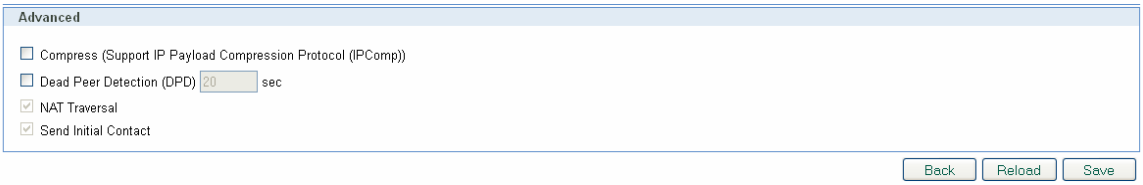


Figure 78 – IPSEC configuration page III for GWR Router 1

NOTE: Firmware version used in this scenario also provides options for Connection mode of IPSec tunnel.
If connection mode Connect is selected that indicates side of IPSec tunnel which sends requests for establishing of the IPSec tunnel.
If connection mode Wait is selected that indicates side of IPSec tunnel which listens and responses to IPSec establishing requests from Connect side.

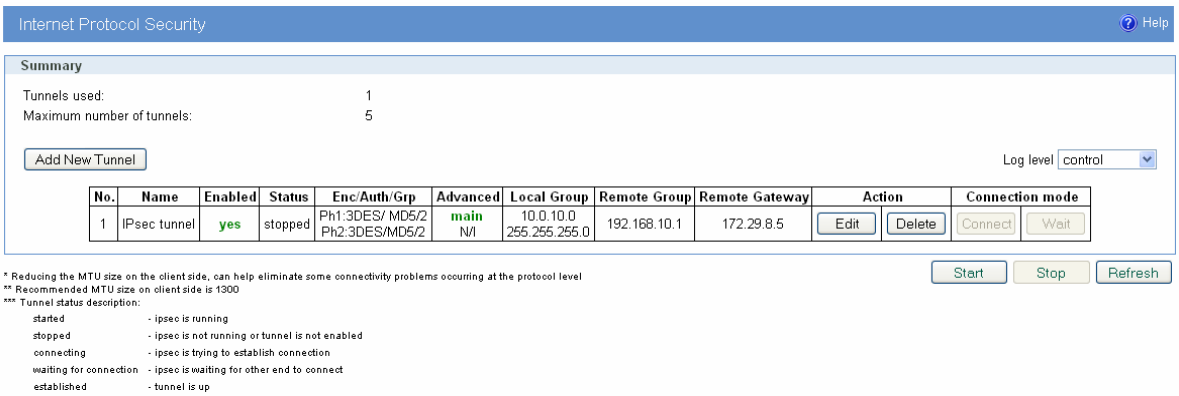


Figure 79 – IPSec start/stop page for GWR Router 1

Click ***Start*** button and after that ***Connect*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel

- On the device connected on GWR router 1 setup default gateway 10.0.10.1.

The GWR Router 2 configuration:

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.
  - IP Address: 192.168.10.1,
  - Subnet Mask: 255.255.255.0.

  Press ***Save*** to accept the changes.

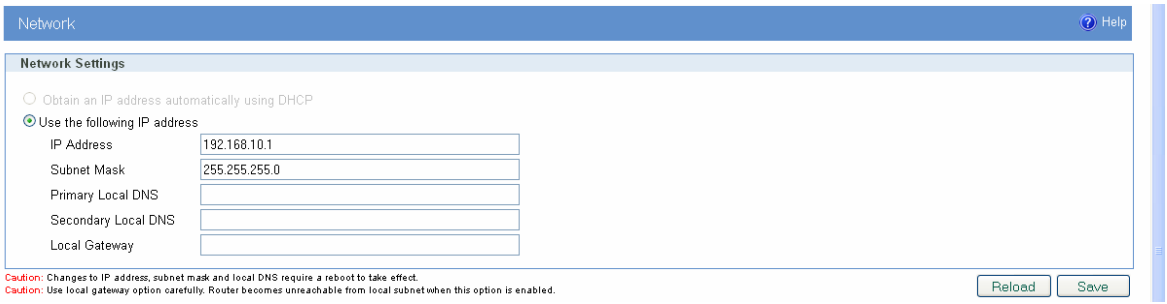


Figure 80 – Network configuration page for GWR Router 2

- Use SIM card with a static IP address, obtained from Mobile Operator.
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > IPSEC*** to configure IPSEC tunnel parameters. Click ***Add New Tunnel*** button to create new IPSec tunnel. Tunnel parameters are:
  - ***Add New Tunnel***
    - Tunnel Name: IPsec tunnel,
    - Enable: true.
  - ***IPSec Setup***
    - Keying Mode: IKE with Preshared key,
    - Mode: main,
    - Phase 1 DH group: Group 2,
    - Phase 1 Encryption: 3DES,
    - Phase 1 Authentication: MD5,
    - Phase 1 SA Life Time: 28800,
    - Perfect Forward Secrecy: true,
    - Phase 2 DH group: Group 2,
    - Phase 2 Encryption: 3DES,
    - Phase 2 Authentication: MD5,
    - Phase 2 SA Life Time: 3600,
    - Preshared Key: 1234567890.
  - ***Local Group Setup***
    - Local Security Gateway Type: SIM card,
    - Local ID Type: IP Address,
    - IP Address From: SIM 1 (WAN connection is established over SIM 1),
    - Local Security Group Type: IP,
    - IP Address: 192.168.10.1.
  - ***Remote Group Setup***
    - Remote Security Gateway Type: IP Only,
    - IP Address: 172.29.8.4,

- Remote ID Type: IP Address,
- Remote Security Group Type: Subnet,
- IP Address: 10.0.10.0,
- Subnet: 255.255.255.0.

- ***Failover***
  - Enable IKE failover: false,
  - Enable Tunnel Failover: false.
- ***Advanced***
  - Compress(Support IP Payload Compression Protocol(IPComp)): false,
  - Dead Peer Detection(DPD): false,
  - NAT Traversal: true,
  - Send Initial Contact: true.

  Press ***Save*** to accept the changes.

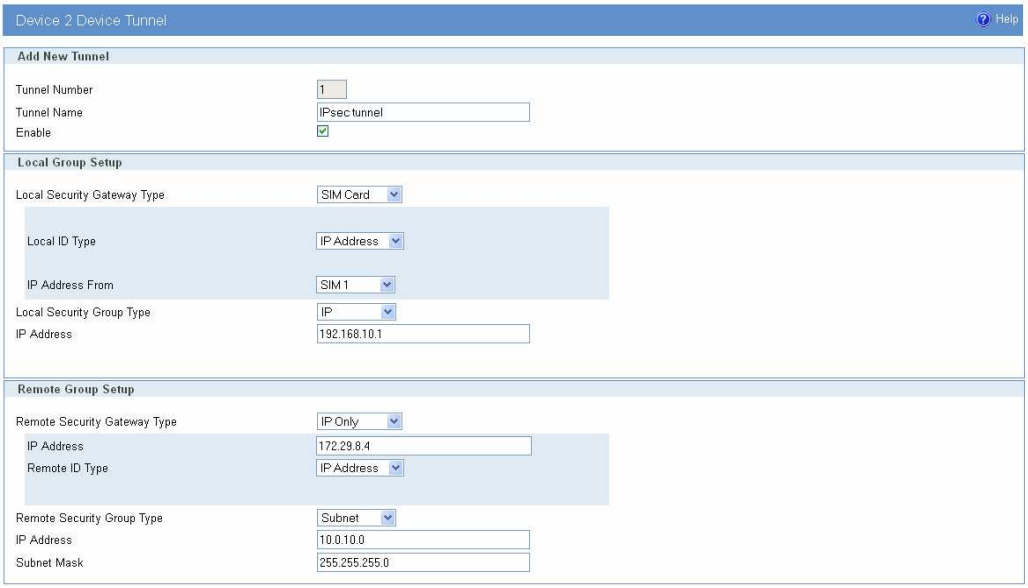


Figure 81 – IPSEC configuration page I for GWR Router 2

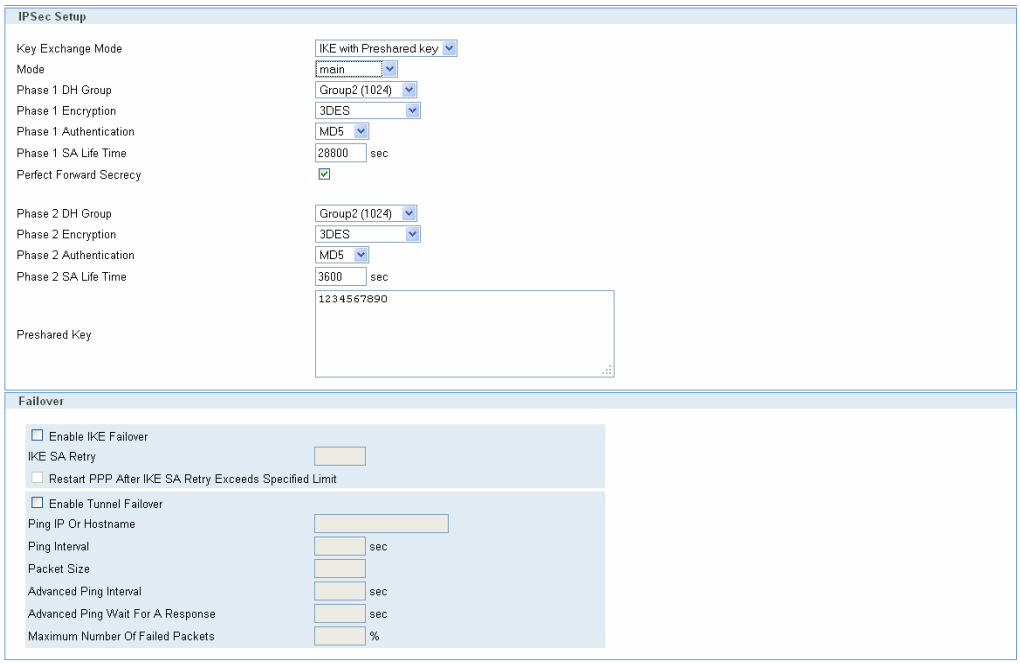


Figure 82 – IPSEC configuration page II for GWR Router 2

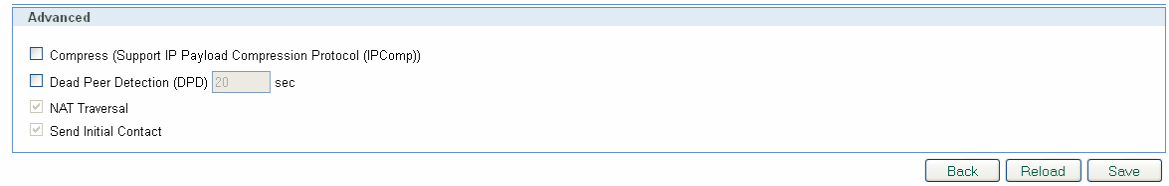


Figure 83 – IPSEC configuration page III for GWR Router 2

NOTE: Firmware version used in this scenario also provides options for Connection mode of IPSec tunnel.
If connection mode Connect is selected that indicates side of IPSec tunnel which sends requests for establishing of the IPSec tunnel.
If connection mode Wait is selected that indicates side of IPSec tunnel which listens and responses to IPSec establishing requests from Connect side.

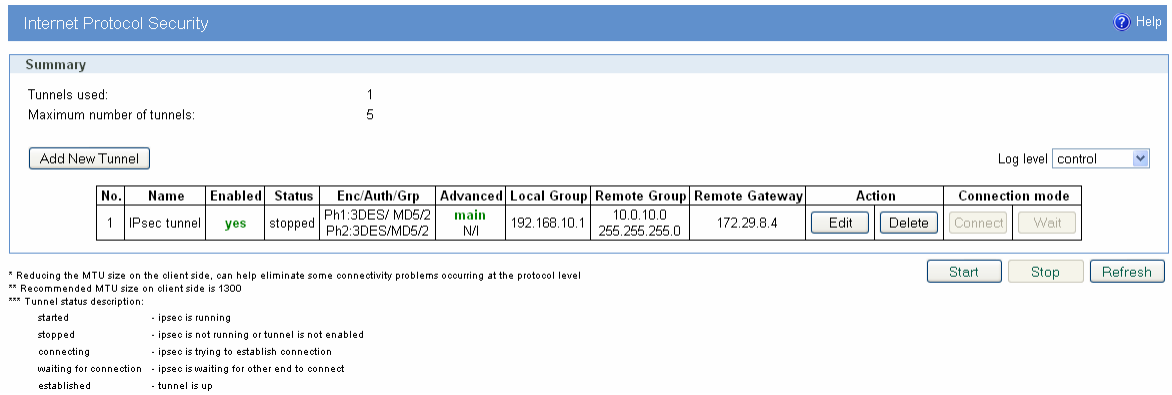


Figure 84 – IPSec start/stop page for GWR Router 1

Click ***Start*** button and after that ***Wait*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel.

- On the device connected on GWR router 2 setup default gateway 192.168.10.1.

IPSec Tunnel configuration between GWR Router and Cisco Router

IPSec tunnel is a type of a VPN tunnels with a secure tunneling method. On the diagram below **Error! Reference source not found.** is illustrated simple network with GWR Router and Cisco Router. Idea is to create IPSec tunnel for LAN to LAN (site to site) connectivity.

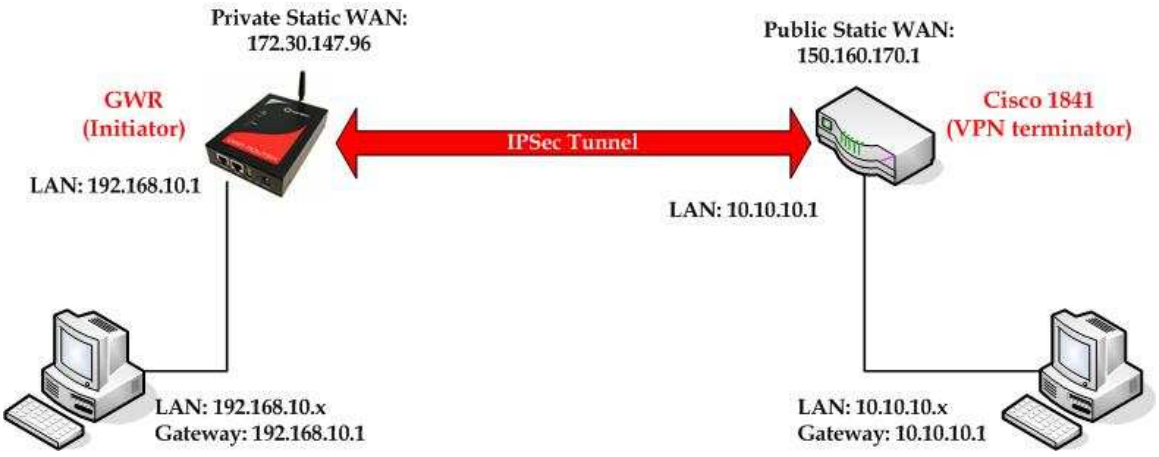


Figure 85 – IPSec tunnel between GWR Router and Cisco Router

The GWR Routers requirements:

- Static IP WAN address for tunnel source and tunnel destination address,
- Dynamic IP WAN address must be mapped to hostname with DynDNS service (for synchronization with DynDNS server SIM card must have internet access).

GSM/UMTS APN Type: For GSM/UMTS networks GWR Router connections may require a Custom APN. A Custom APN allows for various IP addressing options, particularly static IP addresses, which are needed for most VPN connections. A custom APN should also support mobile terminated data that may be required in most site–to–site VPNs.

The GWR Router configuration:

- Click ***Network*** Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.
  - IP Address: 192.168.10.1,
  - Subnet Mask: 255.255.255.0.

  Press ***Save*** to accept the changes.

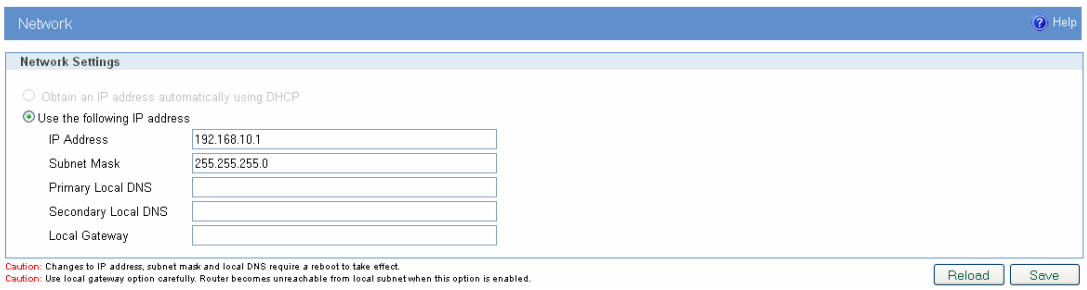


Figure 86 – Network configuration page for GWR Router

- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > IPSEC*** to configure IPSEC tunnel parameters. Click ***Add New Tunnel*** button to create new IPSec tunnel. Tunnel parameters are:
    - ***Add New Tunnel***
        - Tunnel Name: IPsec tunnel,
        - Enable: true.
    - ***Local Group Setup***
        - Local Security Gateway Type: SIM card,
        - Local ID Type: IP Address,
        - IP Address From: SIM 1 (WAN connection is established over SIM 1),
        - Local Security Group Type: Subnet,
        - IP Address: 192.168.10.0,
        - Subnet Mask: 255.255.255.0.
    - ***Remote Group Setup***
        - Remote Security Gateway Type: IP Only,
        - IP Address: 150.160.170.1,
        - Remote ID Type: IP Address,
        - Remote Security Group Type: Subnet,
        - IP Address: 10.10.10.0,
        - Subnet Mask: 255.255.255.0.
    - ***IPSec Setup***
        - Keying Mode: IKE with Preshared key,
        - Mode: aggressive,
        - Phase 1 DH group: Group 2,
        - Phase 1 Encryption: 3DES,
        - Phase 1 Authentication: SHA1,
        - Phase 1 SA Life Time: 28800,
        - Phase 2 Encryption: 3DES,
        - Phase 2 Authentication: SHA1,
        - Phase 2 SA Life Time: 3600,
        - Preshared Key: 1234567890.
    - ***Failover***
        - Enable Tunnel Failover: false.
    - ***Advanced***
        - Compress(Support IP Payload Compression Protocol(IPComp)): false,
        - Dead Peer Detection(DPD): false,
        - NAT Traversal: true,
        - Send Initial Contact Notification: true.

      Press ***Save*** to accept the changes.

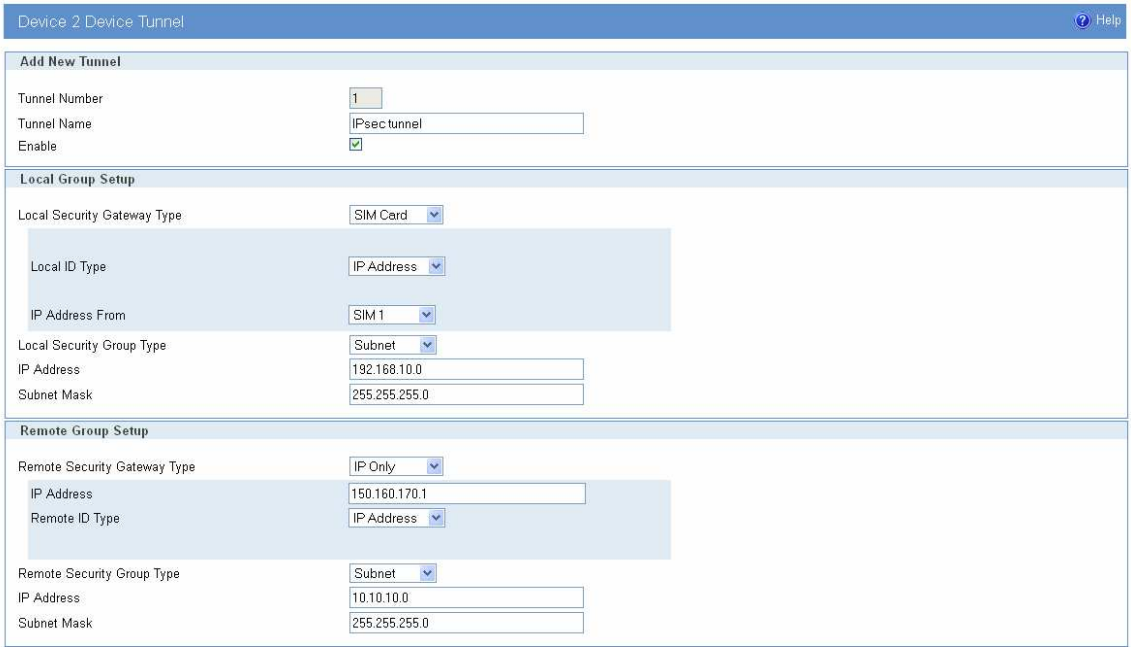


Figure 87 – IPSEC configuration page I for GWR Router

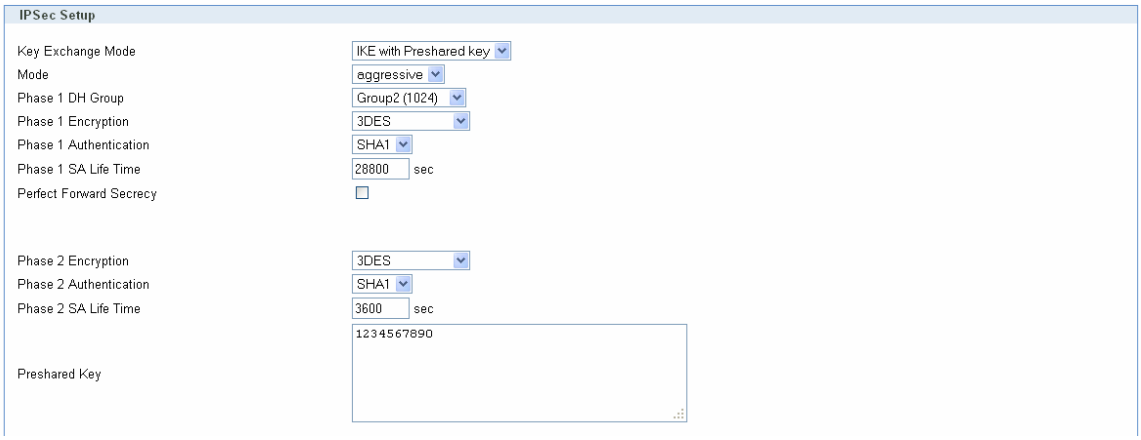


Figure 88 – IPSec configuration page II for GWR Router

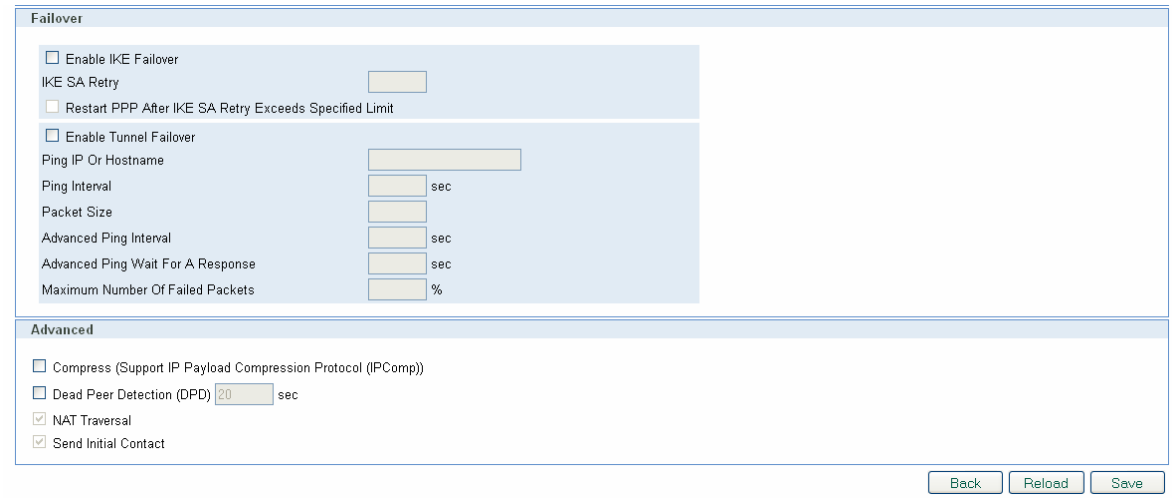


Figure 89 – IPSec configuration page III for GWR Router

- Click ***Start*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel.

Click ***Start*** button and after that ***Connect*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel

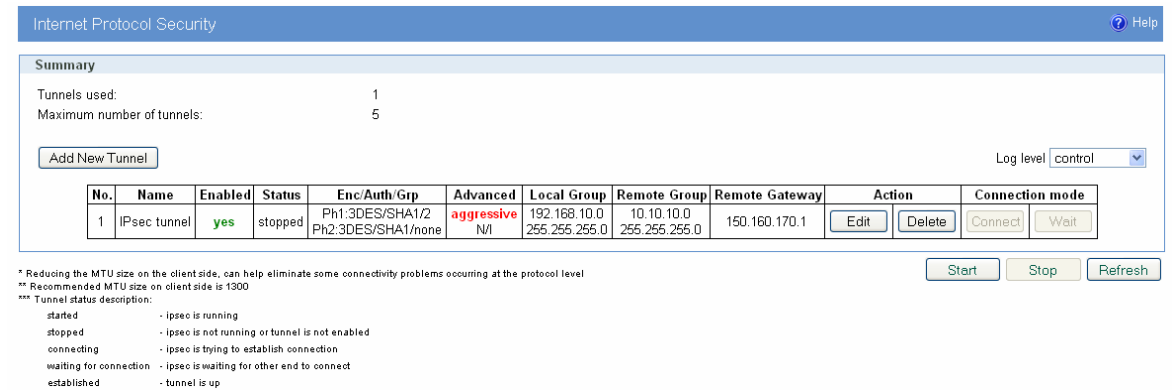


Figure 90 – IPSec start/stop page for GWR Router

- On the device connected on GWR router setup default gateway 192.168.10.1.

The Cisco Router configuration:

```
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Cisco-Router
!
boot-start-marker
boot-end-marker
!
username admin password 7 ****************
!
enable secret 5 ********************
!
no aaa new-model
!
no ip domain lookup
!
!--- Keyring that defines wildcard pre-shared key.
!
crypto keyring remote
    pre-shared-key address 0.0.0.0  0.0.0.0   key  1234567890
```

```
!
!--- ISAKMP policy
!
crypto isakmp policy 10
  encr 3des
  authentication pre-share
  group 2
  lifetime 28800
!
!--- Profile for LAN-to-LAN connection, that references
!--- the wildcard pre-shared key and a wildcard identity
!
crypto isakmp profile L2L
   description LAN to LAN  vpn connection
   keyring remote
   match identity address 0.0.0.0
!
!
crypto ipsec transform-set  testGWR  esp-3des esp-sha-hmac
!
!--- Instances of the dynamic crypto map
!--- reference previous IPsec profile.
!
crypto dynamic-map dynGWR 5
 set transform-set testGWR
 set isakmp-profile L2L
 match address 121
!
!--- Crypto-map only references instances of the previous dynamic crypto map.
!
crypto map GWR 10 ipsec-isakmp dynamic dynGWR
!
interface FastEthernet0/0
 description WAN INTERFACE
 ip address 150.160.170.1 255.255.255.252
 ip nat outside
no ip route-cache
 no ip mroute-cache
duplex auto
speed auto
 crypto map GWR
!
interface FastEthernet0/1
 description LAN INTERFACE
 ip address 10.10.10.1 255.255.255.0
 ip nat inside
no ip route-cache
 no ip mroute-cache
 duplex auto
 speed auto
!
ip route 0.0.0.0 0.0.0.0  150.160.170.2
!
ip http server
no ip http secure-server
ip nat inside source list nat_list interface FastEthernet0/0 overload
!

ip access-list extended nat_list
 deny   ip 10.10.10.0  0.0.0.255  192.168.10.0  0.0.0.255
 permit ip 10.10.10.0  0.0.0.255  any
ip access-list extended 121 permit ip 10.10.10.0 0.0.0.255 192.168.10.0 0.0.0.255
!
access-list 23 permit any
!
line con 0
line aux 0
line vty 0 4
 access-class 23 in
 privilege level 15
 login local
 transport input telnet ssh
line vty 5 15
 access-class 23 in
 privilege level 15
 login local
```

```
 transport input telnet ssh
!
end
```

Use this section to confirm that your configuration works properly. Debug commands that run on the Cisco router can confirm that the correct parameters are matched for the remote connections.

- **show ip interface**—Displays the IP address assignment to the spoke router.
- **show crypto isakmp sa detail**—Displays the IKE SAs, which have been set–up between the IPsec initiators.
- **show crypto ipsec sa**—Displays the IPsec SAs, which have been set–up between the IPsec initiators.
- **debug crypto isakmp**—Displays messages about Internet Key Exchange (IKE) events.
- **debug crypto ipsec**—Displays IPsec events.
- **debug crypto engine**—Displays crypto engine events.

IPSec Tunnel configuration between GWR Router and Juniper SSG firewall

IPSec tunnel is a type of a VPN tunnels with a secure tunneling method. On the diagram below *Figure 87* is illustrated simple network with GWR Router and Cisco Router. Idea is to create IPSec tunnel for LAN to LAN (site to site) connectivity.

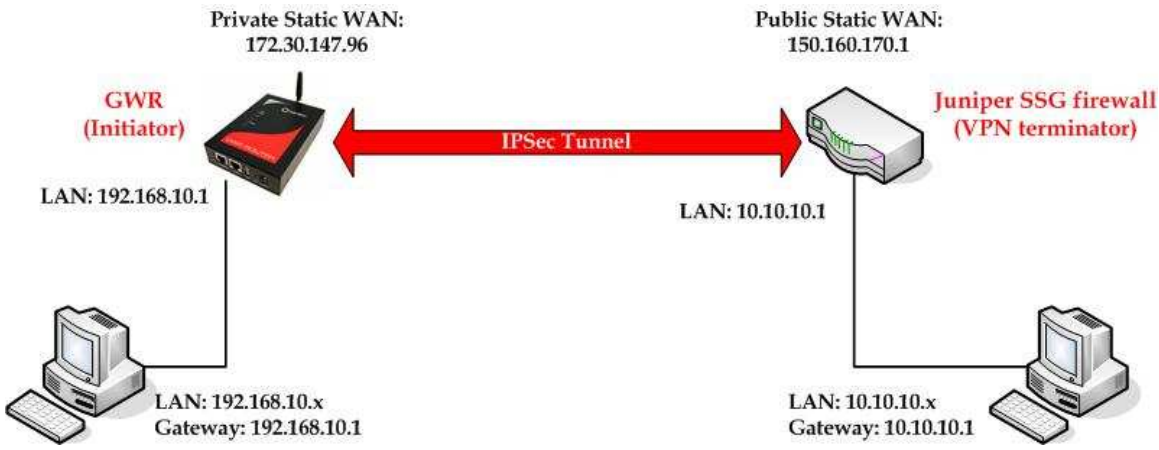


Figure 91 – IPSec tunnel between GWR Router and Cisco Router

The GWR Routers requirements:

- Destination tunnel address should have public static WAN IP address.

GSM/UMTS APN Type: For GSM/UMTS networks GWR Router connections may require a Custom APN. A Custom APN allows for various IP addressing options, particularly static IP addresses, which are needed for most VPN connections. A custom APN should also support mobile terminated data that may be required in most site–to–site VPNs.

The GWR Router configuration:

- Click *Network* Tab, to open the **LAN NETWORK** screen. Use this screen to configure LAN TCP/IP settings. Configure IP address and Netmask.

- IP Address: 192.168.10.1,
- Subnet Mask: 255.255.255.0,
- Press ***Save*** to accept the changes.

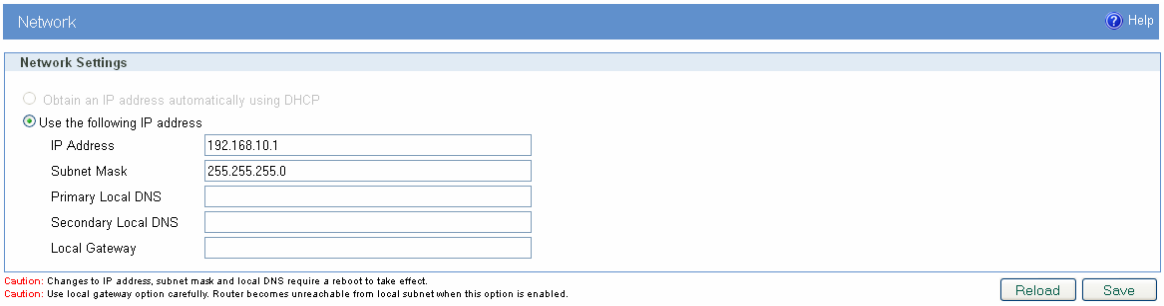


Figure 92 – Network configuration page for GWR Router

- Use SIM card with a static IP address, obtained from Mobile Operator.
- Click ***WAN Settings*** Tab to configure parameters necessary for GSM/UMTS connection. All parameters necessary for connection configuration should be required from mobile operator.
- Check the status of GSM/UMTS connection (***WAN Settings*** Tab). If disconnected please click ***Connect*** button.
- Click ***VPN Settings > IPSEC*** to configure IPSEC tunnel parameters. Click ***Add New Tunnel*** button to create new IPSec tunnel. Tunnel parameters are:
  - ***Add New Tunnel***
    - Tunnel Name: IPsec tunnel,
    - Enable: true.
  - ***IPSec Setup***
    - Keying Mode: IKE with Preshared key,
    - Mode: aggressive,
    - Phase 1 DH group: Group 2,
    - Phase 1 Encryption: 3DES,
    - Phase 1 Authentication: SHA1,
    - Phase 1 SA Life Time: 28800,
    - Perfect Forward Secrecy: true,
    - Phase 2 DH group: Group 2,
    - Phase 2 Encryption: 3DES,
    - Phase 2 Authentication: SHA1,
    - Phase 2 SA Life Time: 3600,
    - Preshared Key: 1234567890.
  - ***Local Group Setup***
    - Local Security Gateway Type: IP Only,
    - Local ID Type: Custom,
    - Custom Peer ID: 172.30.147.96,
    - IP Address: SIM 1,
    - Local Security Group Type: Subnet,
    - IP Address: 192.168.10.0,
    - Subnet Mask: 255.255.255.0.
  - ***Remote Group Setup***
    - Remote Security Gateway Type: IP Only,
    - IP Address: 150.160.170.1,
    - Remote ID Type: IP Address,
    - Remote Security Group Type: Subnet,
    - IP Address: 10.10.10.0,
    - Subnet Mask: 255.255.255.0.
  - ***Advanced***

- Compress(Support IP Payload Compression Protocol(IPComp)): false,
- Dead Peer Detection(DPD): false,
- NAT Traversal: true,
- Press ***Save*** to accept the changes.

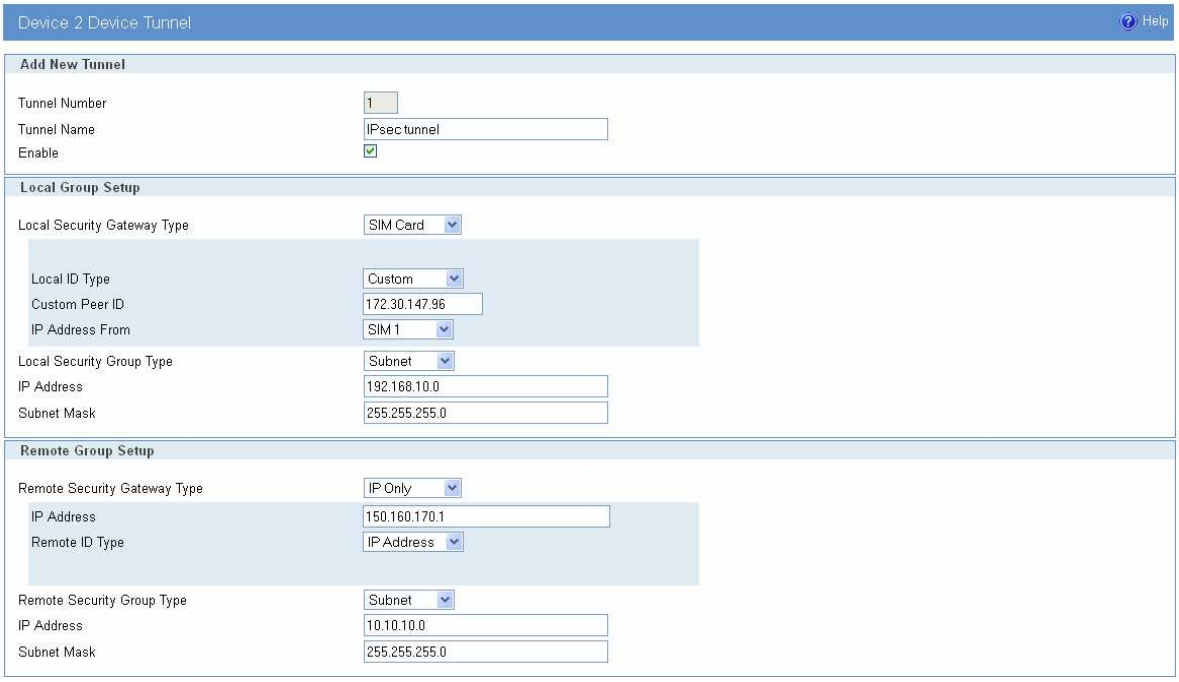


Figure 93 – IPSEC configuration page I for GWR Router

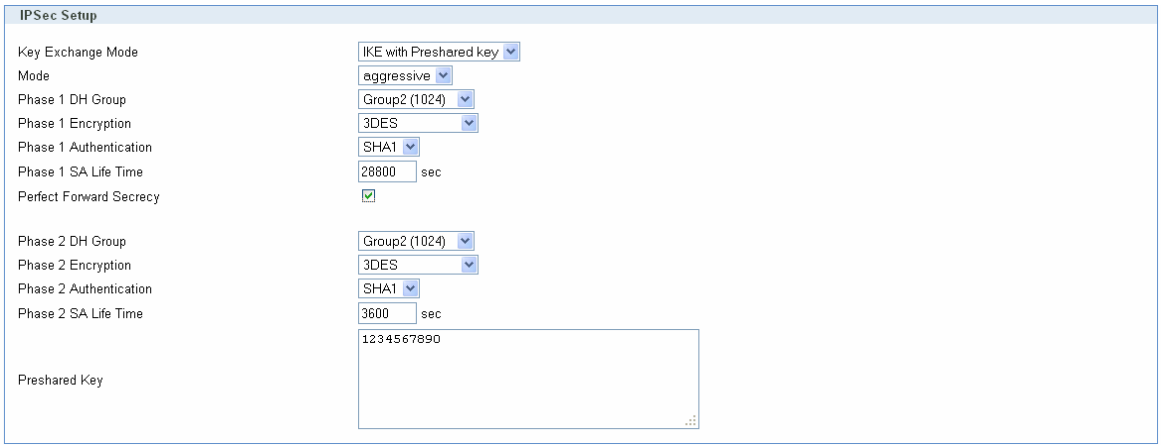


Figure 94 – IPSec configuration page II for GWR Router

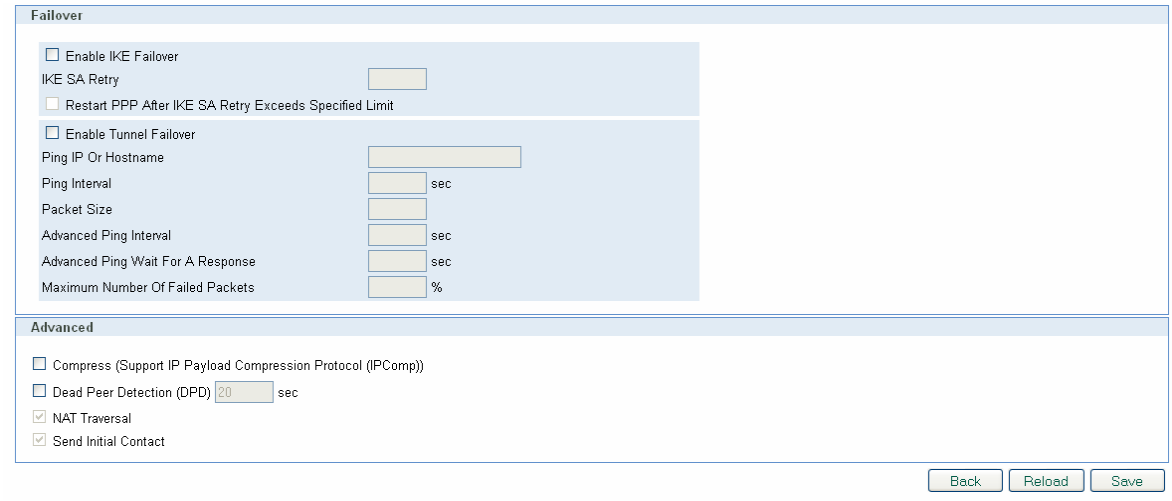


Figure 95 – IPSec configuration page III for GWR Router

- Click ***Start*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel.

Click ***Start*** button and after that ***Connect*** button on ***Internet Protocol Security*** page to initiate IPSEC tunnel

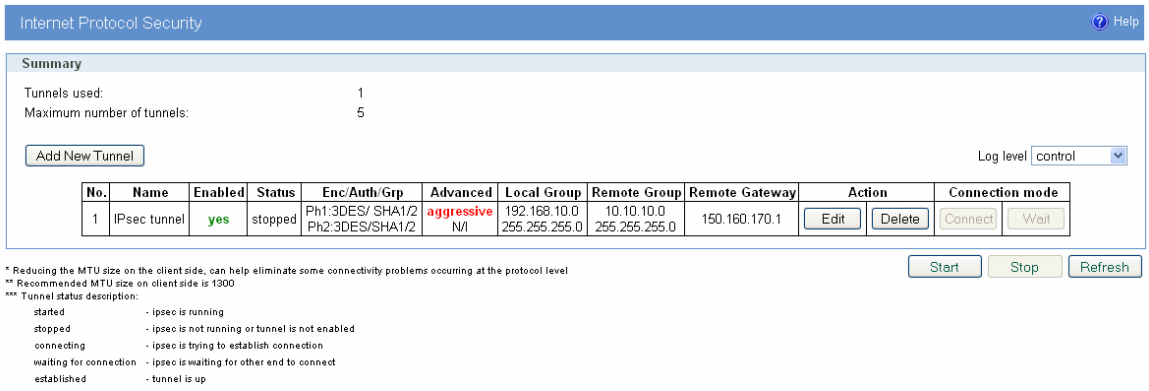


Figure 96 – IPSec start/stop page for GWR Router

- On the device connected on GWR router setup default gateway 192.168.10.1.

The Juniper SSG firewall configuration:

Step1 – Create New Tunnel Interface

- Click Interfaces on Network Tab.

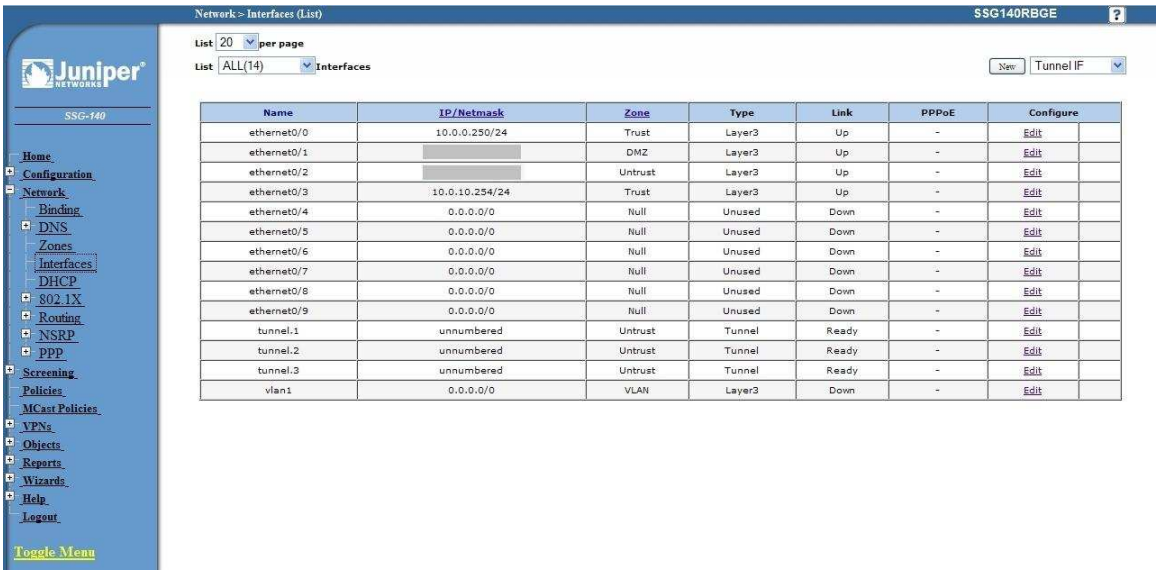


Figure 97 – Network Interfaces (list)

- Bind New tunnel interface to Untrust interface (outside int – with public IP addresss).
- Use unnumbered option for IP address configuration.

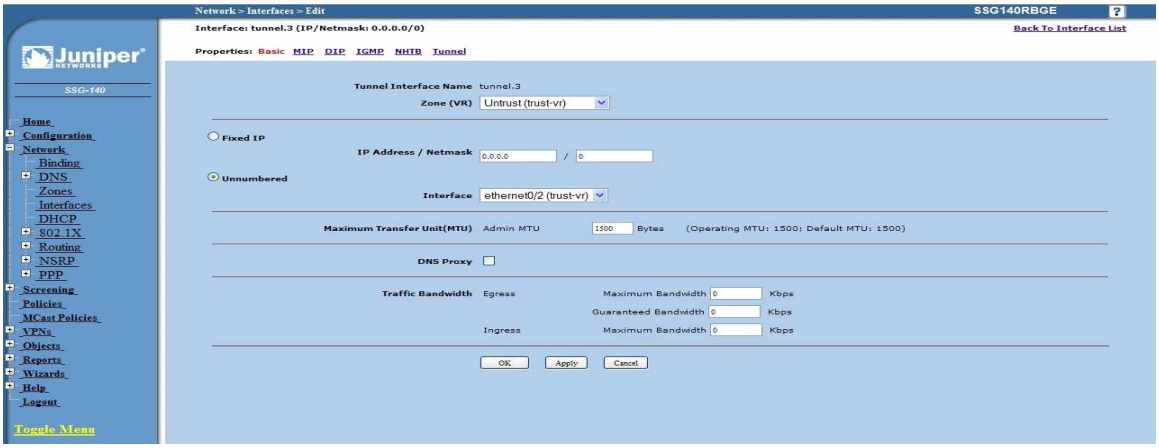


Figure 98 – Network Interfaces (edit)

Step 2 – Create New VPN IPSEC tunnel

- Click ***VPNs*** in main menu. To create new gateway click ***Gateway*** on ***AutoKey Advanced*** tab.

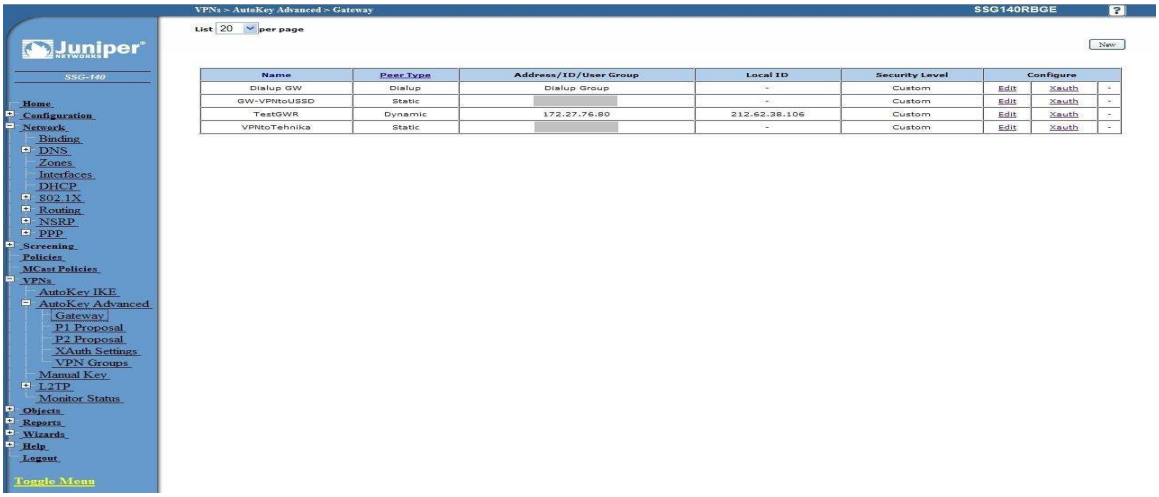


Figure 99 – AutoKey Advanced Gateway

- Click *New* button. Enter gateway parameters:
  - **Gateway name:** TestGWR,
  - **Security level:** Custom,
  - **Remote Gateway type:** Dynamic IP address(because your GWR router are hidden behind Mobile operator router's (firewall) NAT),
  - **Peer ID:** 172.30.147.96,
  - **Presharedkey:** 1234567890,
  - **Local ID:** 150.160.170.1.

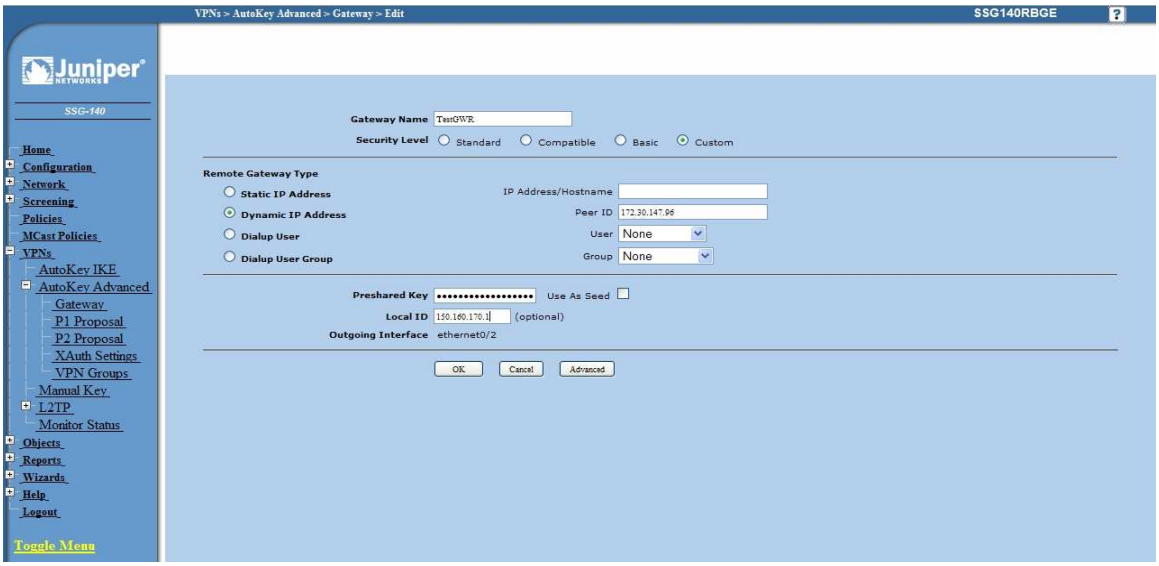


Figure 100 – Gateway parameters

- Click ***Advanced*** button.
  - **Security level – User Defined:** custom,

- **Phase 1 proposal:** pre–g2–3des–sha,
- **Mode:** Agressive(must be aggressive because of NAT),
- **Nat–Traversal:** enabled,
- Click ***Return*** and ***OK***.

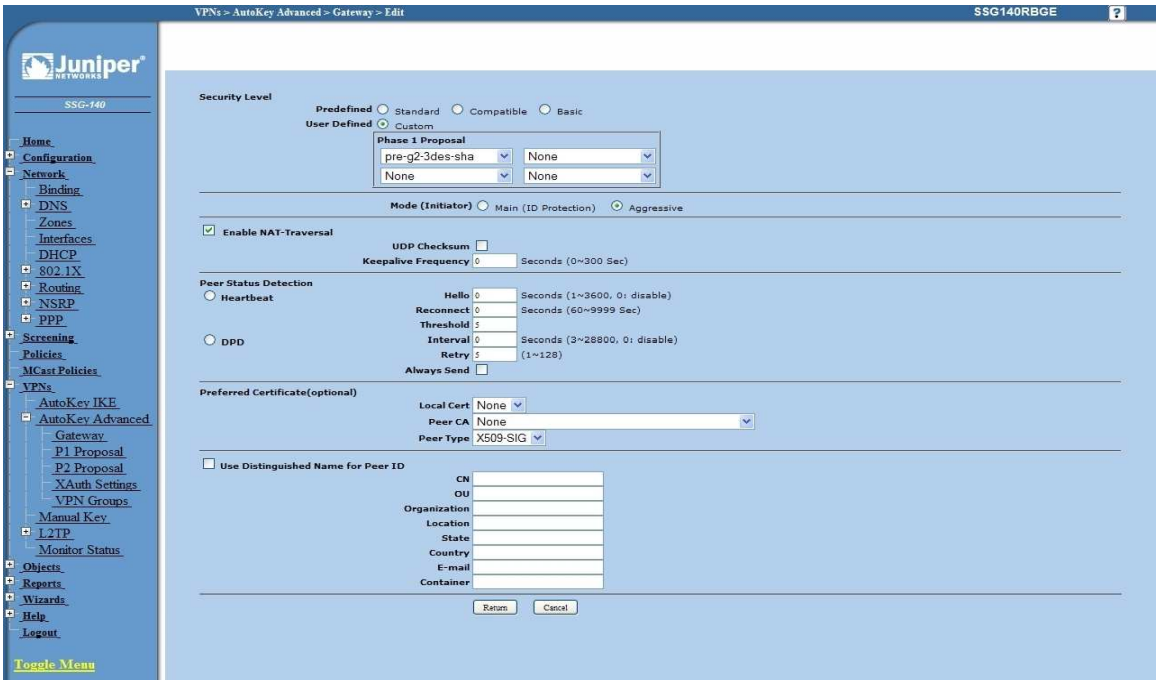


Figure 101 – Gateway advanced parameters

Step 3 – Create AutoKey IKE

- Click ***VPNs*** in main menu. Click ***AutoKey IKE.***
- Click ***New*** button.

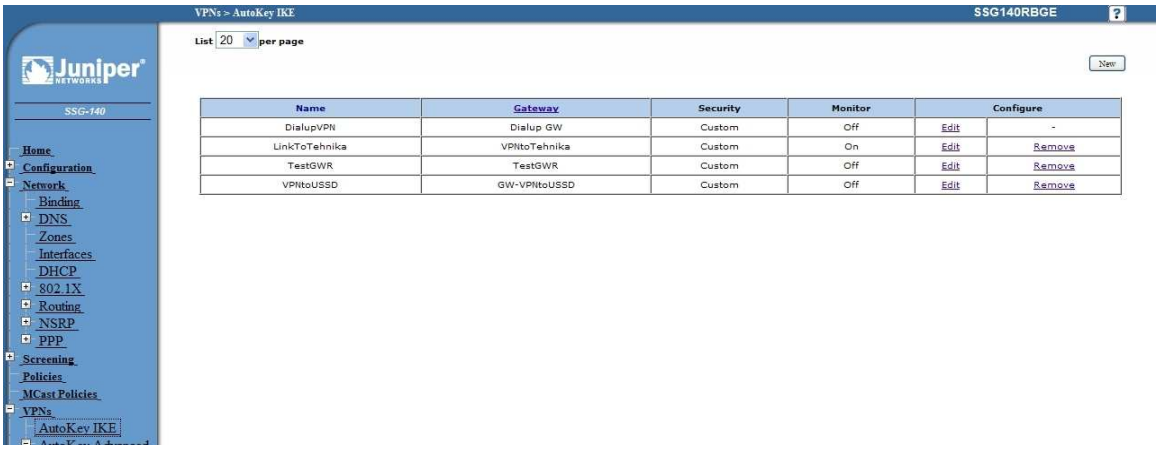


Figure 102 – AutoKey IKE

AutoKey IKE parameters are:

- **VPNname:** TestGWR,
- **Security level:** Custom,

- **Remote Gateway:** Predefined,
- Choose VPN Gateway from step 2.

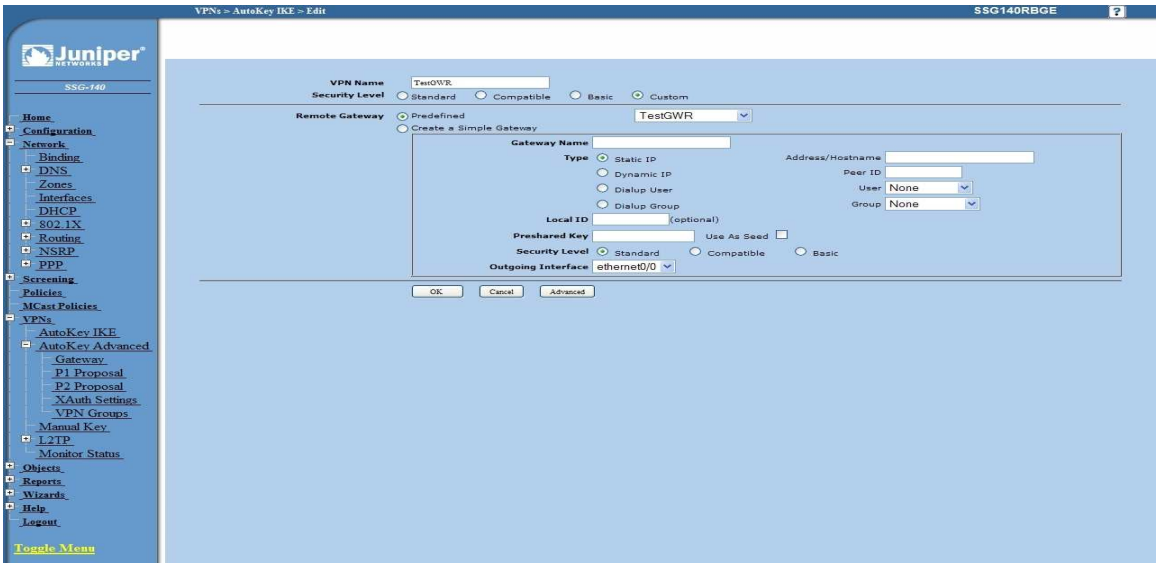


Figure 103 – AutoKey IKE parameters

- Click ***Advanced*** button.
  - **Security level – User defined:** custom,
  - **Phase 2 proposal:** pre–g2–3des–sha,
  - **Bind to – Tunnel interface:** tunnel.3(from step 1),
  - **Proxy ID:** Enabled,
  - **LocalIP/netmask:** 10.10.10.0/24,
  - **RemoteIP/netmask:** 192.168.10.0/24,
  - Click ***Return*** and ***OK***.

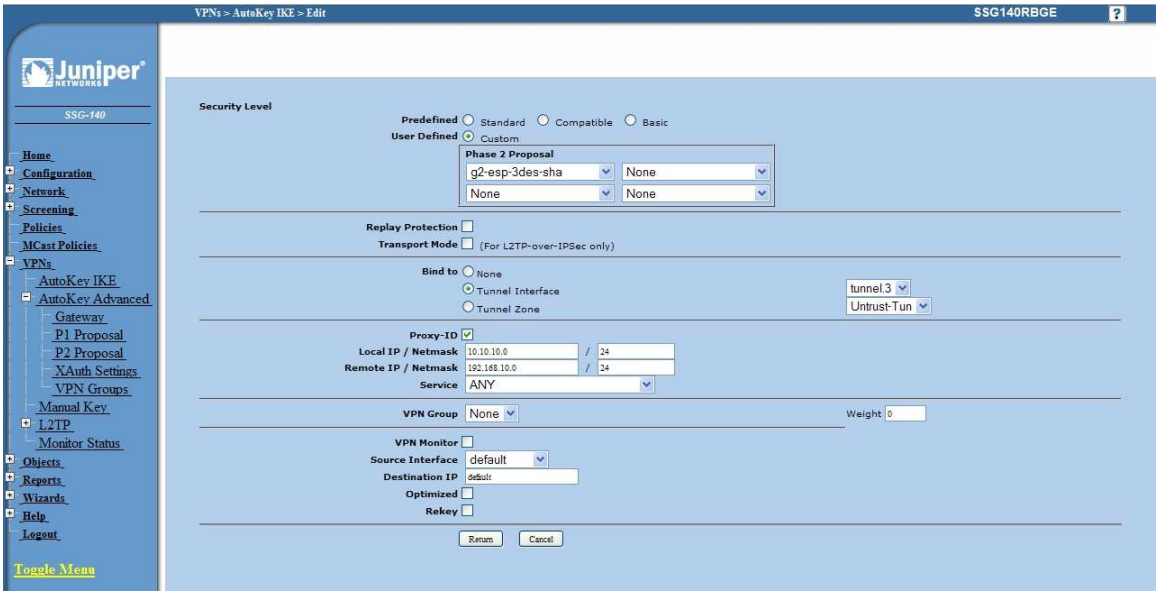


Figure 104 – AutoKey IKE advanced parameters

Step 4 – Routing

- Click ***Destination*** tab on ***Routing*** menu.
- Click **New** button. Routing parameters are:
  - **IP Address:** 192.168.10.0/24,
  - **Gateway:** tunnel.3(tunnel interface from step 1),
  - Click ***OK.***

Figure 105 – Routing parameters

Step 5 – Policies

- Click ***Policies*** in main menu.
- Click *New* button (from Untrust to trust zone),
  - **Source Address:** 192.168.10.0/24,
  - **Destination Address:** 10.10.10.0/24,
  - **Services:** Any.
- Click ***OK.***

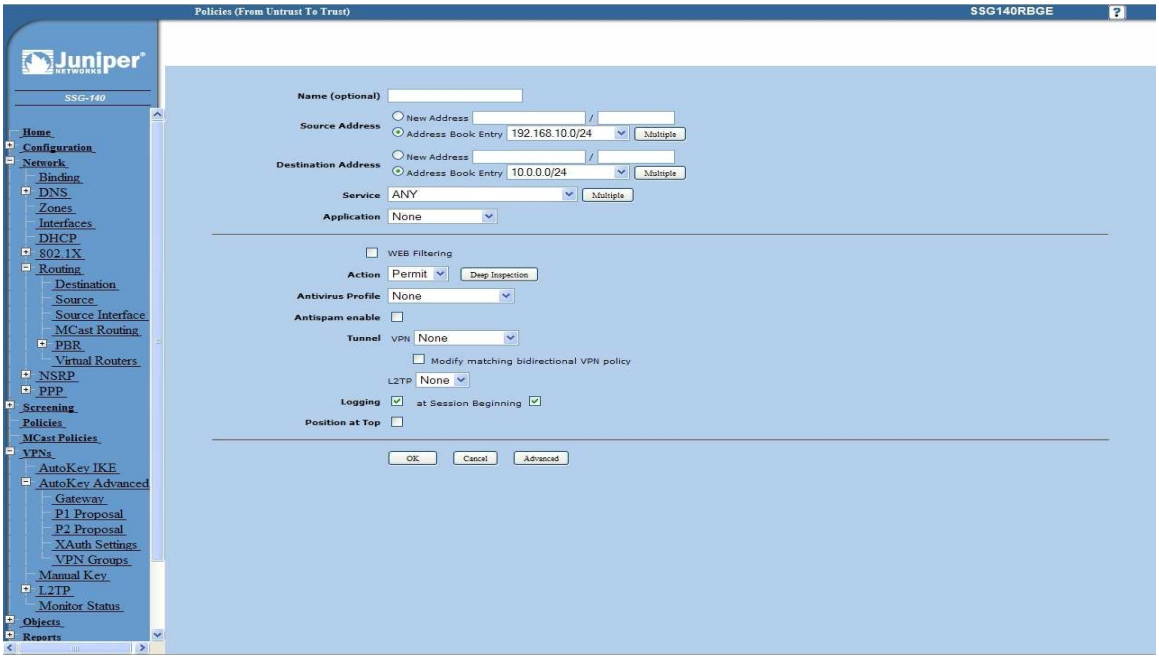


Figure 106 – Policies from untrust to trust zone

- Click ***Policies*** in main menu.
- Click *New* button (from trust to untrust zone),
  - **Source Address:** 10.10.10.0/24,
  - **Destination Address:** 192.168.10.0/24,
  - **Services:** Any.
- Click ***OK.***

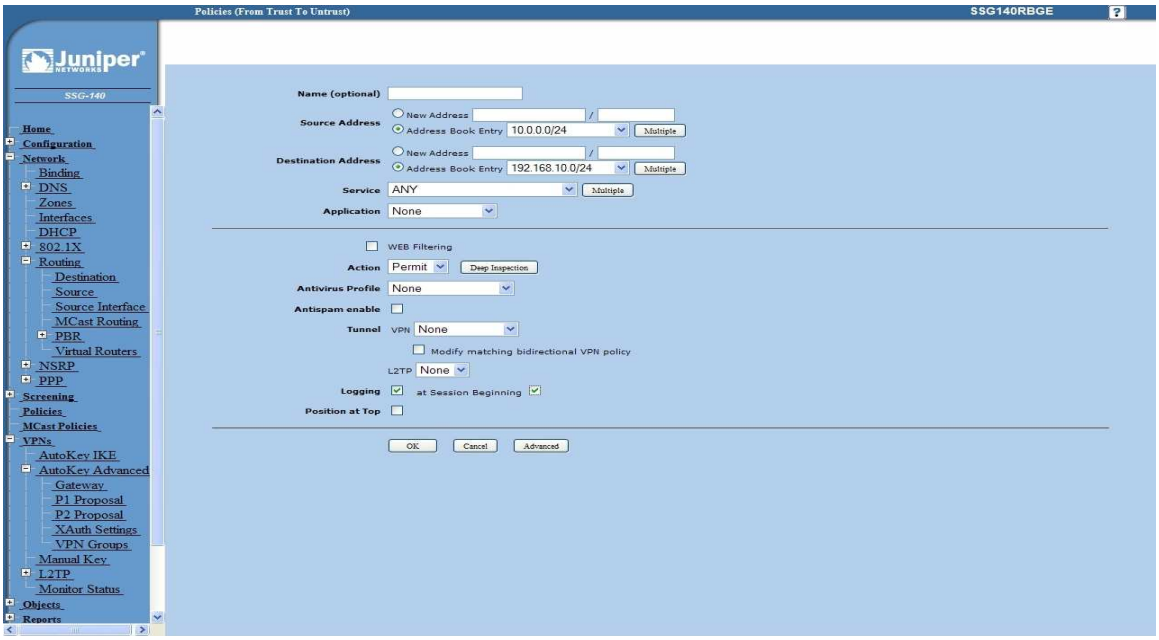


Figure 107 – Policies from trust to untrust zone

OpenVPN tunnel between GWR router and OpenVNP server

Overview

OpenVPN site to site allows connecting two remote networks via point–to–point encrypted tunnel. OpenVPN implementation offers a cost–effective simply configurable alternative to other VPN technologies. OpenVPN allows peers to authenticate each other using a pre–shared secret key, certificates, or username/password. When used in a multiclient–server configuration, it allows the server to release an authentication certificate for every client, using signature and Certificate authority. It uses the OpenSSL encryption library extensively, as well as the SSLv3/TLSv1 protocol, and contains many security and control features. The server and client have almost the same configuration. The difference in the client configuration is the remote endpoint IP or hostname field. Also the client can set up the keepalive settings. For successful tunnel creation a static key must be generated on one side and the same key must be uploaded on the opposite side

OpenVPN configuration

Open VPN is established between one central locations and three remote locations with Geneko router configured in TCP client mode. Authentication used is pre-shared key.

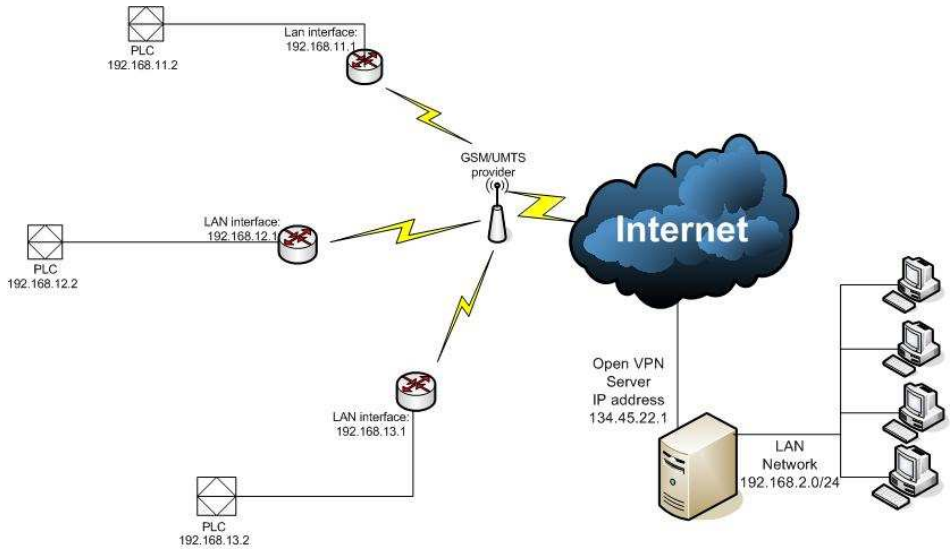


Figure 108 – Multipoint OpenVPN topology

Configuration

1. Open VPN server is in TCP listening mode and it is reachable from the internet over static public IP address 134.45.22.1 and TCP port 1194 (default Open VPN port)
2. Configuration file in Open VPN server is applied in following way:
   a) Open any Text Editor application and make configuration txt file.
   In this example configuration file looks like this

proto tcp-server	TCP server protocol mode
dev tun	dev tun mod of Open VPN server
ifconfig 2.2.2.1 2.2.2.2	Local and remote IP address of the Open VPN tunnel (both addresses must be within 255.255.255.252 subnet)
dev-node adap1	Selection of virtual network adapter named adap1
secret key.txt	Implementing file with pre-shared secret named key.txt
ping 10	Keepalive
comp-lzo	LZO compression enabled
disable-occ	disable option consistency

b) Save configuration file in C:\Program Files\OpenVPN\config as *name*.ovpn file.
It is OpenVPN configuration file directory and you can reach it directly through Start menu>OpenVPN where you get options:

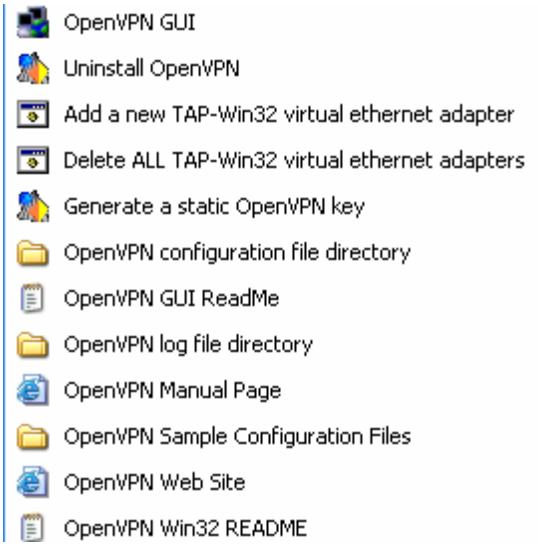


Figure 109 – OpenVPN application settings

c) Generate a static OpenVPN key from the menu above. File will be automatically Saved in Open VPN configuration file directory. Configuration file and pre-shared key must be in same directory.

d) If you have more remote locations every location has to have its own configuration file with different remote interface IP address and virtual network adapter. Second virtual network adapter you can create by selecting "Add a new TAP-Win32 virtual ethernet adapter". The same way you can create the third virtual adapter . Name virtual adapters as adap1, adap2 and adap3 .

For example configuration file for second remote location can be:

proto tcp-server
dev tun
ifconfig 2.2.2.5 2.2.2.6
dev-node adap2
secret key.txt
ping 10
comp-lzo
disable-occ

Only difference to previous configuration is 2.2.2.5, 2.2.2.6 (IP address of local and remote interface) and dev-node adap2.
Configuration file for third remote location is:

proto tcp-server
dev tun
ifconfig 2.2.2.9 2.2.2.10
dev-node adap3
secret key.txt
ping 10
comp-lzo
disable-occ

All three configuration files (e.g. Server1.ovpn, Server2.ovpn, Server3.ovpn) have to be saved in same directory C:\Program Files\OpenVPN\config. Name of configuration file is name of your OpenVPN tunnel.

e) Workstation where OpenVPN server is installed should have ip route to subnet which is on the other end of the OpenVPN tunnel. This subnet is reachable over remote OpenVPN interface which is in this case 2.2.2.2. Enter following command in the command prompt:

route –p add 192.168.11.0 mask 255.255.255.0 2.2.2.2
first remote location

route –p add 192.168.12.0 mask 255.255.255.0 2.2.2.6
second remote location

route –p add 192.168.13.0 mask 255.255.255.0 2.2.2.10
third remote location

2. GWR router is configured with SIM card which has internet access. Configuration of OpenVPN is following:

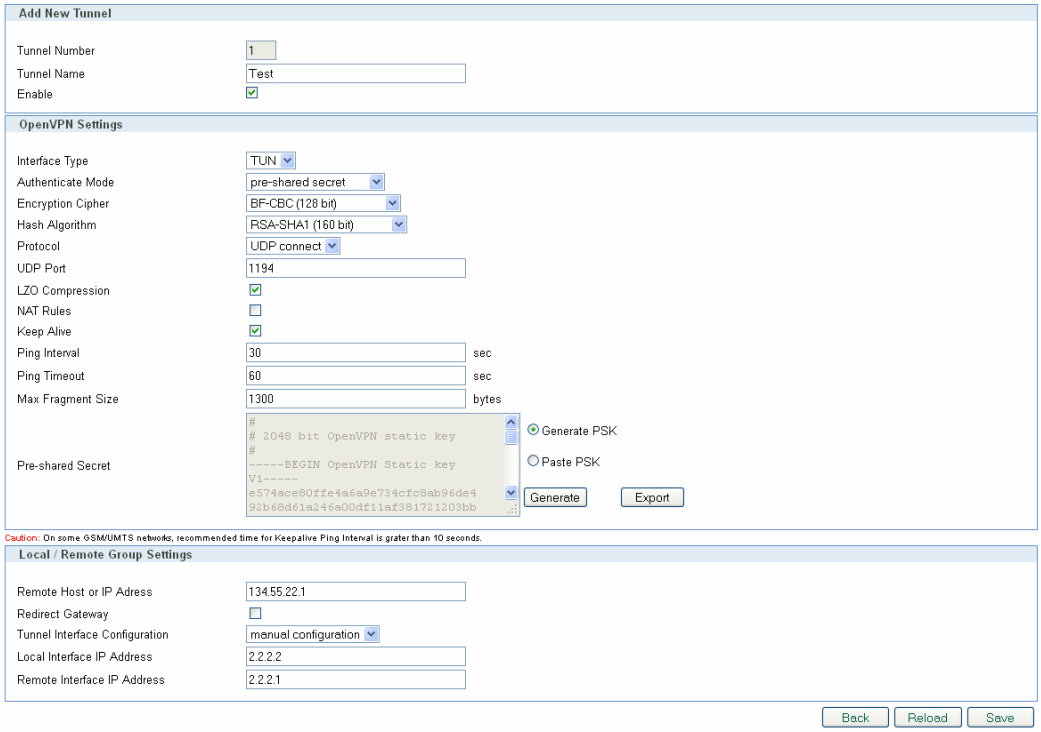


Figure 110 – OpenVPN GWR settings

Where pre-shared secret you paste from the *key.txt* file which you generate on OpenVPN server.

In routing table static ip route to local OpenVPN server network (in this case it is 192.168.2.0/24) should be entered.

Enable	Dest Network	Netmask	Gateway	Metric	Interface	Action
☑	0.0.0.0	0.0.0.0	*	1	ppp_0	Rem
☑	192.168.2.0	255.255.255.0	*	1	tun1	Rem

Figure 111 – Static routes on GWR

TUN1 interface isn't available before you start the OpenVPN tunnel so you must start it first

That accomplishes configuration of the GWR regarding establishing the OpenVPN and routing through it.

Implementation

You start Open VPN tunnel on server side by right click on the icon in notification bar. You choose Open VPN tunnel (Server1) and click Connect. The same procedure repeat for Server2 and Server3.

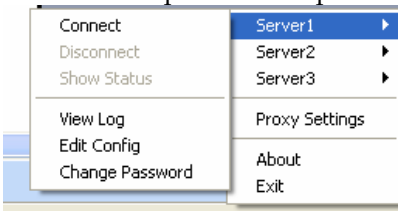


Figure 112 – Starting OpenVPN application

When OpenVPN tunnel is up on the Open VPN server you should get following notification:

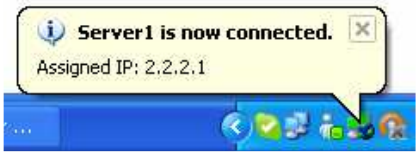


Figure 113 – OpenVPN status on PC

On the GWR side status of the OpenVPN tunnel should be established.

No.	Name	Enabled	Status	Auth. Mode	Advanced	F
1	Test	yes	established	pre-shared secret	LZO/NAT/KeA	

Figure 114 – OpenVPN status on GWR

Portforwarding – example

Portforwarding feature enables access to workstations behind the router and redirecting traffic in both traffic flow directions – inbound and outbound. **Direction is selected by interface – PPP0 for inbound (WAN -> ETH0) and ETH0 for outbound traffic (ETH0 ->WAN).**

In the following example there are three types of access to LAN network enabled, every workstation with different service allowed from the outside. LAN is accessed through the WAN IP of the router. Second and forth rule have additional limitation per source IP address of the incoming packets. The forth defined access flow is redirecting all WEB traffic from the local workstation to one outside IP address, web authentication server for example.

Implemented rules are following:

1. Traffic destined to WAN IP by port 5022 is forwarded to workstation 192.168.1.2 and port 22. Result – SSH is accessible from the outside to the first workstation
2. Traffic destined to WAN IP by port 8080 is forwarded to workstation 192.168.1.3 and port 80. Result – WEB is accessible from the outside to the second workstation. This rule is limited only to traffic coming from the 172.16.234.0/24 subnet
3. Traffic destined to WAN IP from port range 300:400 is forwarded to workstation 192.168.1.4 to port 12345
4. WEB traffic from the workstation 192.168.1.5 is forwarded to one outside IP address (212.62.49.109 for example)

If Source IP and Source Netmask fields are empty stated entry is applied to all incoming packets. When PPP0 interface is selected Destination IP and Netmask are predefined to WAN IP and subnet 32 and cannot be changed.

On the following picture are marked traffic flows stated above.

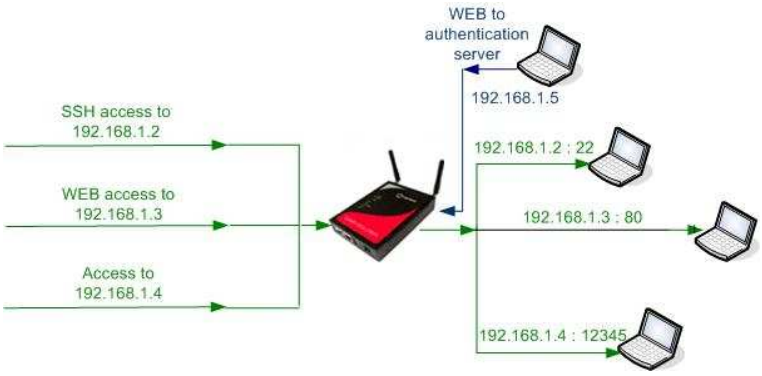


Figure 115– Portforwarding example

Portforwarding is configured on the ROUTING page selected from the main menu. Configuration of the examples described above is presented in the following picture:

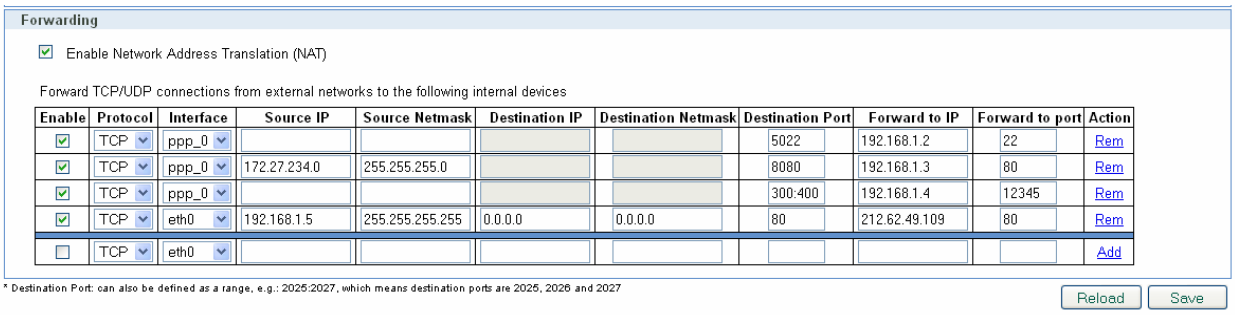


Figure 116– GWR portforwarding configuration

Serial port – example

For connecting serial devices from remote locations to central location serial transparent conversion can be used. Serial communication is encapsulated in TCP/IP header and on the central location is recognized by the Virtual COM port application. This way serial communication is enabled between two distant locations.

In the picture below serial communication is achieved over GWR router in client mode on remote location and Virtual COM port application on central side. As application is in server mode, IP address of the workstation has to be accessible from the router. In this example that is IP address GWR routers supports both server and client mode, so you can use one GWR router on both side of communication link (one in server and one in client mode).

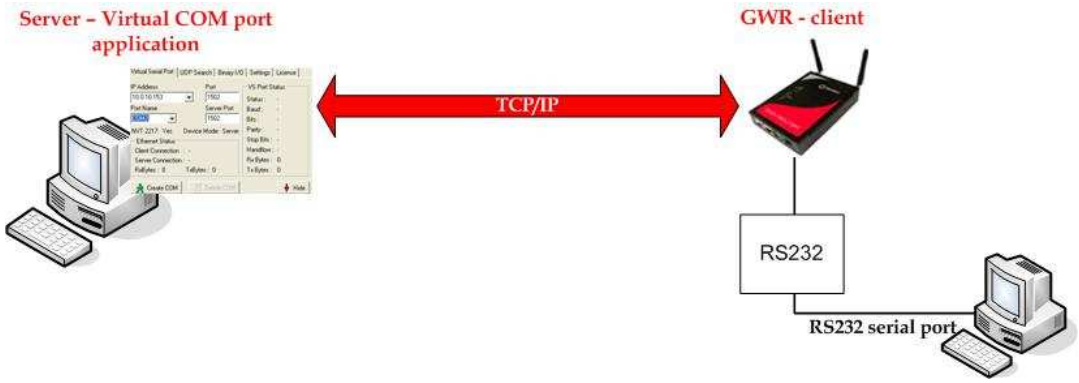


Figure 117– Transparent serial connection

1. Settings on GWR router

From the main menu on the left side of web interface option SERIAL PORT should be selected and following page is displayed.

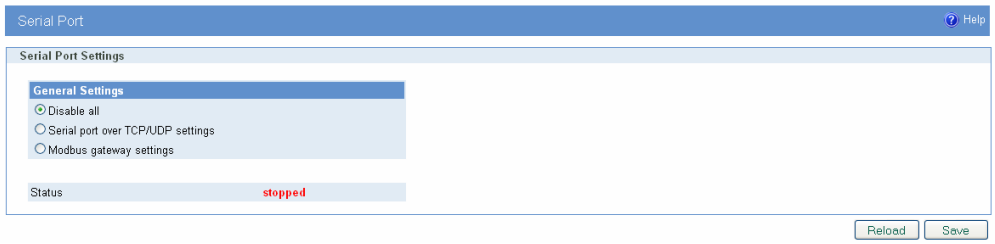


Figure 118– GWR Serial port settings

Option SERIAL PORT OVER TCP/UDP SETTINGS is used for configuration of transparent serial communication. Configuration parameters are presented in picture below

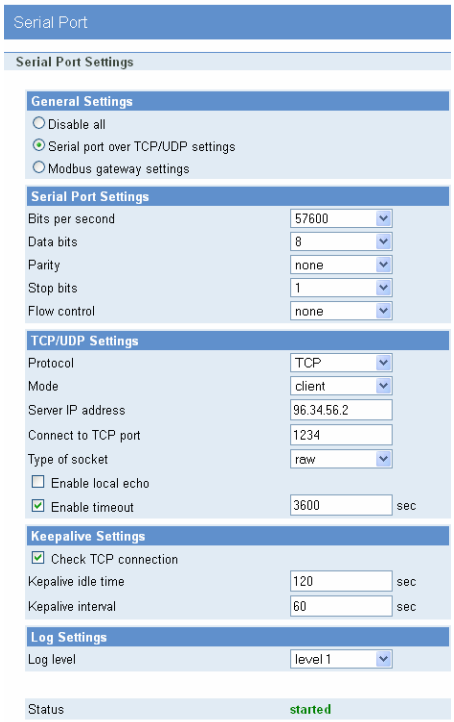


Figure 119– GWR settings for Serial-to-IP conversion

General Settings
- Serial port over TCP/UDP settings

Serial port settings
- Bits per second: 57600
- Data bits: 8
- Parity: none
- Stop bits: 1
- Flow control: none

TCP/UDP Settings
- Protocol: TCP
- Mode: client
- Server IP address: 96.34.56.2 (IP address of server)
- Connect to TCP port: 1234
- Type of socket: raw
- Enable local echo: Disabled
- Enable timeout: 3600 sec

Keepalive Settings
- Check TCP connection: Enable
- Keepalive idle time: 120 sec
- Keepalive interval: 60 sec

Log Settings
- Log level: level 1

When serial port is configured button SAVE should be selected and STATUS of the service should change to **started** like on the picture above.

2. Application settings

In this example is used application HW Virtual Serial Port which is installed on workstation on central location. When application is started on Settings tab option "HW VSP works as the TCP Server only" should be enabled.

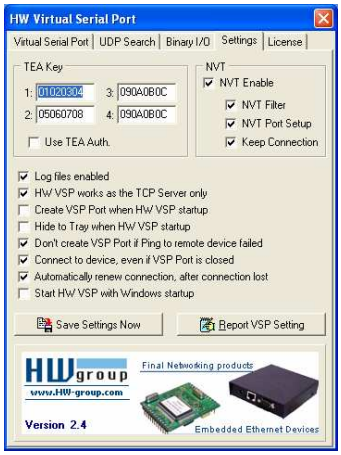


Figure 120- Virtual COM port application

In Virtual Serial Port tab settings should be following:

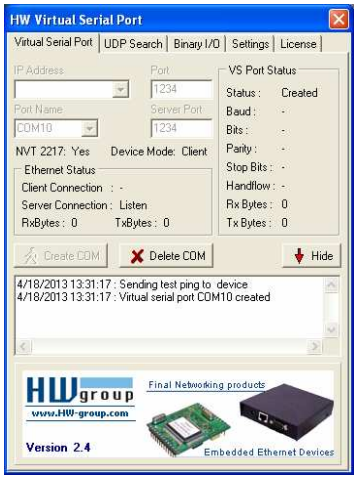


Figure 121– Settings for virtual COM port

- IP address: - (not used in server mode)
- Port: 1234
- Server Port: 1234
- Port Name: COM10 (random selected)

After "Create COM" is activated if everything is alright in log will be shown message that port COM10 is created, like in picture above. In communication with remote serial device COM10 should be selected on workstation.

Firewall – example

Firewall implemented in GWR routers has numerous options for matching interesting traffic. Traffic flow is controlled through the router with three actions triggered by firewall:

1. ACCEPT – traffic is passed through the router without any changes implemented
2. REJECT – traffic is blocked with ICMP error messages
3. DROP – traffic is blocked without any error messages, connection is retried until the threshold for retransmission is exceeded

By default all traffic is PERMITTED. To block all the traffic not defined under stated rules last entry in firewall table should be DROP ALL.

Rule priority defines order by which router matches inspected packets. After first match between rule and packet, no other rule is compared against matched traffic.

Firewall has 17 predefined rules for the most common usage. These 17 rules are following:

1. Allow ALL from local LAN

All traffic originating from local subnet is allowed to access router Ethernet interface. It is important to

keep this rule enabled to prevent losing local management interface.

2. Allow already established traffic
For inbound TCP only. Allows TCP traffic to pass if the packet is a response to an outbound-initiated session.

3. Allow TELNET on ppp_0
Accepts telnet connection from the outside to router's WAN interface, for management over CLI interface

4. Allow HTTP on ppp_0
Accepts WEB traffic from the outside to router's WAN interface, for management over WEB interface

5. Allow PING on ppp_0-with DDoS filter
ICMP traffic to WAN interface of the router is allowed with prevention of Distributed Denial-of-service attack

Allow RIP protocol
6. Allow RIP on ppp_0
7. Allo RIP on ppp_0 – route

Allow GRE protocol
8. Allow GRE tunnels on ppp_0
9. Allow GRE Keepalive on ppp_0

Allow IPSec protocol
10. Allow IPSec tunnels on ppp_0 – protocol
11. Allow IPSec tunnels on ppp_0 – IKE
12. Allow IPSec tunnel on ppp_0 – IKE_NATt

Allow OpenVPN protocol
13. Allow OpenVPN tunnels on ppp_0 – UDP
14. Allow OpenVPN tunnels on ppp_0 – TCP

15. Allow SNMP on ppp_0
SNMP requests are allowed to be sent to the router over WAN interface

16. Allow MODBUS on ppp_0
MODBUS conversion over default port UDP 502 is permitted

17. REJECT all other traffic
All packets which are not stated as ACCEPT in previous rules are denied. If this rule is not enabled all packets which are not stated as DROP/REJECT are permitted.

In following example 8 traffic flows are defined under firewall rules. In the picture presented with green are marked permitted packets and with red blocked.

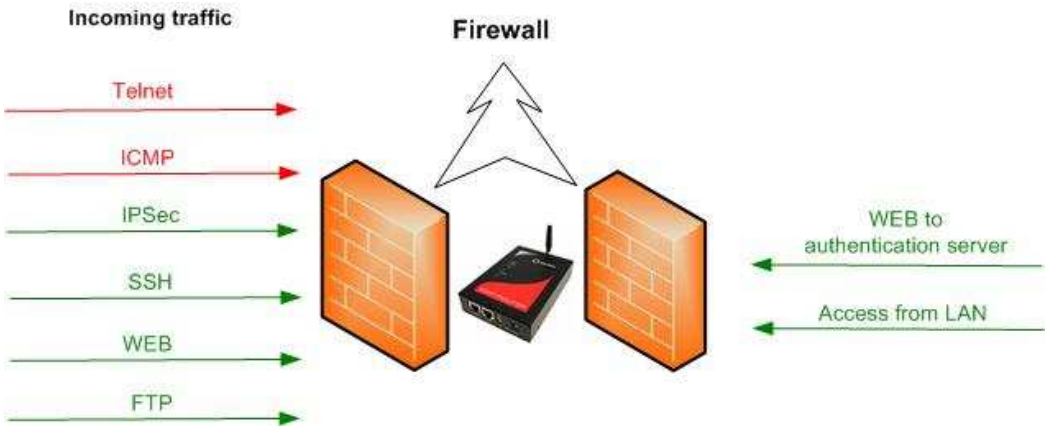


Figure 122 – Firewall example

Firewall is enabled in SETTINGS>FIREWALL page. Page for firewall configuration is presented in the following picture:

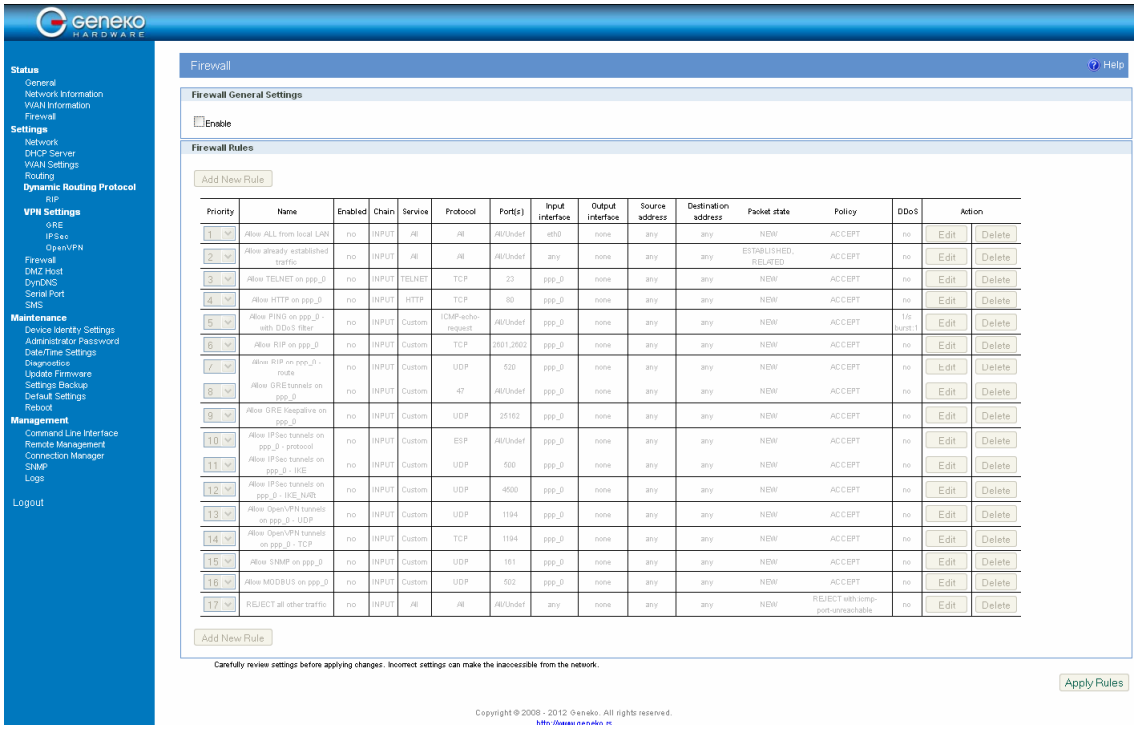


Figure 123 – Initial firewall configuration on GWR

Firstly firewall should be enabled, that is done by selecting:

Firewall General Settings>Enable

Firewall can be configured by enabling or editing existing, predefined rules or by adding new one. Firewall is configured in following way:

1. Telnet traffic is denied

Select predefined rule number 3. Configuration page like on picture below is shown.

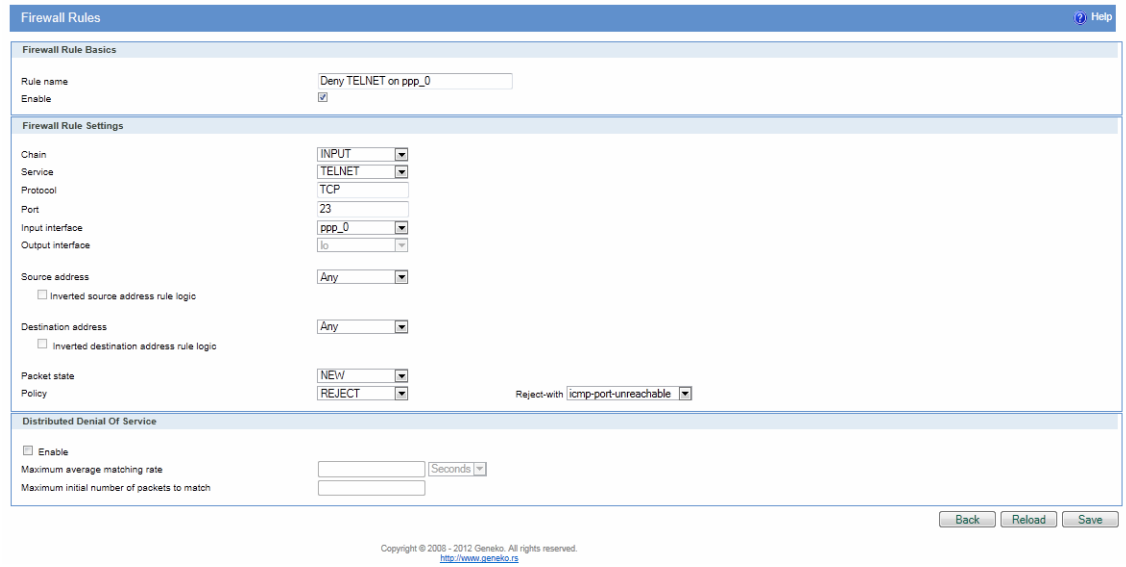


Figure 124 – Filtering of Telnet traffic

ENABLE option should be selected to have this rule active. To deny Telnet traffic POLICY should be changed from ACCEPT to REJECT (ICMP error message type can be selected when policy reject is selected). After that SAVE button should be pressed and user is returned to main configuration page.

2. ICMP traffic is denied from all IP addresses except 212.62.38.196

New rule should be added by selecting ADD NEW RULE button. Policy should be configured in following way:

- Rule name: Deny PING to ppp_0 interface
- Enable: selected
- Chain: INPUT
- Service: Custom
- Protocol: ICMP
- ICMP-Type: echo-request
- Input interface: ppp_0
- Source address: Single IP ; 212.62.38.196
- Inverted source address rule logic: selected
- Destination address: Any
- Packet state: NEW
- Policy: REJECT
- Reject-with: icmp-port-unreachable

Configuration should be like on the picture below.

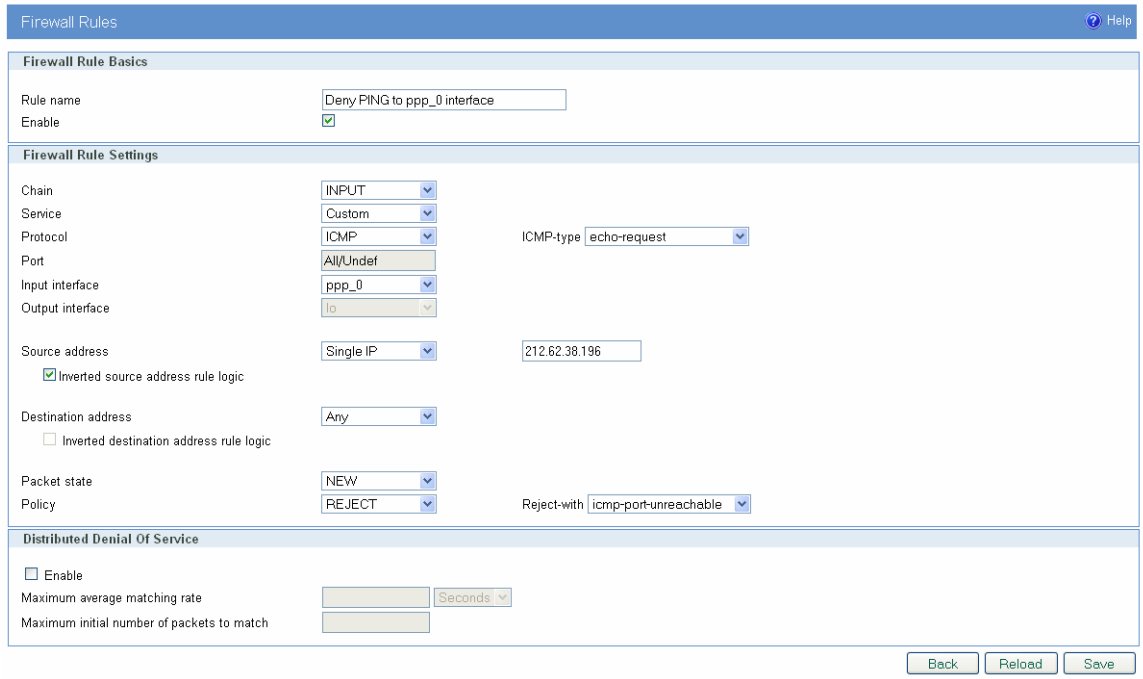


Figure 125 – Filtering of ICMP traffic

After configuration is finished SAVE button should be selected and user is returned to main configuration page. **Priority of rule** is changed by selecting number in drop-down menu. In this example number 4 is selected.

3. ICMP traffic is allowed from single IP addresses

With firewall rule configuration shown above, IP address stated in Source address field is excluded from REJECT policy but in order to allow ping from that IP address it has to be matched with another rule. Configuration of appropriate rule for allowing ping traffic originating from precise IP address is shown below

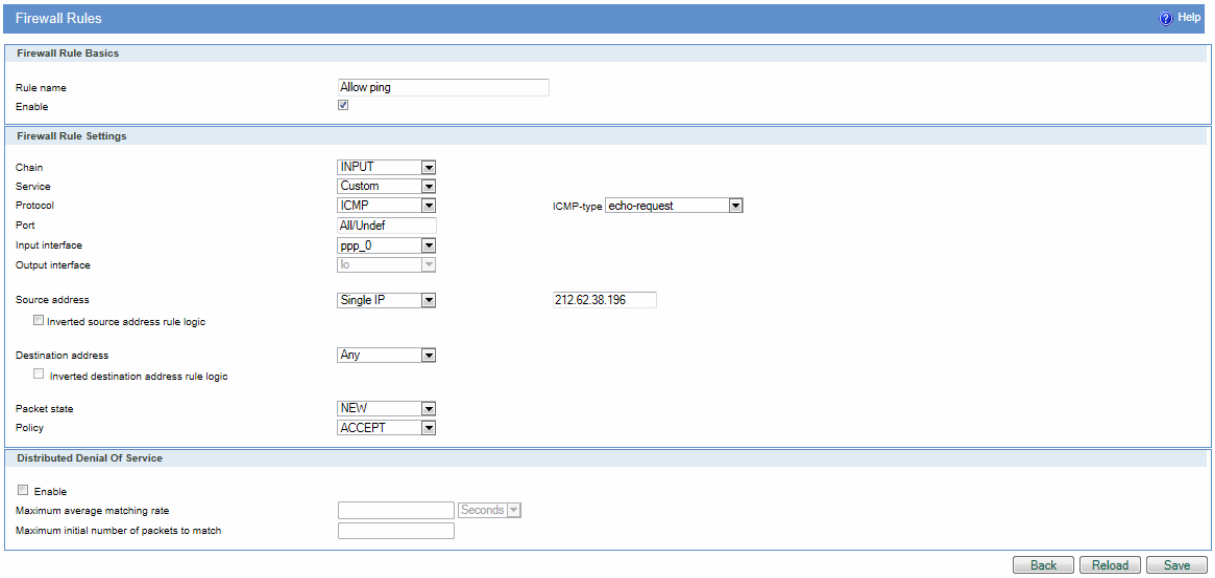


Figure 126 – Allowing ICMP traffic

After configuration is finished SAVE button should be selected and user is returned to main configuration page. **Priority of rule** is changed by selecting number in drop-down menu. In this example number 5 is selected.

4. Establishing of IPSec tunnel is allowed

Firewall has to allow IKE and ESP protocol for IPSec tunnel establishment. If NAT traversal is used one additional port has to be allowed. All these rules are predefined and they have priorities 10, 11 and 12 in default firewall configuration (they are named as *Allow IPSec tunnels on ppp_0 –protocol, IKE and NATt*). As these rules are already configured it is enough just to enable them to have IPSec passed through firewall.

10	Allow IPSec tunnels on ppp_0 - protocol	yes	INPUT	Custom	ESP	All/Undef	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
11	Allow IPSec tunnels on ppp_0 - IKE	yes	INPUT	Custom	UDP	500	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
12	Allow IPSec tunnels on ppp_0 - IKE_NAT1	yes	INPUT	Custom	UDP	4500	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete

Figure 127 – IPSec firewall rules

These three rules are enabled in following way:

- Select EDIT of the rule
- Enable: selected
- SAVE and exit

5. SSH access is allowed from IP range 212.62.38.210-220

New rule should be added by selecting ADD NEW RULE button. Policy should be configured in following way:

- Rule name: Allow SSH
- Enable: selected
- Chain: INPUT
- Service: Custom
- Protocol: TCP
- Port: Custom; 22
- Input interface: ppp_0
- Source address: Range ; 212.62.38.210 : 212.62.38.220
- Destination address: Any
- Packet state: NEW
- Policy: ACCEPT

After configuration is finished SAVE button should be selected and user is returned to main configuration page. **Priority of rule** is changed by selecting number in drop-down menu. In this example number 6 is selected.

6. WEB access is allowed from 212.62.38.210 IP address

In default firewall configuration rule for allowing WEB traffic is predefined (rule with priority 4, named *Allow HTTP on ppp_0*) This rule can be used in example with additional restriction in source IP address to

212.62.38.210. Policy should be configured in following way:

- Enable: selected
- Source address: Single IP; 212.62.38.210
- All other settings should remain the same like in the picture below

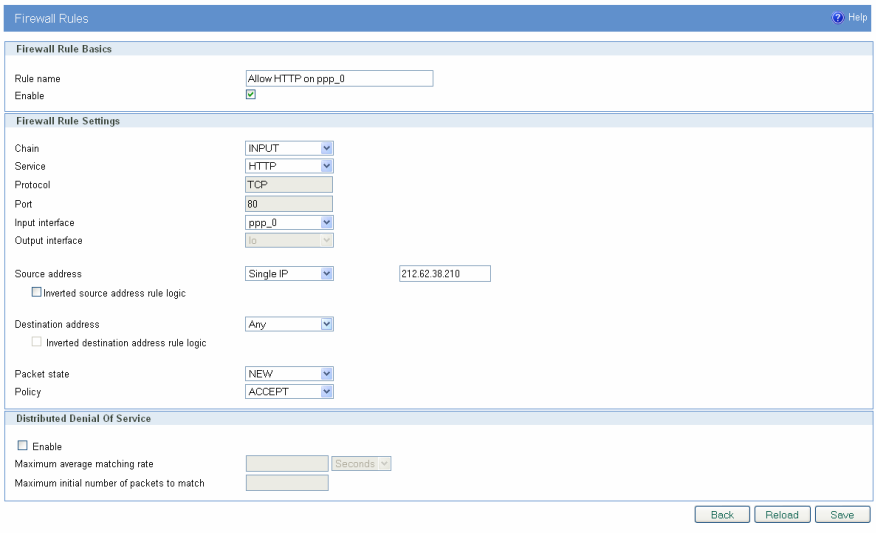


Figure 128 – Allowing WEB access

After configuration is finished SAVE button should be selected and user is returned to main configuration page.

7. FTP traffic is allowed

New rule should be added by selecting ADD NEW RULE button. Policy should be configured in following way:

- Rule name: Allow FTP
- Enable: selected
- Chain: INPUT
- Service: FTP
- Protocol: TCP
- Port: 21
- Input interface: ppp_0
- Source address: Any
- Destination address: Any
- Packet state: NEW
- Policy: ACCEPT

After configuration is finished SAVE button should be selected and user is returned to main configuration page. **Priority of rule** is changed by selecting number in drop-down menu. In this example number 8 is selected.

8. Access from LAN to router is allowed

This is first rule in predefined firewall settings (*Allow ALL from local LAN*). It is recommended to have this rule enabled to allow access to management interfaces of the router. As this rules is already configured it is enough just to enable it to have access to router from LAN:

- Select EDIT of the rule
- Enable: selected

- SAVE and exit

9. WEB traffic is permitted only to 212.62.38.210 from LAN

This rule is example of traffic filtering in direction from inside to outside. New rule should be added by selecting ADD NEW RULE button. Policy should be configured in following way:

- Rule name: Allow HTTP from LAN
- Enable: selected
- Chain: FORWARD
- Service: HTTP
- Protocol: TCP
- Port: 80
- Input interface: eth0
- Output interface: ppp_0
- Source address: Any
- Destination address: Any
- Packet state: NEW
- Policy: ACCEPT

Configuration is shown in following picture:

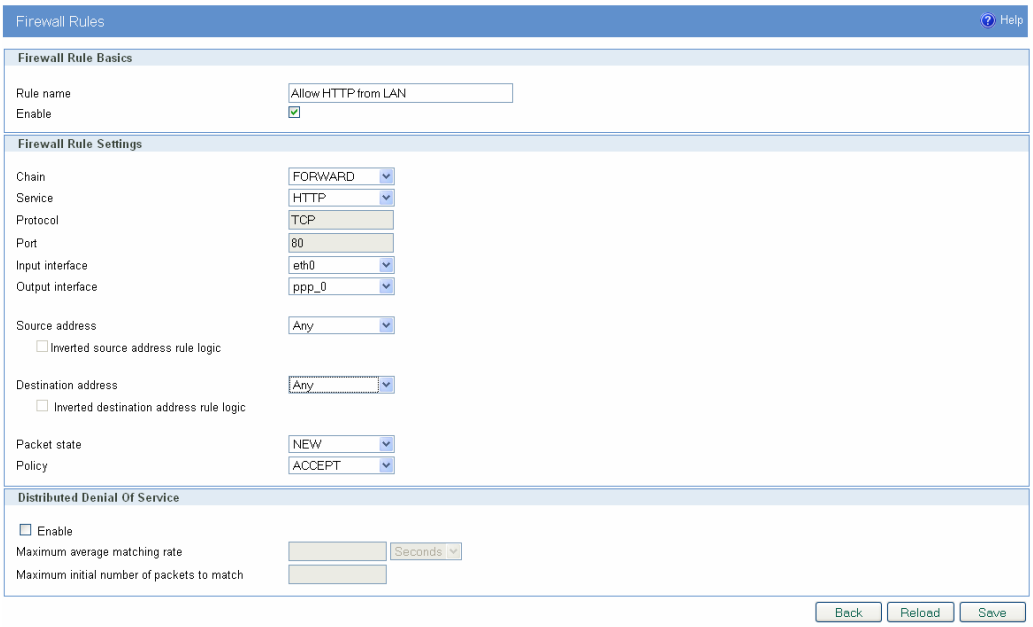


Figure 129 – Outbound rule for WEB access

After configuration is finished SAVE button should be selected and user is returned to main configuration page. **Priority of rule** is changed by selecting number in drop-down menu. In this example number 9 is selected.

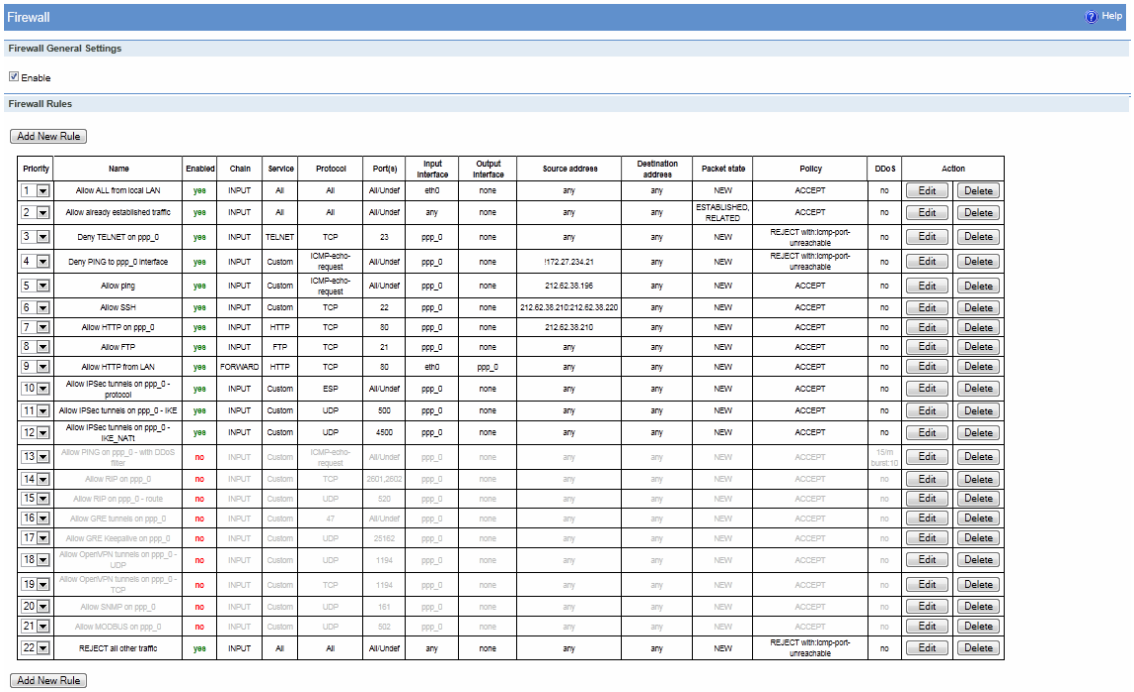
Additionally to these 11 rules two more rules are enabled:

- Allow already established traffic (priority number 2)
- Reject all other traffic (priority number 22)

After all rules are configured and saved button APPLY RULES in bottom right corner should be selected

to activate traffic filtering.

When all 13 rules from this example is configured firewall should look like this:



Priority	Name	Enabled	Chain	Service	Protocol	Port(s)	Input interface	Output interface	Source address	Destination address	Packet state	Policy	DDoS	Action	
1	Allow ALL from local LAN	yes	INPUT	All	All	All/Undef	eth0	none	any	any	NEW	ACCEPT	no	Edit	Delete
2	Allow already established traffic	yes	INPUT	All	All	All/Undef	any	none	any	any	ESTABLISHED, RELATED	ACCEPT	no	Edit	Delete
3	Deny TELNET on ppp_0	yes	INPUT	TELNET	TCP	23	ppp_0	none	any	any	NEW	REJECT with:tcmp-port-unreachable	no	Edit	Delete
4	Deny PING to ppp_0 interface	yes	INPUT	Custom	ICMP-echo-request	All/Undef	ppp_0	none	!172.27.234.21	any	NEW	REJECT with:tcmp-port-unreachable	no	Edit	Delete
5	Allow ping	yes	INPUT	Custom	ICMP-echo-request	All/Undef	ppp_0	none	212.62.38.196	any	NEW	ACCEPT	no	Edit	Delete
6	Allow SSH	yes	INPUT	Custom	TCP	22	ppp_0	none	212.62.38.210:212.62.38.220	any	NEW	ACCEPT	no	Edit	Delete
7	Allow HTTP on ppp_0	yes	INPUT	HTTP	TCP	80	ppp_0	none	212.62.38.210	any	NEW	ACCEPT	no	Edit	Delete
8	Allow FTP	yes	INPUT	FTP	TCP	21	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
9	Allow HTTP from LAN	yes	FORWARD	HTTP	TCP	80	eth0	ppp_0	any	any	NEW	ACCEPT	no	Edit	Delete
10	Allow IPSec tunnels on ppp_0 - protocol	yes	INPUT	Custom	ESP	All/Undef	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
11	Allow IPSec tunnels on ppp_0 - IKE	yes	INPUT	Custom	UDP	500	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
12	Allow IPSec tunnels on ppp_0 - IKE_NATt	yes	INPUT	Custom	UDP	4500	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
13	Allow PING on ppp_0 - with DDoS filter	no	INPUT	Custom	ICMP-echo-request	All/Undef	ppp_0	none	any	any	NEW	ACCEPT	15/m burst:10	Edit	Delete
14	Allow RIP on ppp_0	no	INPUT	Custom	TCP	2601,2602	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
15	Allow RIP on ppp_0 - route	no	INPUT	Custom	UDP	520	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
16	Allow GRE tunnels on ppp_0	no	INPUT	Custom	47	All/Undef	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
17	Allow GRE keepalive on ppp_0	no	INPUT	Custom	UDP	25162	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
18	Allow OpenVPN tunnels on ppp_0 - UDP	no	INPUT	Custom	UDP	1194	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
19	Allow OpenVPN tunnels on ppp_0 - TCP	no	INPUT	Custom	TCP	1194	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
20	Allow SNMP on ppp_0	no	INPUT	Custom	UDP	161	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
21	Allow MODBUS on ppp_0	no	INPUT	Custom	UDP	502	ppp_0	none	any	any	NEW	ACCEPT	no	Edit	Delete
22	REJECT all other traffic	yes	INPUT	All	All	All/Undef	any	none	any	any	NEW	REJECT with:tcmp-port-unreachable	no	Edit	Delete

Figure 130 – Complete firewall configuration

SMS management – example

GWR routers can be managed over the SMS messages. Commands from the SMS are executed on the router with status report sent back to the sender.

On the picture below are settings for SMS management where three mobile phone numbers are allowed to send commands to the router over first SIM card. In this example management over SIM2 is not enabled. Please have in mind that router can receive messages only on SIM card which is currently selected. This information is displayed in WAN settings page, Mobile Status, Current SIM card. SMS service center number is automatically obtained.

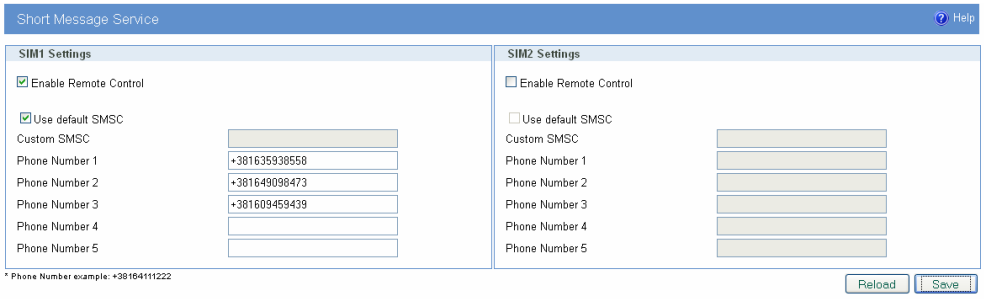


Figure 131– Configuration page for SMS management

Settings are following:

- Enable Remote Control: Enabled
- Use default SMSC: Enabled
- Phone Number 1,2…5: Allowed phone number

From the mobile phone user can send 6 different commands for router management. Commands are following:

1. *:PPP-CONNECT*
2. *:PPP-DISCONNECT*
3. *:PPP-RECONNECT*
4. *:PPP-STATUS*

Reply to this command is one of four possible states:

- CONNECTING
- CONNECTED, WAN_IP:{WAN IP address}
- DISCONNECTING
- DISCONNECTED

5. *:SWITCH-SIM*, for changing SIM slot
6 *:REBOOT*, for router reboot

After every SMS sent to the router, reply is sent back with status information about SMS received by the router.

Defining keepalive functionality

Keep-alive mechanism works through two simple steps.

First step is STANDARD ping proofing. This ping periodically checks if link is alive. Standard ping has 4 packets which are sent over the link and if all 4 are returned keep-alive remains in standard ping proofing mode. If two or more of 4 packets are dropped keep-alive activates ADVANCED ping proofing.

ADVANCED ping proofing is second step in link quality detection. Advanced ping proofing sends 5 ping packets in short period of time and gives statistic how much packets are dropped (for example if 4 packets are dropped, ping lost is 80%). If this value is defined as 100% for example, that means only if all packets are dropped action will be performed (switch SIM or PPP restart). Value which is entered here depends on that how many packets can be tolerated to lose on the link. For example if value 60% is entered 2 packets of 5 (40%) are lost, keep-alive is returned to step one (standard ping proofing) with no action performed. If PPP should be restarted only when all packets are dropped defined value should be 100%.

In following example keepalive is enabled on both SIM cards. Action defined is SWITCH SIM so router will change SIM card when link failure is detected.
Settings are following:

SIM1

Ping target: 8.8.8.8
Ping interval: 120
Advanced ping interval: 10
Advanced ping wait for response: 5
Maximum number of failed packets: 80
Keepalive action: switch SIM

SIM2
Ping target: 212.62.32.1
Ping interval: 120
Advanced ping interval: 10
Advanced ping wait for response: 5
Maximum number of failed packets: 40 (more restrictive condition compared to SIM1)
Keepalive action: switch SIM

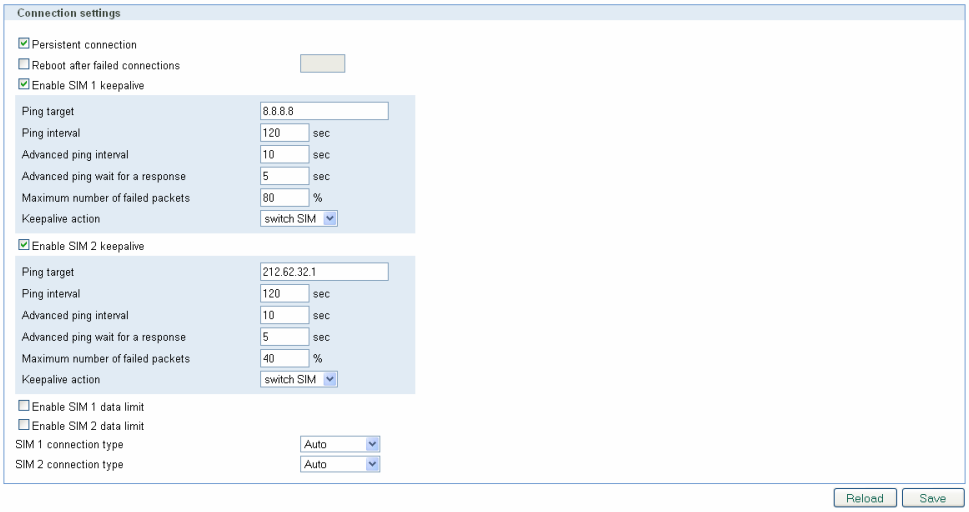


Figure 132– Configuration page for GSM keepalive

Apendix

A. How to Achieve Maximum Signal Strength with GWR Router?

The best throughput comes from placing the device in an area with the greatest Received Signal Strength Indicator (RSSI). RSSI is a measurement of the Radio Frequency (RF) signal strength between the base station and the mobile device, expressed in dBm. The better the signal strength, the less data retransmission and, therefore, better throughput.

RSSI information is available from several sources:

- The LEDs on the device give a general indication.
- Via the GWR Router local user interface.

Signal strength LED indicator:

- –101 or less dBm = Unacceptable (running LED),
- –100 to –91 dBm = Weak (1 LED),
- –90 to –81 dBm = Moderate (2 LED),
- –80 to –75 dBm = Good (3 LED),
- –74 or better dBm = Excellent (4 LED),
- 0 is not known or not detectable (running LED).

Antenna placement

Placement can drastically increase the signal strength of a cellular connection. Often times, just moving the router closer to an exterior window or to another location within the facility can result in optimum reception.

Another way of increasing throughput is by physically placing the device on the roof of the building (in an environmentally safe enclosure with proper moisture and lightning protection).

- Simply install the GWR Router outside the building and run an RJ–45 Ethernet cable to your switch located in the building.
- Keep antenna cable away from interferers (AC wiring).

Antenna Options

Once optimum placement is achieved, if signal strength is still not desirable, you can experiment with different antenna options. Assuming you have tried a standard antenna, next consider:

- Check your antenna connection to ensure it is properly attached.
- High gain antenna, which has higher dBm gain and longer antenna. Many cabled antennas require a metal ground plane for maximum performance. The ground plane typically should have a diameter roughly twice the length of the antenna.

NOTE: Another way of optimizing throughput is by sending non–encrypted data through the device. Application layer encryption or VPN put a heavy toll on bandwidth utilization. For example, IPsec ESP headers and trailers can add 20–30% or more overhead.

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