

AUTOMOTIVE WIRELESS ROUTER WITH LTE CAT-6 AND WI-FI 5



CONFIGURATION MANUAL

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1 IMPORTANT INFORMATION

1.1 Disclaimer

1.1.1 Copyright

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```
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You should have received the following text in an "About" box (see also Web Interface Status → Advanced) together with the product. Here it is replicated for reference:

```
This software product contains software covered by the GNU GPL license.
A list of all modules and their licenses ("FOSS" list) is available on
request, as is the source code of all GPL-covered modules. For details
and GPL text, see the Software Configuration Manual, available on
<https://www.eltec.com>. In case of problems use the
mail (street) address below.
Request FOSS and sources with a mail to:
Westermo Eltec GmbH
Galileo-Galilei-Str. 11
55129 Mainz
Germany
```

1.1.3 Regulatory Limits for Changes in Country and Transmit Power Settings

Make sure that only persons with proper knowledge also in regulatory matters have access to the access point's configuration settings. They must be aware of the consequences of an improper setting of country and transmit power (there may be additional settings). To do so, the standard configuration password must be changed before the access point is deployed. This new password must be given to knowledgeable and responsible persons only.

One example of a regulation affecting country selection is that in Germany, as of October 2016, the frequencies in the range 5150 MHz - 5350 MHz must be used in closed rooms and similar environments only. For more information please see www.bundesnetzagentur.de.

1.2 Known Issues

• When operating WLAN in 11ac mode, the transmit data rate is erroneously wrongly reported as 6 Mbit/s.

2 ABOUT THIS DOCUMENT

This configuration manual is intended for system developers and integrators. It is not intended for end users. It describes the firmware functions of the access point/router/gateway product family and provides information for special applications and configurations of the product.

This manual is intended to guide through the configuration process of an Access Point/Router/Gateway (the names of which are used interchangeably for this manual) for use in a train or bus. We tried to cover the main aspects of this task, including

- Backup and restore of configurations
- Install new firmware versions
- Handling of IP addresses, DHCP, VLAN, VPN, firewall
- Configuration of WiFi and LTE
- MWAN configuration for multiple WAN connection
- Westermo Eltec's train coupling, wireless backbone protocol ICCP
- Remote administration via SNMP
- Scripting and UCI.

Not covered is a complete list of all functions and of all configuration elements in detail.

Information about mechanical and electrical installation of the access points is available in a separate product-specific installation manual which can be downloaded from the Download Center at www.eltec.com.

2.1 Information about Formatting

In the following sections, text formatted like this refers to titles, tabs, boxes, menu names, group names, keys, and other descriptive text on the web-based configuration user-interface ("LuCI"). They are grouped by "→".

This markup is used for all navigation elements needed to access settings, independent from the elements used to click on them or just for visual grouping.

A typewriter font is used for text typed in.

The internal version of this document is 436a4b5.

3 ABOUT THE CyBox RT 2-A

The CyBox RT 2-A is a member of the CyBox family of robust wireless communication routers. It is particularly designed to meet the requirements of automotive applications. It offers stable, secure, and broadband LTE connections for data exchange via vehicle-to-ground connections and high-speed internet.

The CyBox RT 2-A hosts two LTE modems, two independent Wi-Fi radios, a 5-port Ethernet switch (one port being occupied by CyBox RT 2-A itself), an additional Ethernet port and a CAN port. It can be used to connect multiple mobile wireless clients to the internet on a long distance bus for example.

The CyBox RT 2-A firmware provides a convenient management interface via a web service. Besides global setup parameters the open source software allows the configuration of the radio interfaces, such as channel selection, SSID, encryption keys, and firewall setup. The access point and router configurations as well as the management firmware can be updated remotely.

The firmware of the device is based upon Linux and OpenWRT. For Open Source information see the preface.

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4 HOW TO ACCESS THE CyBox RT 2-A

The CyBox RT 2-A can be configured in several ways:

- 1. The graphical web interface
- 2. The command line interface via a SSH or serial connection, see 9 SSH / SERIAL CONSOLE
- 3. Using an USB stick (to update the firmware or apply a prepared configuration, see 10.2 USB Possibilities)
- 4. Using SNMP (see 7 SNMP)

4.1 IP Addresses of the CyBox RT 2-A

By default, the CyBox RT 2-A is accessible through the following IP addresses (see figure The page Network \rightarrow Interfaces (default settings)):

- 192.168.100.1 (LAN)
- An address obtained using DHCP (if possible LAN_DHCP)
- An address derived from the serial number (LAN_ALIAS)
- An address derived from the MAC of the first Ethernet port (LAN_MAC)

The LAN_ALIAS address is derived from the serial number (which is printed on the type plate) as follows (Example Serial Number: EL303289):

- 1. Strip non-digits: 303289
- 2. Print as six-digit hex value: 0x04A0B9
- 3. Use the upper 8 bits for x, the middle for y and the lower for z: x=0x04 y=0xA0 z=0xB9
- 4. Convert x,y,z to decimal: x=4 y=160 z=185
- 5. The LAN_ALIAS address is 10.4.160.185

In a similar manner, the LAN_MAC address is derived from the MAC address of the first Ethernet interface, which is printed on the type plate (example MAC 00:00:5B:04:AE:03):

- 1. Take the last three bytes: 04:AE:03
- 2. Use the upper 8 bits for x, the middle for y and the lower for z: x=0x04 y=0xAE z=0x03
- 3. Convert x,y,z to decimal: x=4 y=174 z=3
- 4. The LAN_MAC address is 10.4.174.4

You can delete unneeded network interfaces by clicking on the red "Delete" button in the web interface.

Status	LAN LAN_ALIAS L	AN_DHCP LAN_MAC MO	DEM_S1 MODEM_S	S2	_	_	_
System	Interfaces						
VPN		Protocol: Static address					
Services	LAN_ALIAS	Uptime: 0h 3m 42s MAC: 00:00:5B:04:AE:03					
Network	eth0	RX: 61.06 KB (585 Pkts.) TX: 364.48 KB (727 Pkts.)		Restart	Stop	Edit	Delete
Interfaces		IPv4: 10.4.160.185/8					
Wireless	LAN_DHCP	Protocol: DHCP client MAC: 00:00:5B:04:AE:03				T (1)	
DHCP and DNS	eth0	RX: 61.06 KB (585 Pkts.) TX: 364.48 KB (727 Pkts.)		Restart	Stop	Edit	Delete
Hostnames		Protocol: Static address					
Static Routes	LAN_MAC	Uptime: 0h 3m 42s MAC: 00:00:5B:04:AE:03					
Diagnostics	eth0	RX: 61.06 KB (585 Pkts.)		Restart	Stop	Edit	Delete
Firewall		TX: 364.48 KB (727 Pkts.) IPv4: 10.4.174.3/8					
Client Isolation		Protocol: Static address					
Connection Check	LAN	Uptime: 0h 3m 42s MAC: 00:00:5B:04:AE:03					
QoS	E .	RX: 61.06 KB (585 Pkts.)		Restart	Stop	Edit	Delete
Configure Diagnostics	eth0	TX: 364.48 KB (727 Pkts.) IPv4: 192.168.100.1/24					
Load Balancing		IPv6: fdb9:bebd:8f2::1/60					
Statistics	MODEM S1	Protocol: ModemManager RX: 0 B (0 Pkts.)					
	<u>P</u>	TX: 0 B (0 Pkts.)		Restart	Connect	Edit	Delete
Logout	wwan_S1_0	Information: Not started on Error: Unknown error (sim-m					
Logoui		Protocol: ModemManager	0,				
	MODEM_S2	RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.)		Restart	Connect	Edit	Delete
	wwan_S2_0	Information: Not started on		Restart	Connect	Luit	Detete
		Error: Unknown error (sim-n	nissing)				
	Add new interface						
	Global network op	tions					
	IPv6 ULA-Prefix	ſ	db9:bebd:08f2::/48				
					Save	e & Apply	Save Reset

The page Network \rightarrow Interfaces (default settings)

4.2 Getting to the Web Interface

Before accessing the web interface, your computer must be connected to the Ethernet port LAN 1, and it must be configured to use the same subnet as the CyBox RT 2-A.

The web interface is accessible using HTTPS on the IP addresses listed in 4.1 IP Addresses of the CyBox RT 2-A (default: https://192.168.100.1/ in the subnet 192.168.100.0/24). It uses a self-signed SSL certificate. Your browser should warn you about that. You can either accept the certificate or fall back to HTTP: http://192.168.100.1/.

On the login web page, use username root and password root. Of course, you should 5.1 Change Password as soon as possible.

Once connected, you can navigate through the different tabs to start configuration. A few rules apply:

- To apply and also save your configuration, click on the button Save && Apply on the bottom-right corner of most pages. Not clicking on this button will discard your modifications.
- Saved configurations will be kept after a reboot.
- If IP addresses are changed, the Access Point must be addressed under the new URL in the browser.



5 QUICK START GUIDE

This chapter describes the steps to configure standard access point operation. The device must be electrically connected (see installation manual). Factory default settings are used.

This chapter shows some common use-cases and an exemplary implementation for each.

When the CyBox RT 2-A configuration requires deep changes, e.g. for a new use-case, there is some risk that previous (maybe meanwhile forgotten) settings get into conflict with the new configuration. Thus it is recommended to start the configuration from factory default settings. Pressing the hardware reset switch for more than 5 seconds will restore the factory settings.

The web interface provides the same function: System → Backup / Flash Firmware → Perform reset.

For all below configuration examples, the following initial situation is assumed:

- CyBox RT 2-A is running
- CyBox RT 2-A has been reset to factory defaults, the IP address is 192.168.100.1
- Default Root-User password: 'root'
- Operator workstation and CyBox RT 2-A are connected via Ethernet
- Workstation browser is logged-in to the CyBox RT 2-A web interface
- Operator is additionally logged in to CyBox RT 2-A via SSH (if available, a serial console terminal would be preferable).

In the following examples [square brackets] are used to indicate actions not requiring operator interaction because they happen automatically or have already been done (mentioning them here might be useful for checking configuration is on the right way).

5.1 Change Password

The password should be changed first to avoid legal consequences as described in the preface. The default user/password is'root'/'root'. To change it, go to System \rightarrow Administration, type new password and click Save.

Status	Router Password SSH Access SSH-Keys	
System	Router Password	
System	Changes the administrator password for accessing the c	levice
Administration	Password	*
Startup		
Scheduled Tasks	Confirmation	*
Mount Points		Password strength:
Backup / Flash Firmware		σιε
Custom Commands		Save

Change Password

5.2 Change LAN IP address (Quick Guide)

The factory default IP address 192.168.100.1 must be changed to meet your network topology. Open Network → Interfaces and click the Edit button of the LAN interface. Modify the IP address (IPv4 address field), or change the Protocol field to DHCP client, then click on Save && Apply. To regain access to the web interface, you must type the new IP address in your browser.

General Settings Advanced Setting Status	Device: eth0 Uptime: 1h 27m 45s
Status	Uptime: 1h 27m 45s
	MAC: 00:00:5B:03:B5:79 RX: 1.49 MB (8494 Pkts.) TX: 2.14 MB (3808 Pkts.) IPv4: 192.168.100.1/24 IPv6: fd96:db0e:c0f1::1/60
Protocol	Static address -
Bring up on boot	
IPv4 address	192.168.100.1
IPv4 netmask	255.255.255.0
IPv4 gateway	
IPv4 broadcast	192.168.100.255
Use custom DNS servers	+
IPv6 assignment length	60 Assign a part of given length of every public IPv6- prefix to this interface
IPv6 assignment hint	0 Assign prefix parts using this hexadecimal subprefix ID for this interface.
IPv6 suffix	 Dptional. Allowed values: 'eui64', 'random', fixed value like '::1' or '::1:2'. When IPv6 prefix (like 'a:b:c:d::') is received from a delegating server, use the suffix (like '::1') to form the IPv6 address ('a:b:c:d::1') for the interface.

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LAN Configuration Example

5.2.1 Disabling IPv6

The custom helper script under System \rightarrow Custom Commands \rightarrow Dashboard will modify the network / firewall configuration to disable all IPv6 network traffic. Normally all network interfaces have an automatic IPv6 address applied. If your environment has no need for IPv6 network traffic, you should use this script in early configuration steps, to remove every IPv6 address setup form network interfaces and to remove IPv6 firewall rules. Note that the Run button has to be executed twice. The first time is only for user information. The configuration modification is permanent.

Status	Dashboard				
System	Custom Commands				
System Administration Startup Scheduled Tasks	System Information	System IPv6 Disable Command: disable_ipv6_support	Wireless Info Command: wireless_info		
Mount Points Backup / Flash Firmware Custom Commands	Run Download	Run Download	Run Download		
License Reboot Ignition Timer VPN Services	ICCP Config Command: cfg_iccp Arguments: Run Download	Modem Information Command: modem_info Run Download	Modem Manager Debug Command: modemmanager_debug Arguments: Run Download		
Network Statistics Logout	Modem Gateway Command: modem_gateway Arguments:	Modem Speedtest Command: modem_speedtest Arguments:	Modem Factory Reset Command: modem_factory_reset Arguments:		
	Run Download Run Download # "disable_ipv6_support" This script will remove IPv6 support from the current configurtion. This script only needs to run once. New settings are saved to 'network' and 'dhcp'. Firewall rules with family=ipv6 are removed form configuration. As finished the firewall IPv6 traffic counters should be zero. This is the first call without action - Run again to apply new settings. Command failed (Code: 256)				

Disable network IPv6 support - first run

5.3 Example: Local Access Point

As a first step, a simple access point is configured. The wired Ethernet and the wireless radios form an isolated local domain where the CyBox RT 2-A provides DHCP services. Finally the example in "LAN IP Address" shows how to set a new static IP address. In Network > Interfaces \rightarrow LAN \rightarrow Protocol you can configure the DHCP client setup to obtain an IP address from a DHCP server in your network. The access point and its clients become part of another local domain where DHCP, DNS, and a gateway are provided, connecting the CyBox RT 2-A and its clients to higher-level networks.

5.3.1 System Settings

- Select System → System (yes, two System tabs nested).
- In box System Properties select tab General Settings: adjust the entries as needed; button Sync with browser is useful for cases where no NTP server is available. Tabs Logging and Language and Style may be ignored for now.
- In the tab Time Synchronization: adjust the entries if needed.
- Click button Save && Apply



5.3.2 Prepare WLAN Radio Interface

- Select Network → Wireless: this shows the wireless controllers *radio0* and *radio1* with some software buttons
- Select tab radio0: Unknown "OpenWrt" or click the Edit button of radio0
- In box Device Configuration:
 - Select tab Advanced Settings
 - In drop-down menu Country Code, select the country of the current location
 - Select tab General Setup
 - In drop-down menu *Mode*, select a mode, usually *N* or *AC*
 - In drop-down menu *Channel*, select a channel (or *auto*)
- If needed, select an appropriate value in drop-down menu Transmit Power
- In box Interface Configuration:
 - [Select tab General Setup]
 - Enter an arbitrary ESSID (will be quoted below as "WLssid")
 - [Mode: select Access Point]
 - [Field Network: activate checkbox lan]
 - [Field Network: clear checkbox create]
 - If needed, activate checkbox Hide ESSID
 - Select tab Wireless Security
 - In drop-down menu Encryption, select as needed
 - In drop-down menu Cipher, select auto unless a specific algorithm is required
 - Enter encryption Key at least 8 characters
- Click button Save & Apply
- Select Network \rightarrow Wireless
 - For radio0, click button *Enable*

At this point, the radio interface should become visible to possible WLAN clients and vice versa. Probably clients need to be prompted to scan for available wireless networks. Then, those clients will become visible in tab *Network*, tab *WiFi*, box *Associated Stations*.

5.3.3 Connect radio0 to the Network

- Select tab Network tab Interfaces tab LAN
- In box Common Configuration
 - Select tab *Physical Settings*:
 - Bridge interfaces: activate checkbox
 - [Enable STP: clear checkbox Spanning Tree Protocol on this bridge]
 - [Interface : activate checkbox Ethernet Adapter: "eth0"]



- Interface : activate checkbox Wireless Network: Master "<SSID>"
- [Interface : clear checkbox Custom Interface]
- In box DHCP Server
 - Select tab General Setup
 - Clear checkbox Disable DHCP for this interface
 - If needed, modify more things in tab General Setup and tab Advanced Settings
- Click button Save & Apply

Now the CyBox RT 2-A connects the Ethernet and all WLAN clients in the local domain 192.186.100.0 and provides a local DHCP service, but there is not yet an uplink to a gateway.

5.3.4 Connecting to WAN

As a goal, the CyBox RT 2-A shall integrate its clients via Ethernet in a higher-level network. DHCP, DNS, and gateway services are supposed to be available in that net.

- Select tab Network tab Interfaces tab LAN
- In section Common Configuration:
 - In drop-down menu Protocol, select DHCP Client
 - Click button Switch Protocol
- Click button Save & Apply

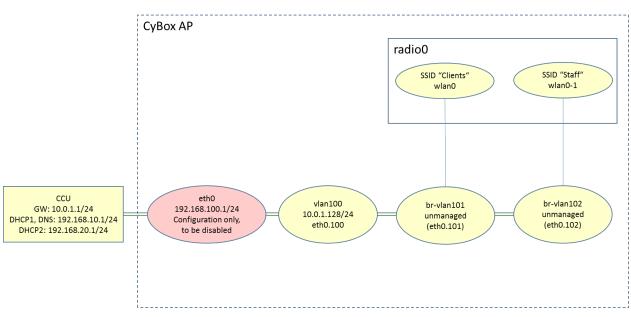
This terminates the local domain 192.186.100.0. Now connect the CyBox RT 2-A via Ethernet to the gateway domain, restart the CyBox RT 2-A (use hardware reset switch) and reconnect the WLAN clients.

5.4 Example: Connecting three VLANs to a server

In this use-case the access point provides 3 VLAN interfaces:

- one for management access via wired Ethernet, using a static IP address
- an unmanaged WLAN access for "clients", no encryption
- another unmanaged WLAN access for "staff" members, encrypted, optional hidden SSID

The access point is connected via Ethernet to a server (or a host computer, called CCU in the illustration below) providing DHCP, DNS, and gateway services. Starting from factory defaults, apply system settings as described in section 7.2.1 (if needed).



Westerma

Network Topology with Three VLANs

5.4.1 Create the Management VLAN

Create a new Ethernet interface (eth0.100) and give it the name "vlan100". Make it a full-valued net host by assigning a static address and a gateway.

- Select tab Network tab Interfaces
- Click button Add new interface
- Enter Name of new interface: "vlan100"
- [Select Protocol of the new interface: Static address]
- [Clear checkbox "Create a bridge over multiple interfaces"]
- Enter name of Custom Interface: "eth0.100"
- Click button Submit
- [page VLAN100 opens]
- [Tab Network tab Interfaces tab VLAN100 tab General Setup]
 - Enter IPv4 address "10.0.1.128"
 - Select IPv4 netmask 255.255.255.0
 - Enter IPv4 gateway "10.0.1.1"
- Click button Save & Apply

5.4.2 Add two unmanaged VLANs

We create 2 more Ethernet interfaces eth0.101 and eth0.102 with names vlan101 and vlan102, resp.

- Network Interfaces: Add new interface → Name of new interface: "vlan101"
- Protocol of new interface: Unmanaged
- [Clear Create a bridge over multiple interfaces]
- Custom Interface: "eth0.101 "



- Submit
- [page VLAN101 opens]
- Click button Save & Apply

Do the same for "vlan102" and "eth0.102".

5.4.3 Configure and Enable the radio(s)

You are free which interface to assign to which radio. If both radios are to be used then this section (7.3.3) must be done for *radio1* as well.

- Select tab Network -> tab WiFi -> tab radio0 (or click button Edit for radio0)
- In box Device Configuration:
 - Select tab Advanced Settings
 - Select Country Code
 - Select Mode

The following 3 lines fix a problem with this LuCI page (The drop-down menu for the country code is not updated correctly)

- Click button Save & Apply
- Logout / Login
- Select tab Network -> tab WiFi -> tab radio0 (or click button Edit for radio0)

Now we can complete the configuration for *radio0*:

- In box Device Configuration:
 - Select tab Advanced Settings
 - Select HT mode
 - Select Channel
 - Select Transmit Power
- Click button Save & Apply
- Select tab Network -> tab WiFi
- Click button Enable for radio0

5.4.4 Attach the "Clients" VLAN to radio0

- Select tab Network -> tab WiFi -> tab radio0 (or click button Edit for radio0)
- In box Interface Configuration:
 - [Select tab General Setup]
 - Enter ESSID "Clients"
 - Clear checkbox lan
 - Activate checkbox vlan101
- Click button Save & Apply

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5.4.5 Attach the "Staff" VLAN to radio0

- Select tab Network tab WiFi
- Click button Add for radio0 (if both VLANs shall run on the same radio).

Alternatively, if the "Staff" shall use the other radio and that radio has been configured and enabled (see 7.3.3), then (instead of *Add*) select tab *Network* tab *WiFi* tab *radio1* (or click button *Edit* for *radio1*)

- In box Interface Configuration:
 - [Select tab General Setup]
 - Enter ESSID "Staff"
 - [Clear checkbox lan]
 - Activate checkbox *vlan102*
 - If needed, set checkbox Hide ESSID
 - Select tab Wireless Security
 - Select Encryption (e.g. WPA2-PSK)
 - Enter Key (at least 8 characters)
- Click button Save & Apply

5.4.6 Check Configuration

As a check, you may login to the CyBox RT 2-A through SSH and issue the ifconfig command. The following interfaces should be shown:

```
br-vlan101 Link encap:Ethernet ...
br-vlan102 Link encap:Ethernet ...
eth0 Link encap:Ethernet
inet addr:192.168.100.1 Bcast:192.168.100.255 Mask:255.255.255.0
...
eth0.100 Link encap:Ethernet
inet addr:10.0.1.128 Bcast:10.0.1.255 Mask:255.255.255.0
...
eth0.101 Link encap:Ethernet ...
eth0.102 Link encap:Ethernet ...
lo Link encap:Local Loopback ...
wlan0 Link encap:Ethernet ...
wlan0 Link encap:Ethernet ...
```

Oder alternativ (anstelle von wlan0-1), wenn beide Funkmodule verwendet werden:

```
wlan1 Link encap:Ethernet ...
```



5.4.7 Disable Unneeded Default Address

After successfully testing the VLAN-based management access (vlan100), the default address 192.168.100.1 may be disabled. This is easily achieved by deleting the *LAN* interface:

- Select tab Network tab Interface
- Click button Delete for the LAN interface (usually the lowermost)
- Select tab Network tab Interfaces tab LAN

Alternatively, you may change the protocol of the LAN interface to Unmanaged:

- Select tab Network tab Interface tab LAN
- In box Common Configuration:
 - In drop-down menu Protocol select Unmanaged
- Click button Save & Apply

5.5 Example: Client Isolation within the Access Point

By default, all clients of an access point can directly communicate with each other. Depending on the use case, this might be undesirable.

5.5.1 Isolate the Radio Clients

- Select tab Network -> tab WiFi -> tab radio0 (or click button Edit for radio0)
- In box Interface configuration
 - Select tab Advanced settings
 - Activate checkbox Separate clients
- Click button Save & Apply
- Do the same for the other radio

5.5.2 Restrict Access to Local Ports to Specified Interfaces

- Select tab System tab Administration
- In box Dropbear Instance
 - Click radio button lan
 - [unselect radio button unspecified]
- Click button Save & Apply

This affects the mentioned port only. To protect more ports against WLAN access, use button *Add*.

Note that all interfaces listed in the *lan* field are allowed to access the respective socket.

6 THE WEB INTERFACE

Most pages of the web interface are concerned with the configuration of the CyBox RT 2-A. Many of these pages show some of the following buttons:

- Reset: clicking on this button reverts the unsaved input fields of the current page to the values as they were before you modified them.
- Save: This button copies the modified input fields of the current page to an intermediate memory. It collects changes without applying them to the CyBox RT 2-A. This is important because some changes if applied stand-alone could break the IP connection between host and the CyBox RT 2-A.

When clicking this button, a change count notification appears at the upper left, indicating the number of to-be-changed lines in the configuration data (The actual text in that message is kind of misleading: it claims to state the number of "unsaved changes" but actually means the number of saved but not yet applied new configuration lines.)

It should be noted, that saved data are not longer subject to the *Reset* button. Rather, saved changes - if not applied - are kept until you click the <u>Save && Apply</u> button, or the <u>Revert</u> button (see below), or CyBox RT 2-A reboots. The configuration is not yet complete as long as the change count is non-zero.

- Revert: Clicking on the change count message pops up an extra window showing the data exactly as they would be entered into the related configuration files. This window provides a button named Revert. Clicking it invalidates the saved changes and clears the change count to zero.
- Save && Apply: this button performs the *Save* operation (see above), modifies the configuration data according to the saved changes, and clears the change count. Please note that Revert and Reset *cannot* undo those changes after a *Save & Apply* operation! Also, depending on the specific parameters changed, networking interfaces are re-initialized with the new data. In consequence, the host-side browser might require to connect a new IP address to access the CyBox RT 2-A.
- Submit: Some pages provide a single Submit button instead of the above. Essentially, Submit performs an immediate Save operation. Thus, the change count in the upper left corner of the screen will increment. The Save operation also takes place when clicking special buttons like Add new interface or Setup DHCP Server. Again, the change count will change. In these cases, Save & Apply is needed to complete the operation.
- Buttons named Enable or Disable cause immediate execution.

6.1 Network

6.1.1 Interfaces

6.1.1.1 DHCP Server per Interface

A DHCP server can run on the device to assign IPv4 addresses to WLAN clients. It is enabled by unchecking *Disable DHCP for this interface*. However, DHCP often is managed by a dedicated DHCP server on the backbone and not directly on the access point. In that case, the DHCP server on the access point must be disabled.

6.1.1.2 Bridges

Physical network interfaces may be bridged to form a "software Ethernet switch". For example, by bridging the LAN 1 interface with a wireless interface, WLAN clients can communicate with LAN clients like they were connected by a switch.

To set up a bridge, use the tab Network \rightarrow Interfaces \rightarrow Devices menu. Use the Add device configuration ... button to set up a new Linux device as bridge type. To be compatible with older OpenWrt versions the new Linux device could be named "br-lan".

tatus	Interfaces Devices Glo	bal network options				
ystem	Devices					
ervices						
etwork	Device	Type	MAC Address	мти	Configuration (Reset
nterfaces	₫ [¢] br-lan	Bridge device	-	-	Configure	
Wireless	bond0	Network device	BE:34:46:F4:B7:A6	1500	Configure	Reset
DHCP and DNS	<pre>bonding_masters</pre>	Network device	-	-	Configure	Reset
Hostnames	Jummy0	Network device	CA:6A:F8:4D:A9:D7	1500	Configure	Reset
Static Routes	erspan0	Network device	00:00:00:00:00:00	1450	Configure	Reset
Diagnostics	Jeth0	Network device	00:00:5B:00:11:22	1500	Configure	Reset
Firewall	eth1	Network device	00:00:5B:00:22:33	1500	Configure	Reset
Configure Diagnostics	@wlan0	Network device	04:F0:21:3F:2E:53	1500	Configure	Reset
oad Balancing	<pre>wlan1</pre>	Network device	04:F0:21:3F:C6:47	1500	Configure	Reset
Client Isolation		_	041 0.2 1.01 .00.47	1000	comgare	Nebec
Connection Check	Add device configuration.					
QoS					Save & Apply 🔻	Save Res

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Bridge Interface Create

Bridge device: br-lan			
General device options Advanced device options	Bridge VLAN filtering		
Device type	Bridge device 🗸		
Device name	br-lan		
Bridge ports	🛃 eth0 🔽		
	Ethernet Adapter: "bond0"		ch wireless
	Ethernet Adapter: "bonding_masters"		eless settings.
Bring up empty bridge	Ethernet Adapter: "dummy0"		
	Ethernet Adapter: "erspan0"		
МТЦ	Ethernet Adapter: "eth0" (lan, lan_alias	, lan_dhcp, lan_mac)	
мто	Ethernet Adapter: "eth1" (wan, wan6)		
MAC address	custom		
TX queue length			
Enable IPv6			
IPv6 MTU			
DAD transmits	1		
	Amount of Duplicate Address Detection presented and the second	robes to send	
			Dismiss Save

Bridge Interface Configure

The configuration specifies the wired ports to attach to this bridge. In order to attach wireless networks, choose the associated interface as network in the wireless settings.

Check Bridge interfaces and include all Interfaces that should belong to the new bridge interface.

In older OpenWrt version the LAN interface automatically created the physical device "br-lan" if bridging was enabled. Since this is no longer done automatically the LAN interface now should be set to *br-lan* instead of *ethO* and also to have this new bridge device in the green firewall zone.

Note that radio interfaces like *wlan0* or *wlan1* will be part of the *br-lan* bridge by selecting the LAN interface in the wireless configuration menu.

LAN	Protocol: Static address Uptime: 0h 0m 46s MAC: 00:00:5B:00:11:22				
ø⊅ (⊉∰) br-lan	RX: 99.02 KB (840 Pkts.) TX: 457.70 KB (760 Pkts.) IPv4: 192.168.100.1/24 IPv6: fd06:31d5:c969::1/60	Restart	Stop	Edit	Delete

LAN Interface Status



Interfaces » LAN						
General Settings Advanced Settings Firewall Setting	ngs DHCP Server					
Status	Device: br-lan Uptime: 0h 1m 6s MAC: 00:00:5B:00:11:22 IF RX: 117.09 KB (1043 Pkts.) TX: 570.09 KB (927 Pkts.) IPv4: 192.168.100.1/24 IPv6: fd06:31d5:c969::1/60					
Protocol	Static address v					
Device	§≶ br-lan ▼					
Bring up on boot						
IPv4 address	192.168.100.1					
IPv4 netmask	255.255.255.0					
IPv4 gateway	192.168.1.1 (lan_dhcp)					
IPv4 broadcast	192.168.100.255					
	Dismiss Save					

Set LAN Interface to use physical device br-lan

Note: Physical interfaces, as eth0 or wlan0, belonging to a network interface, such as LAN, cannot be in any other network interface.

6.1.1.3 VLAN

To enable VLAN (virtual LAN, mostly used for logical subnets built on real LANs) tagging, a new custom interface must be set up for the *LAN*. The VLAN interfaces are named e.g. "eth0.100". In this example "100" is the VLAN tag to be used.

Add device configuration	
General device options Advanced device opti	ons
Device type	VLAN (802.1q)
Base device	jen eth0 ▼
VLAN ID	100
Device name	eth0.100
MTU	1500
MAC address	00:00:5B:00:11:22
TX queue length	1000
Enable IPv6	
IPv6 MTU	1500
DAD transmits	1 @ Amount of Duplicate Address Detection probes to send
	Dismiss Save

VLAN interface setup

Use *eth0.X* as custom interface and disable *eth0* as shown in the dialog above.

WARNING: After saving and applying the changes, the network output on *eth0* is tagged with your VLAN tag and the AP will not be accessible through normal network anymore. You need to enable VLAN tagging on the host interface, or connect to a switch that is able to handle this VLAN tag to be able to access the AP.



6.1.1.4 LTE

This chapter shows how to connect the CyBox RT 2-A to a mobile LTE network.

By using the WLAN modules, CyBox RT 2-A can be turned into a WLAN hotspot.

6.1.1.4.1 Configuring LTE

The CyBox RT 2-A provides 2 SIM slots per LTE modem. Only one slot per modem can be active at any time. The slots can be selected via an SNMP command or using the web interface.

Note: Switching between SIM slots takes about 30 seconds, Slot 1 being preselected at power up. If you plan to use only one SIM card for a given LTE modem, it is advisable to use Slot 1 to avoid slot switching delay during the boot phase.

To access the SIM cards, the cover must be removed. It is secured with two Torx T10 screws. Insert the SIM cards at the desired position. The contacts of the SIMs must be faced toward the circuit board. Finally, mount the cover again.

The LTE configuration requires the following parameters which can be requested from the LTE provider:

- PIN code of the SIM card
- APN (Access Point Name)
- Username (most often empty)
- Password (most often empty)

On the page Network → Interfaces, click the Edit button for the modem to be configured (e.g. Modem_S1). On the appearing page the active slot is chosen and the LTE parameters are configured (see next Figure):

Status	LAN MODEM_S1 MODEM_S2					
System	Interfaces - MODEM_S1					
VPN	On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge interfaces" field and enter the					
Services	names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANNR (e.g.: eth0.1).					
Network	Common Configuration					
Interfaces	General Setup Advanced Settings Physical Setting	Firewall Settings				
Wireless	Status	Device: wwan S1 0				
DHCP and DNS		RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.)				
Hostnames						
Static Routes	Protocol	ModemManager _				
Diagnostics	Bring up on boot					
Firewall	SIM card slot	Slot 1				
Client Isolation						
Connection Check	SIM Card Configuration					
QoS Configure Diagnostics	SIM Slot 1 SIM Slot 2					
Load Balancing	PIN	*				
Statistics	APN					
Logout		Always use provider APN				
	Username	*				
	Password	*				
	Back to Overview		Save & Apply Save Reset			

The modem configuration page

• In the section SIM Card Configuration, enter the configuration for each SIM card. Do so by first selecting a tab (e.g. SIM Slot 1) and then enter the corresponding configuration. Note that these tabs do no influence which SIM is actually active. For each SIM card:

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Interfaces » modem_S1		
General Settings Advanced Settings Firewall	Settings DHCP Server SIM1 SI	M2 SIM3 SIM4
PIN	0000	
APN	web.vodafone.de	
Username		
Password		
Allowed Authentication Method	None	~
ІР Туре	IPv4 only	v
Alive Ping Address		
	Ping address to check if cor	nnection is alive. Default(empty) is 8.8.8.8.
		Dismiss Save

The SIM slot configuration page

- Enter the **PIN** of the SIM card. Take care to enter the PIN on the correct tab, as a wrong configured **PIN** may lead to SIM card locking.
- Enter the APN, Username and Password as supplied by the LTE provider.
- Enter the **Allowed Authentication Method**, if the LTE provider has special requirements. The method is either PAP, CHAP or both PAP/CHAP. The default is empty, so no special requirements.
- Enter the **Alive Ping Address** if the LTE provider has special requirements. The default value is empty (means 8.8.8.8). This address should be accessible at all times for a standard internet connection.

Complete the configuration by pressing the Save & Apply button. The modem needs to be (re)started in order to re-detect the SIM card. You can do so on the Network → Interfaces page by clicking Restart for the modem. After a short while, the info box for the modem shows an IPv4 address, and any Error message in the box disappears:

MODEM_S1	Protocol: ModemManager Uptime: 0h 1m 23s				
wwan_S1_1	MAC: 00:00:00:00:00:00 RX: 4.25 KB (44 Pkts.) TX: 3.76 KB (49 Pkts.) IPv4: 10.51.68.104/28	Restart	Stop	Edit	Delete

MODEM_S1 is now connected

After the LTE connection was established, a "ping" test can verify that a connection to the internet is actually available. Go to Network \rightarrow Diagnostics and press Ping. Instead of pinging the default host "openwrt-project.org" you might as well use another one. The figure below shows a successful run of the test.



Status	Diagnostics	
System	Network Utilities	
VPN		
Services	openwrt.org	openwrt.org
Network	IPv4 T Ping	IPv4 - Traceroute
Interfaces	PING openwrt.org (139.59.209.225):	56 data bytes

VPN			
Services	openwrt.org	openwrt.org	openwrt.org
Network	IPv4 Ping	IPv4 Traceroute	Nslookup
Interfaces	PING openwrt.org (139.59.209.225): 1		
Wireless	64 bytes from 139.59.209.225: seq=0 64 bytes from 139.59.209.225: seq=1	ttl=51 time=47.064 ms	
DHCP and DNS	64 bytes from 139.59.209.225: seq=2 64 bytes from 139.59.209.225: seq=3		
Hostnames	64 bytes from 139.59.209.225: seq=3		
Static Routes	openwrt.org ping statistics		
Diagnostics	5 packets transmitted, 5 packets re-	ceived, 0% packet loss	
Firewall	round-trip min/avg/max = 47.064/93.	136/133.752 ms	

A successful "ping" test

Please refer to chapter 7.9.4 SNMP Support for LTE to learn about the LTE related SNMP commands.

Now switch to the 'Network Interface Overview' and delete unused LAN interfaces like LAN_DHCP, LAN_MAC and LAN_ALIAS. LAN_MAC and LAN_ALIAS are using IPs in the 10.x.y.z network, which are often also used by internet service providers and may disturb routing. The LAN_DHCP should also be deleted because it may get a DHCP setup with a gateway which is not part of this MWAN configuration. You may setup a new IP for the LAN interface using a private address pool (192.168.x.y).

6.1.1.4.2 LTE Troubleshooting

Problem	Possible cause and solution
No LTE connection	Missing configuration parameters. Some providers require additional parameters for the LTE connection, namely the IP type (4 or 6) and the authentication method (PAP, CHAP or BOTH). The web interface does currently not provide means to enter these parameters; however, as a workaround, it is possible to add them to the "APN" parameter as follows: pinternet.interkom.de,ip-type=4,auth=CHAP Note that the string must not contain spaces.
LTE can reach the internet, but devices connected to it can't	 The firewall settings might be wrong. Normally, the LTE interface should be assigned to the firewall zone "wan", while the Ethernet/WLAN interfaces should be assigned to "lan". However, depending on your firewall settings, another configuration might apply, see 6.1.6 Firewall (zone-based) for details.
	2. Routing conflict if LTE provider assigns private IPv4 addresses Some LTE providers assign IPv4 addresses within the private subnet 10.0.0.0/8. This interferes with the preconfigured interfaces which uses addresses within the same subnet (LAN_ALIAS, LAN_MAC). These interfaces should be reconfigured or deleted.

6.1.1.4.3 Modem Status Information

The extended status menu, $Status \rightarrow Advanced \rightarrow Modem X$, in the web interface, can display the current modem connection status cyclically, every 10 seconds. It does not matter whether a connection to the provider has already been established. The information is queried via *qmicli* and *AT-Command* at the selected modem.



Status	Module Information Modem 1 Modem 2 Revision Information Temperature
Overview	Modem 1 Status
Advanced	
Firewall	RSRP: '-74 dBm' SNR: '20.8 dB'
Routes	5G: RSRP: 'n/a'
System Log	SNR: 'n/a' RSRQ: 'n/a'
Kernel Log	<pre>[/dev/cdc_wdm_S1_0] Successfully got serving system:</pre>
Processes	Registration state: 'registered' CS: 'attached'
Realtime Graphs	PS: 'attached' Selected network: '3gpp'
Load Balancing	Radio interfaces: '1' [0]: 'lte'
Flying Controller	Roaming status: 'off'
System	Data service capabilities: 'l' [0]: 'lte'
System	Current PLMN: MCC: '262'
Services	MNC: '3'
Network	Description: 'MEDIONmobile' Roaming indicators: '1'
Notwork .	[0]: 'off' (lte)
VPN	3GPP cell ID: '17933862' Detailed status:
Otetieties	Status: 'available'
Statistics	Capability: 'cs-ps'
	HDR Status: 'none'
	HDR Hybrid: 'no' Forbidden: 'no'
Logout	LTE tracking area code: '47021'
	Full operator code info:
	MCC: '262'
	MNC: '3' MNC with PCS digit: 'no'
	-
	<pre>[/dev/cdc_wdm_S1_0] Successfully got system info: WCDMA service:</pre>
	Status: 'none'
	True Status: 'none'
	Preferred data path: 'no'
	LTE service: Status: 'available'

Analogous to the extended Status menu, further information can be queried via the menu $System \rightarrow Custom$ Commmands $\rightarrow Modem Status$. The information query is done once for all modems installed in the system.



Status	Dashboard Configure
System	Custom Commands
System	
Administration	System Information
Software	Command: cyap_status
Startup	
Scheduled Tasks	
Mount Points	Run Download
LED Configuration	
Backup / Flash Firmware	ICCP Config
Custom Commands	
Reboot	Command: cfg_iccp
Services	Arguments:
Network	Run Download
VPN	
Statistics	Modem Status
Logout	Command: modem_status
	Run Download
	# "modem_status"
	LTE: RSSI: '-41 dBm'
	RSRQ: '-10 dB'
	RSRP: '-74 dBm' SNR: '19.4 dB'
	5G: RSRP: 'n/a'
	SNR: 'n/a' RSR0: 'n/a'
	[/dev/cdc_wdm_S1_0] Successfully got slots status [/dev/cdc_wdm_S1_0] 2 physical slots found: Physical slot I: Card status: present Slot status: active Logical slot: 1 ICCTD: 894921003608889297

6.1.1.4.4 5G

5G is the "fifth generation" of the mobile communication standard which is developed by the global initiative 3GPP.

Many applications with specific demands for very low response time and faster connection requirements can be realized for the first time by using of 5G mobile broadband standard.

Some of specified mobile bands (e.g. 3.6 GHz) are already ready to use, especially in the cities. Other bands are still experimental. They will provide download/upload rates up to 100 times faster than LTE. All this by having very low latency!

5G is the next big step in the evolution of mobile communication technology!

In order to setup a 5G connection the same steps like for using of LTE have to be done (see chapter 6.1.1.4 LTE).

Important

A **must** precondition to establish a 5G connection is a use of a modem with 5G capabilities as well as a SIM card with a 5G support.





6.1.2 WLAN

Wireless radios are disabled by default to avoid erroneous WLAN operation. Use $Network \rightarrow Wireless \rightarrow Edit$ to enter the configuration menu. Details about WLAN configuration can be found in the next section. After configuration, enable the interfaces with Enable.

Status	Wireless Overview	,				
System						
VPN	👳 radio0		ros QCA986x/988x 80 GHz) Bitrate: ? Mbit/s	2.11bgnac	Restart	can Add
Services	📶/-99 dBm	SSID: System-radio0 BSSID: 04:F0:21:2E:	Mode: Master 49:B5 Encryption: None		Disable	dit Remove
Network	👳 radio1		ros QCA986x/988x 80 GHz) Bitrate: ? Mbit/s	2.11bgnac	Restart	can Add
Interfaces		SSID: System-radio1				
Wireless	/-102 dBm		49:BB Encryption: None		Disable	dit Remove
DHCP and DNS	Associated Station	s				
Hostnames	Network	MAC-Address	Host	Signal / Noise	RX Rate / TX Rate	
Static Routes				-		
Firewall			No ini	formation available		
Diagnostics					Save & Appl	Save Reset
Configure Diagnostics						
Load Balancing						
Connection Check						
Client Isolation						
QoS						
Statistics						
Logout						

Wireless Device Overview

The example shows a CyBox RT 2-A with two radios installed. Depending on the hardware, other configurations may be shown.

After enabling the radio, you can configure physical settings. Clicking $Network \rightarrow Wireless \rightarrow Edit$ redirects you to the 'Device Configuration' menu.

6.1.2.1 Channel, Wireless mode, HT mode, Power settings

Advanced Settings allows to select the appropriate country in the pull-down menu. After a country change, press the *Save & Apply* button, refresh the browser page, and reboot.

Disclaimer: The wireless configuration must observe the local regulation. The upper limit of the transmission power has to be set correctly ("Transmit power"). This does not account for an antenna gain. If, for example, the regulation imposes a maximal power of 15 dBm and the gain of the antenna is 5 dBm, you must set the transmit power to a value at or below 10 dBm.

In *General Setup* you can configure wireless mode, HT mode and channel. Wireless mode can be forced to any 802.11 standard supported by the radio. The channel selection is adapted to the wireless mode chosen. The channel configuration can be set to auto but this slows down WLAN activation and requires a reboot to work properly. Therefore, it is recommended to select a defined channel.



Vireless	Network:	Master	"System-radio0"	(wlan0)
1101033	Heeron A.	muscul	System ruuloo	(mano)

General Setup	Advanced Settings					
Status		Mode: Master SSID: System-radio0 BSSID: 04:F0:21:2E:49:B5 Encryption: None Channel: 36 (5.180 GHz) Tx-Power: 23 dBm Signal: 0 dBm Noise: -94 dBm Bitrate: 0.0 Mbit/s Country: DE				
Wireless networ	k is enabled	Disable				
Operating freque	ency	Mode Channel Width AC _ 36 (5180 Mhz) _ 80 MHz _				
Maximum transmit power		driver default - Current power: 23 dBm				
nterface Con	figuration	Specifies the maximum transmit power the wireless radio may use. Depending on regulatory requirements and wireless usage, the actual transmit power may be reduced by the driver.				
nterface Con General Setup	figuration	wireless radio may use. Depending on regulatory requirements and wireless usage, the actual				
	_	wireless radio may use. Depending on regulatory requirements and wireless usage, the actual transmit power may be reduced by the driver.				
General Setup	_	wireless radio may use. Depending on regulatory requirements and wireless usage, the actual transmit power may be reduced by the driver.				
General Setup Mode	_	wireless radio may use. Depending on regulatory requirements and wireless usage, the actual transmit power may be reduced by the driver.				
General Setup Mode ESSID	_	wireless radio may use. Depending on regulatory requirements and wireless usage, the actual transmit power may be reduced by the driver.				

Wireless Device Configuration

After the device has been enabled, the radio status should be checked if the selected channel / mode combination is working.

6.1.2.2 Radio Band Configuration for Models with Antenna Combiner

If the system is equipped with an antenna combiner, (e.g. having two radio modules (WLE-900) but only three antennas) the frequency bands 2.4 GHz and 5 GHz cannot be freely configured for each wireless module. The first radio module radio0 must use band 2.4 GHz and the second radio radio1 the 5 GHz band. An incorrect wireless band configuration in the software is possible. However, this means that no output power arrives at the antenna ports.

6.1.2.3 ESSID, WDS Mode, Client separation

The ESSID is used for WLAN clients to select the wireless LAN by name. Set up a ESSID name for the wireless network in the *General Setup* of the *Interface configuration* and use mode *Access Point*.

A Wireless Distribution System (WDS) can be set up by using two access points with the same ESSID, one in "Access Point (WDS)" mode and the other in "Client (WDS)" mode. This mode is required for the Inter Carriage Connection Protocol (ICCP).

In public access point environments the client-to-client communication should be prevented by activating the Interface Configuration \rightarrow Advanced Settings \rightarrow Isolate Clients checkbox. Note that this configuration only prevents the communication between clients connected to the same access point. In a backbone



with many access points having the same SSID, an additional "Client isolation" function between APs is needed (see 6.1.2.5 Multi-AP Client Isolation).

6.1.2.4 Encryption

On the tab Wireless Security you can choose a security mode. The following modes are supported:

- WPA3 (strong security)
 - WPA3-SAE: "personal mode", using a key (password) for access.
 - WPA3-EAP: "enterprise mode", using a RADIUS server for client

authentication.

- WPA2 (strong security)
 - WPA2-PSK: "personal mode", using a password for access. Note that the cipher "TKIP" is considered insecure, and CCMP should be used instead.
 - WPA2-EAP: "enterprise mode", using a RADIUS server for client authentication.
- WPA (medium security)
 - WPA-PSK: WPA in "personal mode", using a password for access. Note that the cipher "TKIP" is considered insecure, and CCMP should be used instead.
 - WPA-EAP: "enterprise mode", using a RADIUS server for client authentication.
- WEP (weak security)
 - WEP Shared Key
 - WEP-EAP Open System
- OWE (open, encrypted)
 - OWE: The "Opportunistic Wireless Encryption" mode requires no password, yet the WLAN traffic is encrypted. This mode is intended for public access points.
- No Encryption (open):
 - The WLAN traffic is not secured at all.

In addition, some of these modes can be combined ("mixed mode"). For an access point, this allows to support multiple modes, supporting newer encryption standards while still supported older clients. When configuring the CyBox RT 2-A as client with a "mixed mode", it will try both modes when connecting to an access point (normally, only the configured mode is used). The following modes can be combined:

- WPA3 and WPA2 in enterprise mode (EAP)
- WPA3 and WPA2 in personal mode (PSK respective SAE)
- WPA2 and WPA in personal mode (PSK)

Device Configuration	1					
General Setup Advanced Settings Status	Mode: Master SSID: System-radio0 BSSID: 04:F0:21:2E:49:B5 Encryption: None Channel: 36 (5.180 GHz) /-94 dBm Tx-Power: 23 dBm Signal: 0 dBm Noise: -94 dBm					
	WPA2-PSK (strong security)					
Wireless network is enabled	WPA2-EAP (strong security)					
	WPA3-EAP (strong security)					
0	WPA2-EAP/WPA3-EAP Mixed Mode (strong security)					
Operating frequency	WPA3-SAE (strong security)					
Maximum transmit power	WPA2-PSK/WPA3-SAE Mixed Mode (strong security)					
	WPA-PSK/WPA2-PSK Mixed Mode (medium security)					
	WPA-PSK (medium security)					
	WPA-EAP (medium security)					
	WEP Open System (weak security)					
nterface Configuration	WEP Shared Key (weak security)					
	OWE (open network)					
General Setup Wireless Security	No Encryption (open network)					
Encryption	No Encryption (open network)					

Wireless Device Configuration – Encryption Settings

6.1.2.5 Multi-AP Client Isolation

Client separation inhibits direct communication between clients of the same WLAN radio. However, if more than one Access Point is attached to the same cable backbone, and the wifi clients use the same subnet, client isolation must also be enabled between APs. This is also true if the CyBox RT 2-A operates multiple APs on different WLAN modules which are connected (e.g. by using a bridge). Isolation is also done for clients on different radios within the same Access Points.

In order to use Multi-AP client isolation, all APs must use the same Server and use the same interface name. (Network traffic can be restricted with a configuration for 'ebtables' on FORWARD rules, managed by the 'client isolation' functionality).

For Client isolation over APs, check Network \rightarrow Client Isolation \rightarrow Enable, then enter parameters for your configuration.

The screenshot below shows a configuration where the server address is set in the parameters of the LAN interface (under '*Network*' \rightarrow '*Interfaces*'). When the interface is set up as a bridge, the corresponding Bridge name is always 'br-<original_interface_name>'



Status	Client Isolation				
System	Network Isolation for WiFi clients on different APs connected to same backbone. Isolation is also done for clients on different radios within the same AP.				
VPN	Network Isolation Settings				
Services					
Network	Enable				
Interfaces		Inable client isolation service			
Wireless	Server address list	192.168.100.100 172.16.0.100			
DHCP and DNS Hostnames		Specifies the server or server list for MAC address requests			
Static Routes	Device	br-lan			
Diagnostics		Constitue the shuminal device for an inclusion and an under			
Firewall		Specifies the physical device for arping test requests			
Client Isolation	SSID list to isolate	Please choose CyBoxAP-2-radio0			
Connection Check		CyBoxAP-2-radio1			
QoS					
Configure Diagnostics Load Balancing		Select one or more SSIDs for isolation rules			
Statistics	Allowed MAC address list				
Logout		Specifies a comma separated list of allowed MAC addresses			
	Timeout	20			
		Maximum time in seconds to wait for server reaction			
	Wait time	120			
		Time in seconds to wait before a new server list scan starts			
		Save & Apply Save Reset			

Client isolation across access points

6.1.2.6 Connection Check

The connection check service allows to disable WLANs while no internet connectivity is possible. This can improve the user experience by avoiding being connected to a WLAN which delivers no internet connectivity.

The connection check works by issuing an *arping* to the server. When the server cannot be reached, the WLAN gets deactivated. Otherwise, the WLAN gets activated. The service can be configured on the page Network \rightarrow Connection Check (see figure "Deactivate SSIDs when the server is not reachable" below). The checkbox Enable enables or disables it.

The parameter Server address determines which address is arpinged to determine whether the connection is healthy. The parameter Interface name dictates which interface to use for the arping. Note that this is a physical interface, such as br-lan or eth0.

In the SSID list, the controlled SSIDs can be chosen. The selected SSIDs are activated or deactivated by the service, while the others remain unaffected.

The connection is checked every Check time interval seconds. The selected SSIDs are disabled when the connection was down for at least Shutdown time seconds, and they are enabled again when the connection was healthy for at least Activate time seconds. Note that the latter two work at the granularity of Check time interval \Rightarrow 15s and Activate time \Rightarrow 20s, the WLANs will be activated after the 2nd successful check, i.e. after 30s.



Status	Connection Check Connection Check allows to enable/disable wifi SSIDs depending on server accessibility Connection Check Settings					
System VPN Services						
	Enable					
Network		Enable connection check for specified SSIDs				
Interfaces	Server address					
Wireless	Server address	192.168.100.100				
DHCP and DNS Hostnames		Specifies the server for MAC address requests				
Static Routes	Interface name	br-lan				
Diagnostics						
Firewall		Specifies the interface for arping test requests				
Client Isolation	SSID list	Please choose CyBoxAP-2-radio0				
Connection Check		CyBoxAP-2-radio1				
QoS						
Configure Diagnostics						
Load Balancing		Select one or more SSIDs for connection check				
Statistics	Check time interval	20				
Logout		Wait time (seconds) between two connection checks				
	Activate time	60				
		Wait time (seconds) before wifi is activated after connection valid				
	Shutdown time	60				
		Wait time (seconds) before wifi shutdown after connection invalid				
		Save & Apply Save Reset				

Deactivate SSIDs when the server is not reachable

6.1.3 Multi-WAN Manager (MWAN3)

The multi-WAN manager (MWAN3) can be used to control which network connection is to be used for traffic. This section uses LTE uplink connections as example, but other connections - like WLAN or Ethernet - can also be used.

It provides the following features:

- Monitoring of WAN connectivity using repeated ping tests (ping | arping | httping).
- Routing of outbound traffic to another WAN interface if the first WAN interface loses connectivity, based on metric. The connection with the lowest metric is preferred, other connections are only used if the preferred one fails. Interfaces sharing the same metric value form a "group".
- Outbound WAN traffic load balancing over multiple WAN interfaces based on a numeric weight assignment. All connections sharing the same metric ("within the same group") are used simultaneously, distributing traffic over them. Connections with higher weights gets more traffic assigned.
- Different policies can be defined for different traffic types. For example, OpenVPN traffic could be routed through the first connection (using the other connections only if it fails), while routing all other traffic through the remaining connections (using load-balancing among them).

Load-balancing requires no remote station on the ground, it is handled entirely by the CyBox RT 2-A. As such, it is no link aggregation. It distributes traffic by streams, not by packets, i.e. a single stream cannot benefit from multiple LTE connections. For example, a single download stream can only use one LTE connection. However, multiple streams (e.g. generated by many WLAN users onboard a train) can be distributed over multiple WAN connections, increasing the overall bandwidth.

The figure Example traffic flow in MWAN shows an example configuration and visualizes the traffic flows in various situations:

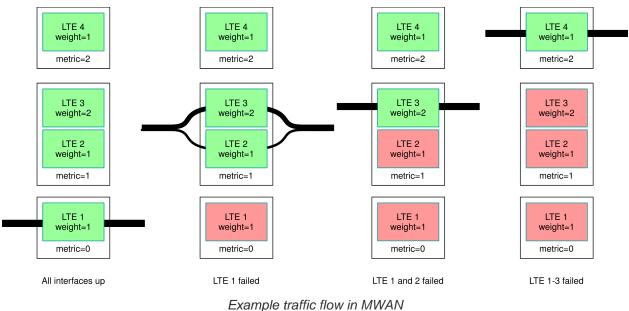
• When all interfaces are up, all traffic is routed through the interface with the lowest metric, which is LTE 1 (metric=0).

• If LTE 1 fails, all traffic is still routed through the operable interfaces with the lowest metric (=1). But now, this is LTE 2 and LTE 3, which share the same metric. The traffic is distributed (load-balanced) over these interfaces.

Westermn

- If LTE 1 and 2 fail, the traffic is routed over LTE 3, because this is now the operable interface with the lowest metric. There is no load-balancing any more, because only one interface is used.
- It LTE 1-3 fail, LTE 4 is used. Technically it is the operable interface with the lowest metric.

Note that the load balancing between LTE 2 and LTE 3 routes more traffic through LTE 3 than through LTE 2. This is because of the different weights. The interface with the higher weight gets more traffic. When there is now load balancing, the weight values have no effect.



Example traffic flow in M

6.1.3.1 Capabilities

The MWAN3 package provides the following capabilities:

- provides outbound WAN traffic load balancing over multiple WAN interfaces based on a numeric weight assignment
- monitors WAN connections using repeated ping tests (ping | arping | httping) and automatically routes outbound traffic to another WAN interface if the first WAN interface loses connectivity
- provides specific outbound traffic rules to customize which outbound connections should use which WAN interface

6.1.3.2 MWAN Test

6.1.3.2.1 Gateway

After complete Modem setup the modem interfaces are up and tracking via ping is active. To check the hotplug MWAN mechanism open a second web interface to CyBox RT 2-A and go to $Network \rightarrow Interfaces$.

In this example MODEM_S1 has the lowest metric and will be first standard gateway. The test is started with *Stop* action on interface MODEM_S1.





MWAN test stopping a modem

As the interface is down, all traffic has stopped and standard gateway switches to modem1.

CyRTA-2000 OpenWrt V20.0	05-rc2-84-gb60ce0a2f1 Load: 0.30 0.27 0.27 A	uto Refresh: on		CyRTA-2000 OpenWrt V20.0	5-rc2-84-gb60ce0a2f1 Loa:	d: 2.29 0.78 0.44 Auto Refresh: on	
Status	Status		Status	LAN LAN_ALIAS LAN_DHCP LAN_MAC MODEM_S1 MODEM_S2			
Overview	System		System	System Interfaces			
Advanced	-			VPN		Protocol: Static address	
Firewall	Hostname Model	CyRTA-2000 CYRTA-2090V0		Services	LAN_ALIAS	Uptime: 2h 43m 58s MAC: 00:00:5B:04:AE:03	
Routes	Architecture	e5500		Network	2 000	RX: 2.19 MB (19865 Pkts.)	Restart Stop Edit Delete
System Log	Firmware Version	OpenWrt V20.05-rc2-84-gb60ce0a2f1 / LuCI (V20.05-rc2-84-gb60ce0a2f1)		Interfaces	enu	TX: 4.38 MB (18877 Pkts.) IPv4: 10.4.160.185/8	
Kernel Log	Kernel Version	4.14.137		Wireless		Protocol: DHCP client	
Processes Realtime Graphs	Local Time	Tue Feb 25 12:48:39 202	0	DHCP and DNS	LAN_DHCP	Uptime: 2h 43m 51s MAC: 00:00:58:04:AE:03 RX: 2.19 MB (19865 Pkts.) TX: 4.38 MB (18877 Pkts.)	
Load Balancing	Uptime Load Average	2h 44m 48s 2.12, 0.89, 0.49		Hostnames			Restart Stop Edit Delete
	-	2.12, 0.00, 0.40		Static Routes		IPv4: 192.168.100.133/24	
System	Memory			Diagnostics		Protocol: Static address Uptime: 2h 43m 58s	
VPN	Total Available		1.80 GB / 1.95 GB (92%)	Firewall	LAN_MAC	MAC: 00:00:5B:04:AE:03 RX: 2.19 MB (19865 Pkts.) TX: 4.38 MB (18877 Pkts.) IPv4: 10.4.174.3/8	Restart Stop Edit Delete
Services	Free		1.80 GB / 1.95 GB (92%)	Client Isolation	eth0		
Network				Connection Check			
Statistics	Buffered		232.00 KB / 1.95 GB (0%)	QoS		Protocol: Static address Uptime: 2h 43m 58s MAC: 00:00:58:04;AE:03 RX: 2.19 MB (19865 Pxts.) TX: 4.38 MB (18877 Pxts.)	
	Network			Configure Diagnostics	LAN		Restart Stop Edit Delete
Logout	IPv4 Upstream		IPv4 Upstream	Load Balancing	eth0		increate stop con better
	Protocol: ModemManager Address: 10.49.35.127/24		Protocol: DHCP dient Address: 192.168.100.133/24	Statistics		IPv4: 192.168.100.1/24 IPv6: fd8e:98f0:3cdf::1/60	
	Address: 10.49.35.127/24 Gateway: 10.49.35.128 DNS 1: 62.109.121.17		Address: 192.168.100.133/24 Gateway: 192.168.100.2 DNS 1: 192.168.100.90		MODEM_S1	Protocol: ModernManager RX: 0 B (0 Pkts.)	
	DNS 2: 62.109.121.18		Expires: 0h 0m 7s	Logout	www.an_S1_0	TX: 0 B (0 Pkts.)	Restart Connect Edit Delete
	Connected: 1h 53m 12s		Connected: 2h 43m 53s		waar_or_o	Information: Not started on boot Protocol: ModemManager	
	Device: Ethernet Adapter: "wwan_S2_0"		Device: Ethernet Adapter: "eth0" MAC-Address: 00:00:58:04:AE:03		MODEM_S2	Uptime: 1h 53m 10s	
			10		2		Restart Stop Edit Delete
	Active Connections	Active Connections 65 / 16384 (0%)			wwan_S2_0	TX: 116.89 KB (1399 Pkts.) IPv4: 10.49.35.127/24	
	MWAN Interfaces				Add new interface		
					Global network options		
	Interface: Interface: modem_51 modem_52 Status: Office Status: Orden Downline: Uptime: 11:53m11s			IPv6 ULA-Prefix fd8e:98		#0:3cdf::/48	
						Save & Apply Save Reset	
	0h:0m:36s						Sone drappy Sone make
	Active DHCP Leases						
	Hostname IPv4-Address	MAC-Addres	s Leasetime remaining				
	There are no active leases.						
	Active DHCPv6 Leases			Powered by LuCI (V20.05-rc2-84-gb)			

MWAN test

6.1.3.3 MWAN Status

The detailed MultiWan status information is found in Status \rightarrow Load Balancing \rightarrow Detail.



Status	Interface Detail Diagnostics Troubleshooting
Overview	MWAN Status - Detail
Advanced	
Firewall	Interface status: interface modem S1 is offline and tracking is active
Routes	interface modem_S2 is online and tracking is active
System Log	Current ipv4 policies:
Kernel Log	balanced: modem S2 (100%)
Processes	modem_S1_modem_S2: modem_S2_(100%)
Realtime Graphs	modem_S1_only:
Load Balancing	unreachable modem S2 modem S1:
System	modem_S2 (100%) modem_S2 only:
VPN	modem_S2_(100%)
Services	Current ipv6 policies:
Network	balanced: unreachable
	<pre>modem_S1_modem_S2: unreachable</pre>
Statistics	modem_S1_only:
	unreachable modem S2 modem S1:
Logout	unreachable modem S2 only:
	unreachable
	Directly connected ipv4 networks:
	192.168.100.255 10.35.82.53
	127.0.0.0
	192.168.100.133 10.49.35.0/24
	192.168.100.1 10.49.35.255
	10.0.0/8
	10.49.35.0 10.0.0.0
	192.168.100.0
	192.168.100.0/24 10.35.82.55
	10.255.255.255
	10.4.174.3 10.35.82.52/30
	10.35.82.52 127.0.0.1
	224.0.0.0/3
	127.255.255.255 10.4.160.185
	10.49.35.127 127.0.0.0/8
	Directly connected ipv6 networks: fd8e:98f0:3cdf::/64
	5-00

MWAN detailed status page

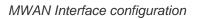




6.1.3.4 MWAN Modem Interface Configuration

The MWAN interface configuration has a default setup for every modem card.

Status	Globals	nterfaces	Members	Policies	s Notification						
System	MWAN -	WAN - Interfaces									
VPN	There are c	urrently 2	2 of 60 suppor	ted interfaces	configured						
Services	WARNING:	Interface	modem_S1 h	as no default r	oute in the main	routing table					
Network		WAN supports up to 252 physical and/or logical interfaces WAN requires that all interfaces have a unique metric configured in /etc/config/network									
Interfaces				found in /etc/co z, 0-9, _ and no							
Wireless					members, policies	s or rules					
DHCP and DNS	Name	Enabled	Tracking method	Tracking method	Tracking	Ping interval	Interface down	Interface	Metric		
Hostnames				method	reliability			up			
Static Routes	modem_S1	Yes	ping	-	1	5s	3	8	10	Edit	Delete
Diagnostics	modem_S2	Yes	ping	_	1	5s	3	8	20	Edit	Delete
Firewall			Add								
Client Isolation								Save &	Apply	Save	Reset
Connection Check											
QoS											
Configure Diagnostics											
Load Balancing											
Statistics											
Logout											



The tracking parameters can handle target host IPs, ping interval and timeout.



Status	Globals Interfaces Members Policies Rules	Notification					
System	MWAN Interface Configuration - mo	odem_S1					
VPN							
Services	Enabled		-				
Network	Initial state	Online					
Interfaces		② Expect interface state on up event					
Wireless	Internet Protocol	IPv4	•				
DHCP and DNS	Tracking hostname or IP address	8.8.8.8	⊿				
Hostnames Static Routes		208.67.220.220	×				
Diagnostics			+				
Firewall		This hostname or IP address will be ping					
Client Isolation		or down. Leave blank to assume interfac	e is always online				
Connection Check	Tracking method	ping -					
QoS	Tracking reliability	1					
Configure Diagnostics		Acceptable values: 1-100. This many Training Control of the second se	acking IP addresses must				
Load Balancing Statistics		respond for the link to be deemed up					
Statistics	Ping count	1]				
Logout	Ping size	56 _]				
	Max TTL	60 _					
	Check link quality						
	Ping size	56 _]				
	Ping timeout	2 seconds]				
	Ping interval	5 seconds]				
	Failure interval	5 seconds					
		Ping interval during failure detection					
	Keep failure interval						
		Keep ping failure interval during failure s	tate				
	Recovery interval	5 seconds					
		Ping interval during failure recovering					
	Interface down	3]				
		Interface will be deemed down after this	many failed ping tests				
	Interface un	-	1				

Tracking parameters

6.1.3.5 MWAN Members Configuration

Members are profiles attaching a metric and weight to an MWAN interface. Names may contain characters A-Z, a-z, 0-9, _ and no spaces. Members may not share the same name as configured interfaces, policies or rules.



Status	Globals Interfaces Members Policies Rules Notification								
System	MWAN - Members								
VPN	Members are profiles attaching a metric and weight to an MWAN interface								
Services	Names may contain characters Members may not share the sar			ies or rules					
Network	Name	Interface	Metric	Weight					
Interfaces	modem_S1_m1_w3	modem_S1	1	3	Up	Down	Edit	Delete	
Wireless	modem_S1_m2_w3	modem_S1	2	3	Up	Down	Edit	Delete	
DHCP and DNS	modem_S2_m1_w2	modem_S2	1	2	Up	Down	Edit	Delete	
Hostnames	modem_S2_m2_w2	modem_S2	2	2	Up	Down	Edit	Delete	
Static Routes		Add							
Diagnostics						Save	& Apply	ave Reset	
Firewall						Jave		ineser	
Client Isolation									
Connection Check									
QoS									
Configure Diagnostics									
Load Balancing									
Statistics									
Logout									

MWAN members

6.1.3.6 MWAN Policies Configuration

Policies are profiles grouping one or more members controlling how MWAN distributes traffic. Member interfaces with lower metrics are used first. Interfaces with the same metric use load-balancing. Load-balanced member interfaces distribute more traffic out through those interfaces with higher weights.

Status	Globals Interfaces Members	s Policies Rules Notif	fication						
System	MWAN - Policies	WAN - Policies							
VPN	Policies are profiles grouping one of	olicies are profiles grouping one or more members controlling how MWAN distributes traffic lember interfaces with lower metrics are used first ember interfaces with the same metric will be load-balanced bad-balanced member interfaces distribute more traffic out those with higher weights armes may contain characters A-Z, a-Z, 0-9, _ and no spaces ames must be 17 characters or less olicies may not share the same name as configured interfaces, members or rules							
Services									
Network									
Interfaces	Names must be 17 characters or le								
Wireless	Name	Members assigned	Last resort						
DHCP and DNS	modem_S1_only	modem_S1_m1_w3	unreachable (reject)	Up Down Edit Delete					
Hostnames	modem_S2_only	modem_S2_m1_w2	unreachable (reject)	Up Down Edit Delete					
Static Routes Diagnostics	balanced	modem_S1_m1_w3	unreachable (reject)	Up Down Edit Delete					
Firewall	modem_S1_modem_S2	modem_S2_m1_w2 modem_S1_m1_w3 modem_S2_m2_w2	unreachable (reject)	Up Down Edit Delete					
Client Isolation Connection Check	modem_S2_modem_S1	modem_S1_m2_w3 modem_S2_m1_w2	unreachable (reject)	Up Down Edit Delete					
QoS		Add							
Configure Diagnostics				Save & Apply Save Reset					
Load Balancing									
Statistics									
Logout									



MWAN policies page

6.1.3.7 MWAN Rules Configuration

Rules specify which traffic will use a particular MWAN policy based on IP address, port, or protocol. Rules are matched from top to bottom. Rules below a matching rule are ignored. Traffic not matching any rule is routed using the main routing table. Traffic destined for known (other than default) networks is handled by the main routing table. Traffic matching a rule, but with all WAN interfaces for that policy down, will be blackholed.

Status	Globals	nterfaces	bers	es Rules Notifica	tion						
System	MWAN -	WAN - Rules									
VPN	Rules specify	which traffic will u	use a particula	r MWAN policy							
Services		sed on IP address tched from top to		col							
Network	Rules below	ules are matched from top to bottom ules below a matching rule are ignored raffic not matching any rule is routed using the main routing table									
Interfaces		raffic destined for known (other than default) networks is handled by the main routing table raffic destined for known (other than default) networks is handled by the main routing table raffic matching a rule, but all WAN interfaces for that policy are down will be blackholed									
Wireless	Names may	contain characters	A-Z, a-z, 0-9,	_ and no spaces							
DHCP and DNS	Rules may no			igured interfaces, men	•						
Hostnames	Name	Source address	Source port	Destination address	Destination port	Protocol	Policy assigned				
Static Routes	https	-	_	_	443	tcp	balanced	Up	Down	Edit	Delete
Diagnostics	default_rule	;	_	0.0.0/0	_	all	balanced	Up	Down	Edit	Delete
Firewall	i		Add								
Client Isolation			Add				_				
Connection Check							S	ave & A	pply	Save	Reset
QoS											
Configure Diagnostics											
Load Balancing											
Statistics											
Logout											

MWAN rules page

6.1.3.8 MWAN Notification Configuration

In the advanced configuration you may add a custom specific action on MWAN3 hotplug events, on interfaces for which MWAN3 is enabled.

This section allows to modify the content of "/etc/mwan3.user". The file is also preserved during sysupgrade.

Notes:

- This file is interpreted as a shell script.
- The first line of the script must be "#!/bin/sh" without quotes.
- Lines beginning with # are comments and are not executed.
- There are three main environment variables that are passed to this script:
- \$ACTION Either "ifup" or "ifdown"
- \$INTERFACE Name of the interface which went up or down (e.g. "wan" or "wwan")
- \$DEVICE Physical device name which interface went up or down (e.g. "eth0" or "wwan0")



Status	Globals Interfaces Members Policies Rules Notification
System	MWAN - Notification
VPN	This section allows you to modify the content of "/etc/mwan3.user".
Services	The file is also preserved during sysupgrade.
Network	Notes: This file is interpreted as a shell script.
Interfaces	The first line of the script must be "#!/bin/sh" without quotes. Lines beginning with # are comments and are not executed.
Wireless	Put your custom mwan3 action here, they will
DHCP and DNS	be executed with each netifd hotplug interface event on interfaces for which mwan3 is enabled.
Hostnames	There are three main environment variables that are passed to this script.
Static Routes	
Diagnostics	\$ACTION * "ifup" Is called by netifd and mwan3track
Firewall	* "ifdown" Is called by netifd and mwan3track * "connected" Is only called by mwan3track if tracking was successful
Client Isolation	* "disconnected" Is only called by mwan3track if tracking has failed
Connection Check	\$INTERFACE Name of the interface which went up or down (e.g. "wan" or "wwan") \$DEVICE Physical device name which interface went up or down (e.g. "eth0" or "wwan0")
QoS	
Configure Diagnostics	#!/bin/sh
Load Balancing	# This file is interpreted as shell script.
Statistics	<pre># Put your custom mwan3 action here, they will # be executed with each netifd hotplug interface event</pre>
	# on interfaces for which mwan3 is enabled. #
Logout	# There are three main environment variables that are passed to this script.
	# SACTION
	# <ifup> Is called by netifd and mwan3track # <ifdown> Is called by netifd and mwan3track</ifdown></ifup>
	# <connected> Is only called by mwan3track if tracking was successful</connected>
	<pre># <disconnected> Is only called by mwan3track if tracking has failed # \$INTERFACE Name of the interface which went up or down (e.g. "wan" or "wwan")</disconnected></pre>
	<pre># \$DEVICE Physical device name which interface went up or down (e.g. "eth0" or "wwan0")</pre>
	Submit Reset

MWAN notification configuration

6.1.4 MultiPath TCP / Link Aggregation

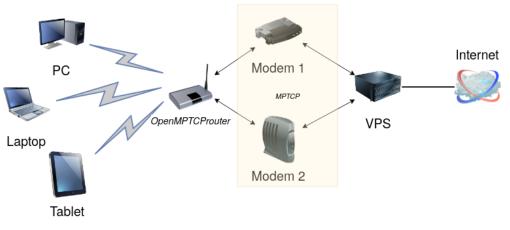
Getting better throughput performance and failsave connections by using of MultiPath TCP (MPTCP) protocol.

Link aggregation part is done by package OpenMPTCProuter.



OpenMPTCProuter

OpenMPTCProuter use MultiPath TCP (MPTCP) to really aggregate multiple Internet connections and OpenWrt.



A simple diagram to describe how OpenMPTCProuter is working.

Aggregation	Failover	Security
Bonding connections to really aggregate bandwidth from up to 8 internet connections (Fiber, ADSL, VDSL, 4G,) Provide hybrid Internet with any FAI	Always up with connection and VPS failover	All data between the router and the VPS can be encrypted and obfuscated

Important

A **shall** precondition to use OpenMPTCProuter feature is the availability of at least two network interfaces e.g. modems configured and connected to provider. Otherwise no link aggregation or connection fallback will be possible.

6.1.4.1 OpenMPTCProuter versus MWAN3

MultiWAN (mwan3) algorithm distributes multiple TCP connections over multiple lines. All packets of one TCP session are always transferred over a single line. Resulting data throughput is limited by a capabilities of this line. In case of connection fail, established session will be closed. If other line is available, a new session will be established over another line.

While MultiWAN uses only one line for all session packets, OpenMPTCProuter split one TCP session over several lines. Resulting data throughput is limited by a sum of all used lines together. In case of a connection error e.g. one



of a lines goes down, established session is not closed. Transmission of remaining TCP packets belonging to a session continues over other available lines.

6.1.4.2 OpenMPTCProuter/MWAN3 selection

OpenMPTCProuter and MWAN3 are concurrent tools and can not run at the same time. The active tool can be selected by using the UI page $S_{YStem} \rightarrow MWAN3$ and the command "routing_set mwan3" have to be executed. Also the factory reset is triggered. After the system restart MWAN3 UI pages and configuration defaults are available. OpenMPTCProuter UI pages and configurations are not available. To use OpenMPTCProuter instead of MWAN3 the same procedure has to be done. The only difference is using parameter "omr" instead of "mwan3" for command "routing_set".

SW-P Openwit v20.25 E08	ad: 0.41 0.31 0.23
Status	Dashboard Configure
System	Custom Commands
System	
Administration	System Information
Startup	Command: cyap_status
Scheduled Tasks	
Mount Points	
Backup / Flash Firmware	Run Download
Custom Commands	
License	ICCP Config
Reboot	Command: cfg iccp
VPN	Arguments:
Services	
Network	Run Download
Statistics	
	Modem Gateway
Logout	Command: modem gateway
	Arguments:
	Run Download
	Select Routing App (!RESET ALL CONFIGURATIONS!)
	Command: routing_set
	Arguments: omr
	Run Download

6.1.4.3 VPS Configuration

6.1.4.3.1 Recommendations

Multiple interface data streams are ends up into a single data stream (Link Aggregation) on a special Server (VPS) which OpenMPTCProuter software are connecting to. Therefore the VPS/server need to have the lowest latency as possible with used network connections. It is recommended to use a linux based server with e.g. Debian 10 or Ubuntu 18.04 installed on as a VPS/server.

6.1.4.3.2 Install / setup VPS tools

VPS Setup is done by using of installation scripts provided by OpenMPTCProuter project.

Connect with SSH on your server, using ssh command under Linux or Putty under windows for example.

Then, as root:

wget -0 - https://www.openmptcprouter.com/server/debian10-x86_64.sh | sh



This will install and configure mptcp kernel, shadowsocks, glorytun and shorewall (as firewall). Key for shadowsocks and glorytun are generated by the script.

- SSH port is changed to 65222 (TCP)
- Shadowsocks port is 65101 (TCP & UDP)
- Glorytun port is 65001 (TCP & UDP)
- OMR JSON admin is 65500 (TCP)
- OpenVPN port is 65301 (TCP)
- MLVPN ports are 65201-65208 (UDP)
- Iperf3 on port 65400 (TCP & UDP)
- DSVPN port is 65401 (TCP)

6.1.4.3.3 Generated keys

After installation, keys can be found in file /root/openmptcprouter_config.txt.

6.1.4.3.4 Choosing a VPN Technology

Per default VPS (Virtual Private Server) is prepared to interact with multiple common implementations of VPN (Virtual Private Network) technology. Each of the supported VPN's OpenVPN/Glorytun/DSVPN/MLVPN) have preconfigured ports and keys. The decision which VPN should be used, or use it at all can be met by user during configuration of OMR (OpenMPTCProuter). The choice of using a VPN Shadowsocks only or a combination of Shadowsocks and VPN should be met depending on project goals and available tools.

Shadowsocks implementation make use of SOCKS5 Protocol which can handle not just multiple link connections, but also support different encryption methods. A default configuration of VPS and OMR software setup uses Shadowsocks connection for all TCP traffic and a GlorytunTCP VPN for any non-TCP traffic. In case Glorytun TCP VPN is deactivated or disconnected, all traffic is done over Shadowsocks interface. Alternative, if the Shadowsocks interface is disabled or disconnected, all data is send/received over Glorytun TCP VPN interface OMRVPN.

Important

In the following example, a default setup, a combination of Shadowsocks/Glorytun is used.

6.1.4.4 OpenMPTCProuter configuration example

The following example gives a step-by-step instruction of the configuration and testing of Link Aggregation with MPTCP by using two LTE modems as internet connections to a VPS server.

6.1.4.4.1 Setup DHCP

Optionally DHCP server functionality can be activated for LAN interface. This can be helpful for later connection of e.g. clients to router.

Status	LAN LAN_ALIAS LAN_DHCP LAN_MAC MODEM_S1 MODEM_S2 OMRVPN WAN1 WAN2 WAN6								
System	Interfaces - LAN								
VPN	On this page you can configure the network interfaces. You can bridge several interfaces by tocking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAY notation INTERFACE.VLANR (bg.) et th. 1).								
Services	Common Configuration								
Network	General Setup Advanced Settings Physical Settings Fiewall Settings								
Interfaces	Status	Device: eth0							
Wireless DHCP and DNS		Uptime: Lh 33m 22s MAC: 00:0058:04:AD:02							
Hostnames		RX: 1.48 MB (14275 Pits.) TX: 6.24 MB (15813 Pits.)							
Static Routes		IPv4: 192.158.100.1/24 IPv6: tda4:255.8888::1/60							
Diagnostics	Protocol								
Firewall Client Isolation		Static address							
Connection Check	Bring up on boot								
MPTCP	IPv4 address	192.168.100.1							
QoS	IPv4 netmask	255.255.255.0 v							
Configure Diagnostics	IPv4 gateway								
Statistics	IPv4 broadcast								
Logout	Use custom DNS servers	+							
	IPv6 assignment length	60 •							
		Ø Assign a part of given length of every public IPv6-prefix to this interface							
	IPv6 assignment hint								
		Assign prefix parts using this hexadecimal subprefix ID for this interface.							
	IPv6 suffix								
		Optional. Allowed values: 'culifs', 'andom', fixed value like '::1' or '::1:2'. When IPv6 prefix (like 'a:b:::d::) is received from a delegating server, use the suffix (like '::1) to form the IPv6 address ('a:b:::d::) for the interface.							
	DHCP Server								
	General Setup Advanced Settings IPv6 Settings								
	Ignore interface								
		Disable DHCP for this interface.							
	Start	100							
		Our Lowest leased address as offset from the network address.							
	Limit	150							
		Maximum number of leased addresses.							
	Lease time	12h							
		② Expiry time of leased addresses, minimum is 2 minutes (2n).							
	Back to Overview	Save & Apply Save Reset							

6.1.4.4.2 Remove / Disable unused default interfaces

Unused network interfaces should be either removed from configuration or set as disabled to not disturb MPTCP functionality.

Ш	es 1	191	П	

yBoxGW-P OpenWrt V20.29	Load: 0.38 0.40 0.18 Auto Refresh: on						
Status	LAN LAN_ALIAS LAN_DHCP LAN_M	AC MODEM_S1 MODEM_S2 OMRVPN WANG	1				
System	Interfaces						
VPN Services	LAN_ALIAS	Protocol: Static address MAC: 00:00:58:04:AD:02 RX: 120.91 KB (1021 Pkts.)		Restart	Connect	Edit	Delete
Network	eth0	TX: 776.02 KB (1410 Pkts.) Information: Not started on boot					
OpenMPTCProuter Interfaces Wireless	LAN_DHCP	Protocol: DHCP client MAC: 00:00:58:04:AD:02 RX: 120:91 KB (1021 Pkts.) TX: 776:02 KB (1410 Pkts.) Information: Not started on boot		Restart	Connect	Edit	Delete
DHCP and DNS Hostnames Static Routes Diagnostics	LAN_MAC	Protocol: Static address MAC: 00:00:5B:04:AD:02 RX: 120:91 KB (1021 Pkts.) TX: 776.02 KB (1410 Pkts.) Information: Not started on boot		Restart	Connect	Edit	Delete
Firewall Client Isolation Connection Check MPTCP	LAN E eth0	Protocol: Static address Uptime: 0h 2m 49s MAC: 00:0058:04:40.002 RX: 120:91 KB (1021 Pkts.) TX: 77:02 KB (1410 Pkts.) IPv4: 192:168.100.1/24 IPv6: 178:4c08:thb1:://60		Restart	Stop	Edit	Delete
QoS Configure Diagnostics Statistics	OMRVPN tun0	Protocol: DHCP client RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.) Error: Network device is not present		Restart	Stop	Edit	Delete
Logout	MODEM_S1	Protocol: ModemManager RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.) Information: Not started on boot		Restart	Connect	Edit	Delete
	MODEM_S2	Protocol: ModemManager RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.) Information: Not started on boot		Restart	Connect	Edit	Delete
	WAN6	Protocol: DHCPv6 client RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.) Information: Not started on boot		Restart	Connect	Edit	Delete
	Add new interface Global network options						
	IPv6 ULA-Prefix		fd78:4c08:fbb1::/48				
						Save	& Apply Save Reset

6.1.4.4.3 Setup LTE Modems

Configuration of the first modem (MODEM_S1) can be done by using of UI page Network \rightarrow Interfaces \rightarrow MODEM_S1. In order to initiate a data connection, SIM_PIN and APN have to be specified. After that Bring up on boot flag has to be checked.

	Status	LAN_LAN_ALAS, LAN_DHCP_LAN_MAC_MODEM_S1_MODEM_S2_OMRVPN_WANKS					
	System	Interfaces - MODEM_S1					
	VPN	on this page you can configure the network interfaces. You can bridge several interfaces by licking the "bridge interfaces" field and enter the names of several network interfaces separated by spaces. You can also use VLAN notation INTERFACE.VLANN (e.g., etho. 1).					
	Services						
Network Common Configuration Network							
	OpenMPTCProuter						
	Interfaces	Status	Device: wwan_S1_0				
	Wireless		TX: 0 B (0 Pkts.)				
	DHCP and DNS	Protocol	ModemManager ·				
	Hostnames Static Routes	Bring up on boot					
	Diagnostics	SIM card slot	Slot 1 -				
	Firewall	SIM Card Configuration					
	Client Isolation Connection Check	SM Sol 1 SM Sol 2 SM Sol 3 SM Sol 4					
	MPTCP QoS	PIN	*				
	Configure Diagnostics	APN	internet.telekom				
	Statistics		Always use provider APN				
	Logout	Username	*				
	Logou	Password	*				
		Back to Overview	Save & Apply Save Reset				

After applying new settings the connection process starts. After some time, depending e.g. on signal strength, modem connection should be established.



BoxGW-P OpenWrt V20.29 L	xGW-P OpenWrt V20.29 Load: 0.49 0.36 0.20 Auto Refrest: on						
Status	LAN LAN_ALAS LAN_DHCP LAN_MAC MODEN_S1 MODEN_S2 OMRVPN) WANS						
System	Interfaces - MODEM_S1						
VPN							
Services							
Network							
OpenMPTCProuter		General Setup Advanced Settings Physical Settings Flewall Settings					
Interfaces	Status	Device: wwan_S1_0 Uptime: 0h 0m 15s					
Wireless		MAC: 00:00:00:00:00:00 RX: 168 B (2 Pkts.)					
DHCP and DNS		TX: 720 B (8 Pkts.)					
Hostnames Static Routes		IP94. 10.207.207.00700					
Diagnostics	Protocol	ModernManager	•				
Firewall	Bring up on boot	✓					
Client Isolation	SIM card slot	Slot 1	×				
Connection Check	SIM Card Configuration						
QoS	SIM Slot 1 SIM Slot 2 SIM Slot 3 SIM Slot 4						
Configure Diagnostics	PIN	••••	*				
Statistics	APN	internet.telekom					
1		Always use provider APN					
Logout		• mayo doo pre					
	Username		*				
	Password		*				
	Back to Overview		Save & Apply Save Reset				

Same procedure have to be done for the second modem interface (MODEM_S2) too.

Status	LAN LAN_ALIAS LAN_DHCP LAN_MAC MODEM_S1 MODEM_S2 OMRVPN WAN6					
System	per per de la persona per en la contra per de la contra per					
VPN	The traces - to extract - to ex					
Services						
Network	Common Configuration					
OpenMPTCProuter	General Setup Advanced Settings Physical Settings Provail Settings					
Interfaces	Status	Device: wwan_S2_0 RX: 0 B (0 Pkts.)				
Wireless		TX: 0 B (0 Pkts.)				
DHCP and DNS Hostnames	Protocol	ModemManager	Y			
Static Routes	Bring up on boot					
Diagnostics	SIM card slot	Slot 1	•			
Firewall	SIM Card Configuration					
Client Isolation Connection Check	SIM Slot 1 SIM Slot 2 SIM Slot 3 SIM Slot 4					
MPTCP	PIN	••••	*			
QoS	APN		*			
Configure Diagnostics	APN	internet.telekom				
Statistics		Always use provider APN				
Lengut	Username		*			
Logout	Password		*			
	Back to Overview		Save & Apply Save Reset			
yBoxGW-P OpenWrt V20.29	.oad: 0.70 0.47 0.26 Auto Refresh: on					
Status	LAN LAN_ALIAS LAN_DHCP LAN_MAC MODEM_S1 MODEM_S2 OMRVPN WAN6					
System						
System VPN	Interfaces - MODEM_S2	erfaces" field and enter the names of sev	veral network interfaces separated by spaces. You can also use <u>YLAN</u> notation INTERFACE . VLANNR (e.g.: eth8. 1).			
System VPN Services	Interfaces - MODEM_S2	erfaces" field and enter the names of sev	eral network interfaces separated by spaces. You can also use YLAN notation INTERFACE . VLANINR (e.g.: eth0.1).			
System VPN Services Network	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge int	erfaces" field and enter the names of sev	eral network interfaces separated by spaces. You can also use YLAN notation INTERFACE.VLANIR (e.g.: eth0.1).			
System VPN Services Network OpenMPTCProuter	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge int Common Configuration	Device: wwan S2 0	veral network interfaces separated by spaces. You can also use YLAN notation INTERFACE.VLANNR (e.g.: eth0.1).			
System VPN Services Network	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge in Common Configuration General Setup Advanced Settings Physical Settings Ferenal Settings	Device: wwan_52_0 Uptime: 0h 0m 195 ••• MAC: 00:00:00:00:00:00	veral network interfaces separated by spaces. You can also use YLAN notation INTERFACE.VLANNR (e.g.: eth0.1).			
System VPN Services Network OpenMPTCProuter Interfaces	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge in Common Configuration General Setup Advanced Settings Physical Settings Ferenal Settings	Device: wwan, S2, 0 Uptime: 0h 0m 195 MAC: 00:000:00:00:00 RX: 990 B (9 Pks.) TX: 1911 LKB (27 Pkts.)	veral network interfaces separated by spaces. You can also use <u>VLAN</u> notation INTERFACE.VLANNR (<u>e.g.</u> ; eth0.1).			
System VPN Services Network OpenMPTCProuter Interfaces UtrcP and DNS Hostnames	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge in Common Configuration General Setup Advanced Settings Physical Settings Ferenal Settings	Device: wwan_S2_0 Uptime: 0h 0m 19s MAC: 00:00:00:00:00 RX: 809 (6) PMs.)	eral network interfaces separated by spaces. You can also use <u>VLAN</u> notation INTERFACE . VLANIR (<u>e.g.</u> : eth0.1).			
System VPN Services Network OpenMPTCProuter Interfaces Uricelass DirCo and DNS Hostamanes Static Routes	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge in Common Configuration General Setup Advanced Settings Physical Settings Ferenal Settings	Device: wwan, S2, 0 Uptime: 0h 0m 195 MAC: 00:000:00:00:00 RX: 990 B (9 Pks.) TX: 1911 LKB (27 Pkts.)	weral network interfaces separated by spaces. You can also use <u>YLAN</u> notation INTERFACE.VLANNR (e.g.; eth0.1).			
System VPN Services Network OpenMPTCProuter Interfaces UtrcP and DNS Hostnames	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Prevail Settings Status	Device: wwan_52_0 Uptime: 0h 0m 19s MAC: 000000000000 XX: 900 B (9 Pits.) TX: 1911 IKB (27 Pits.) IPv4: 10.201141.213/30				
System VPN Services Network OpenMPTCProuter Interfaces UniCP and DNS Hostnames Static Routes Diagnostics	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Frewall Settings Protocol	Device: wwen. 52.0 Uptime: 0h 0m 395 PM Acc: 000.000.000.000 PKC: 801.000 The Uptime: 0h 100.000 The Uptime: 0h 100.000 Weith 100.001 100.000 ModernManager ModernManager				
System VPN Services Network OpenMPTCProuter Interfaces Wreless DHCP and DNS Hostnames Static Routes Diagnostics Firenal Client Isolation Connection Check	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge in Common Configuration General Setup Advanced Settings Physical Settings Freewall Settings Status Protocol Bring up on boot	Device: tween. 52.0 Uptime: On Ion 306 ## Macc: 000000000 RC: 0000 (9 Pots.) TK: 1011 (8 (27 Pots.)) IPW: 10.0114 (213:00) ModernManager				
System VPN Services Network OpenMPTCProter Interfaces WrCP and DNS Hostnames Static Routes Diagnosics Firewail Client Isolation Connection Check MPTCP	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge im Common Configuration General Setup Advanced Settings: Physical Settings: Prevail Settings Freevail Settings Freevail Settings Freevail Settings Status Situation SIM Card Configuration	Device: tween. 52.0 Uptime: On Ion 306 ## Macc: 000000000 RC: 0000 (9 Pots.) TK: 1011 (8 (27 Pots.)) IPW: 10.0114 (213:00) ModernManager				
System VPN Services Network OpenMPTCProuter Interfaces Wreless DHCP and DNS Hostnames Static Routes Diagnostics Firenal Client Isolation Connection Check	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by ticking the "bridge im Common Configuration General Setup Advanced Settings Physical Settings Freewall Settings Status Protocol Bring up on boot SM card stor	Device: tween. 52.0 Uptime: On Ion 306 ## Macc: 000000000 RC: 0000 (9 Pots.) TK: 1011 (8 (27 Pots.)) IPW: 10.0114 (213:00) ModernManager				
System VPN Services OpenMPTCProuter Interfaces Unterfaces DHCP and DNS Hostnames Static Routes Diagnostics Firewall Client Isolation Connection Check MPTCP QoS	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by tacking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Prevail Settings Status Protocol Bring up on boot SiM card configuration SM Sot SiM Set 3 SiM Set 4 PiN	Device: wwan. 52,0 Uptime: 0. for 395 ✓ Mcc.: 0.00.000.00 Mcc.: 0.00.000.00 0.000.00 Tr: 13.14.16.27 Mss.) Pred: MccentManager ✓ ✓ Sice 1				
System VPN Services Network OpenMPTCProuter Interfaces Writeless DICP and DNS Hostnames Static Routes Diagnostics Firewall Client Isolation Connection Check MPTCP QoS Configure Diagnostics	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by tacking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Prevail Settings Status Protocol Bring up on boot SIM Card Configuration SIM Stort 1 SIM Stort 2 SIM Stort 3 SIM Stort 4	Device: wwan. 52,0 Uptime: 0. To 00000000 Image: Mcd.: 0.000000000000 Th: 13.14.16.27 Mss.) Pred: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image:				
System VPN Services Network OpenMPTCProuter Interfaces Writeless DICP and DNS Hostnames Static Routes Diagnostics Firewall Client Isolation Connection Check MPTCP QoS Configure Diagnostics	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by tacking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Prevail Settings Status Protocol Bring up on boot SiM card configuration SM Sot SiM Set 3 SiM Set 4 PiN	Device: wwan. 52,0 Uptime: 0. for 395 ✓ Mcc.: 0.00.000.00 Mcc.: 0.00.000.00 0.000.00 Tr: 13.14.16.27 Mss.) Pred: MccentManager ✓ ✓ Sice 1				
System VPN Services Detwork OpenMPTCProuter Interfaces DHCP and DNS Hostnames Static Routes Diagnostics Fiewal Client Isolation Connection Check MPTCP QoS Configure Diagnostics Statistics	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by tacking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Prevail Settings Status Protocol Bring up on boot SiM card configuration SM Sot SiM Set 3 SiM Set 4 PiN	Device: wwan. 52,0 Uptime: 0. To 00000000 Image: Mcd.: 0.000000000000 Th: 13.14.16.27 Mss.) Pred: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image:				
System VPN Services Dependent CProuter Interfaces DHCP and DNS Hostnames Static Routes Diagnostics Firewal Citers Isolation Connection Check MPTCP QoS Configure Diagnostics Statistics	Interfaces - MODEM_S2 On this page you can configure the network interfaces. You can bridge several interfaces by tacking the "bridge int Common Configuration General Setup Advanced Settings Physical Settings Protocol Bring up on boot SiM card a dot SIM Card Configuration SiM sold Sold Sold Sold Sold Sold Sold Sold APN	Device: wwan. 52,0 Uptime: 0. To 00000000 Image: Mcd.: 0.000000000000 Th: 13.14.16.27 Mss.) Pred: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image: Image:				

6.1.4.4.4 Setup MPTCP

Now, MPTCP can be configured. This can be done by using of UI page (Network \rightarrow MPTCP \rightarrow Settings). By default MPTCP is enabled. Configuration of e.g. MultiPath TCP scheduler and MultiPath TCP path-manager can be done according to project goals. Configuration manual of a MultiPath TCP project ConfigureMPTCP contains further information about possible settings and their meaning.



3oxGW-P OpenWrt V20.29 L	1040:0.71 0.50 0.29				
Status	Settings Bandwidth MPTCP Support Check MPTCP Fullmesh Established connections				
System	мртср				
VPN	Networks MPTCP settings. Visit <u>http://multipath-tcp.org/prwviki.php/Users/ConfigureMPTCP</u> for help.				
Services	GLOBALS				
Network	Multipath TCP enable *				
OpenMPTCProuter					
Interfaces	Multipath TCP checksum	disable •			
Wireless DHCP and DNS	Multipath Debug	disable -			
Hostnames	Multipath TCP path-manager	fullmesh			
Static Routes Diagnostics	Multipath TCP scheduler	default -			
Firewall	Multipath TCP SYN retries	1			
Client Isolation	Congestion Control	bbr			
Connection Check		Ø Default is bbr			
QoS	Fullmesh subflows for each pair of IP addresses	1			
Configure Diagnostics Statistics	Re-create fullmesh subflows after a timeout	enable			
Statistics	ndiffports subflows number	1			
Logout	Interfaces Settings				
	LOOPBACK				
	Multipath TCP	disabled •			
		One interface must be set as master			
	LAN				
	Multipath TCP	disabled •			
		One interface must be set as master			

The role of each interface running MPTCP have to be defined. One interface have to be selected as master. Unused interfaces have to be marked as disabled.

WAN6	
Multipath TCP	disabled
	One interface must be set as master
OMRVPN	
Multipath TCP	disabled •
	One interface must be set as master
LAN_ALIAS	
Multipath TCP	disabled •
	One interface must be set as master
LAN_DHCP	
Multipath TCP	disabled
	One interface must be set as master
LAN_MAC	
Multipath TCP	disabled •
	One interface must be set as master
MODEM_S1	
Multipath TCP	master
	One interface must be set as master
MODEM_S2	
Multipath TCP	enabled •
	One interface must be set as master
	Save & Apply Save Reset

6.1.4.4.5 Setup VPS access

Last part needed for using of Link Aggregation is configuration of OpenMPTCProuter (OMR). OMR configuration can be done by using of UI page (Network \rightarrow OpenMPTCProuter \rightarrow Settings Wizard). Server IP, username and also server key have to be entered.



yBoxGW-P OpenWrt V20.29 I	040: 0.20 0.36 0.27					
Status	Settings Wizard Status Advanced Settings Show all settings					
System	Wizard					
VPN						
Services	Server settings					
Network		Delete				
OpenMPTCProuter	vps					
Interfaces	Server IP	152.89.244.210				
Wireless		O Server IP will be set for ShadowSocks, Glorytun, OpenVPN and MLVPN				
DHCP and DNS						
Hostnames	Server username	openmptcprouter				
Static Routes Diagnostics		API username to retrieve personnalized settings from the server.				
Firewall	Server key	'A7253F145AEC88B4E5C3699EA1B43254				
Client Isolation		Wey to configure and retrieve others keys from Server and to set server settings from OpenMPTCProuter.				
Connection Check		5				
MPTCP	Disable server	U				
005	Add server					

Settings according to technology which should be used for OMR<->VPS communication can be configured by using of the same UI page (Network > OpenMPTCProuter > Settings Wizard). Default setup allows usage of Shadowsocks between OMR and VPS. As a default encryption algorithm is chacha20 chosen. Also multiple different types of VPN endpoints can be used for communication between OMR and VPS.

Common server settings				
Advanced settings				
IPv6 settings				
Enable IPv6	You should disable IPv6 here if server doesn't provide IPv6.			
IPv6 ULA-Prefix	fd78.4c08:fbb1://48 Image: White State in the second se			
ShadowSocks settings				
By default ShadowSocks is used for TCP traffic.				
ShadowSocks key	//eLtknOLzpP80ikNxV2bFtAzla++KDCUxrvC Key is retrieved from server API by default. ShadowSocks is used for TCP.			
Disable ShadowSocks				
Encryption	chacha20 There is no Advanced Encryption Standard (AES) instruction set integrated in the processor, you should use chacha20. Encryption method is also used for Glorytun.			
VPN settings				
By default VPN is used for any traffic that is not TCP.				
Glorytun key	C03F164CAC99496058A02AF62B7EED1B Key is retrieved from server API by default. Glorytun TCP is used by default for UDP and ICMP			
Default VPN	Glorytun TCP Set the default VPN used for UDP and ICMP when ShadowSocks is enabled, for all traffic if ShadowSocks is disabled. All VPN available here can do aggregation over MPTCP or using own internal method.			

Further network interface configuration according to OMR<->VPS communication can be done by using of the same UI page (Network → OpenMPTCProuter → Settings Wizard).

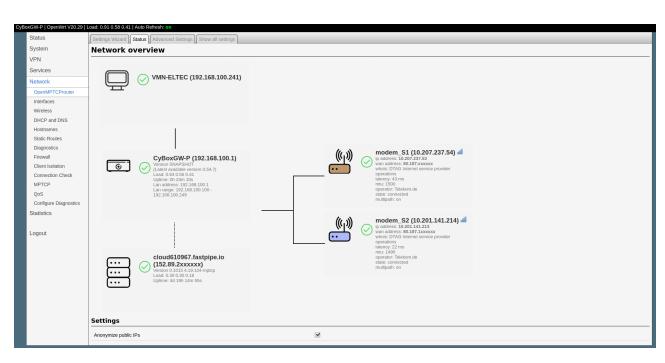


Interfaces settings	
You must disable DHCP on your modems and set IP in different networks.	Delete
modem_S1	
Label	Label for the interface
Protocol	Other Vou can use DHCP if you have multiple real ethernet ports. Select other if you want to use another protocol available in Network Interfaces page.
MPTCP over VPN	Vou can enable MPTCP over VPN if your provider filter Multipath TCP.
Enable SQM	Vou should disable SQM for LTE or any interfaces with variable speed.
Download speed (Kb/s)	Used by Glorytun UDP and SQM/QoS If enabled. 0 to use default value.
Upload speed (Kb/s)	Used by Glorytun UDP and SQM/QeS if enabled. 0 to use default value.
	Delete
modem_S2	
Label	Label for the interface
Protocol	Other Vou can use DHCP if you have multiple real ethernet ports. Select other if you want to use another protocol available in Network Interfaces page.
MPTCP over VPN	You can enable MPTCP over VPN if your provider filter Multipath TCP.
Enable SQM	Vou should disable SQM for LTE or any interfaces with variable speed.
Download speed (Kb/s)	Used by Glopfun UDP and SQMIQoS If enabled. 0 to use default value.
Upload speed (Kb/s)	O Used by Gloptun UDP and SQM/QoS If enabled. 0 to use default value.
eth0 • Add an interface	
Select the device you want to base the interface on.	
	Save & Apply Reset

Advanced settings such as e.g. runtime Master interface selection can be done by using of UI page (Network \rightarrow OpenMPTCProuter \rightarrow Advanced Settings).

Status	Settings Wizard Status Advanced Settings Show all settings					
System	Advanced Settings					
VPN	VPS settings					
Services						
Network	vps					
OpenMPTCProuter	Redirects all ports from server to this router					
Interfaces Wireless	Disable ports redirection defined in firewall from server to this router					
DHCP and DNS	Networks settings					
Hostnames Static Routes	IPv4 TCP Keepalive time	7200				
Diagnostics	IPv4 TCP FIN timeout	80				
Firewall Client Isolation	IPv4 TCP SYN retries	3				
Connection Check	IPv4 TCP Fast Open	3				
MPTCP OoS	Enable IPv6					
Configure Diagnostics Statistics	Disable external check	When enable check are done on external sites to get each WAN IP and the IP used to go outside.				
Logout	Disable TCP Fast Open	Disable TCP Fast Open on Linux and Shadowsocks configuration				
Eugour	Enable TCP Low Latency	Optimize for latency instead of bandwidth				
	Save vristats stats	Save vrstatis statistics on disk				
	Disable gateway ping	Olsable gateway ping status check				
	Disable default gateway	Oisable default gateway, no internet il VPS are down				
	Disable server ping	Oisable server ping status check				
	Master interface selection	Balancing				
		Save & Apply Reset				

After all settings are done and applied, network overview can be discovered by using of UI page (Network \rightarrow OpenMPTCProuter \rightarrow Status).



6.1.4.4.6 Speed test / IP

Previously configured OMR<-->VPS constellation is used to validate link aggregation functionality.

Important

Client connection to the internet destinations should be established over external VPS servers IP and not over one of two local uplinks at OMR! Check the IP reported by the website. It should match the IP of the VPS.

Important

Measured bandwidth is strongly dependent as well on currently available signal strength respectively quality as on contractual provider limitations for each used interface. Measurement values are only a snapshot. The exactly reproducibility can not be guaranteed!





6.1.5 Global DHCP and DNS Settings

Be sure you understand DHCP and DNS services before changing any configurations. Under normal circumstances, keeping the factory default setting should be sufficient.

The CyBox RT 2-A uses a DNS, TFTP and DHCP server. It is intended to provide coupled DNS and DHCP service to a LAN. This service accepts DNS queries and either answers them from a small, local, cache or forwards them to a real, recursive DNS server. See Chapter DHCP server 6.1.1.1 DHCP Server per Interface .

The DHCP server supports static address assignments and multiple networks. It automatically sends a sensible default set of DHCP options, and can be configured to send any desired set of DHCP options, including vendor-encapsulated options. It includes a secure, read-only, TFTP server to allow net/PXE boot of DHCP hosts and also supports BOOTP.



Status	DHCP and DNS						
System	Dnsmasq is a combined <u>DHCP</u> -Server and <u>DNS</u> -Forwarder for <u>NAT</u> firewalls						
VPN Server Settings							
Services							
Network		Settings Advanced Settings Static Leases					
Interfaces	Domain required	On't forward <u>DNS</u> -Requests without <u>DNS</u> -Name					
Wireless							
DHCP and DNS	Authoritative	This is the apply DHCD is the level potyood					
Hostnames		This is the only <u>DHCP</u> in the local network					
Static Routes	Local server	/lan/					
Diagnostics		Local domain specification. Names matching this domain are never forwarded and are resolved from DHCP or hosts files only					
Firewall		-					
Client Isolation	Local domain						
Connection Check		Local domain suffix appended to DHCP names and hosts file entries					
QoS	Log queries						
Configure Diagnostics Load Balancing		Write received DNS requests to syslog					
Statistics	DNS forwardings	/example.org/10.1.2.3 +					
Statistics		List of DNS servers to forward requests to					
Logout	Rebind protection						
		Obscard upstream RFC1918 responses					
	Allow localhost						
		Allow upstream responses in the 127.0.0.0/8 range, e.g. for RBL services					
	Domain whitelist	ihost.netflix.com +					
		Ist of domains to allow RFC1918 responses for					
	Local Service Only						
		Iimit DNS service to subnets interfaces on which we are serving DNS.					
	Non-wildcard						
		Bind dynamically to interfaces rather than wildcard address (recommended as linux default)					
	Listen Interfaces	+					
		Limit listening to these interfaces, and loopback.					
	Exclude interfaces	+					
		Prevent listening on these interfaces.					
		Save & Apply Save Reset					

DHCP And DNS Configuration Screen

6.1.6 Firewall

Be sure you understand zone-based firewalls before changing the firewall configurations.

The CyBox RT 2-A has a built-in stateful firewall mapping interfaces into Zones that are used to describe default rules for a given interface, forwarding rules between interfaces, and extra rules that are not covered by the first two.

The first rule that matches is executed, often leading to another rule-chain until a packet hits either ACCEPT or DROP/REJECT. Such an outcome is final, therefore the default rules take effect last, and the most specific rule takes effect first. Zones are also used to configure masquerading also known as NAT (network-address-translation) as well as port forwarding rules, which are more generally known as redirects.



Zones must always be mapped onto one or more Interfaces, which ultimately map onto physical devices; therefore zones cannot be used to specify networks (subnets), and the generated iptables rules operate on interfaces exclusively. The difference is that interfaces can be used to reach destinations not part of their own subnet, when their subnet contains another gateway. Usually however, forwarding is done between LAN and WAN interfaces, with the router serving as 'edge' gateway to the Internet. The default configuration of the Firewall provides for such a common setup.

Status	General Settings Port Forwards Traffic Rules Custom Rules					
System Firewall - Zone Settings						
VPN	The firewall creates zones over your network interfaces to control network traffic flow.					
Services	General Settings					
Network						
Interfaces	Enable SYN-flood protection					
Wireless	Drop invalid packets					
DHCP and DNS	Input accept r					
Hostnames	Output accept -					
Static Routes						
Diagnostics	Forward reject					
Firewall	Routing/NAT Offloading					
Client Isolation	Experimental feature. Not fully compatible with QoS/SQM.					
Connection Check	Software flow offloading					
QoS						
Configure Diagnostics						
Load Balancing	Zones					
Statistics	Zone ⇒ Forwardings Input Output Forward Masquerading					
	Ian ⇒ wan accept • accept • accept •					
Logout	wan ⇒ REJECT reject reject Edit Delete					
	Add					
	Save & Apply Save Reset					

Firewall Zone Setting Screen

6.1.7 OpenVPN

Starting with firmware version 3.2 the Open Source VPN solution is included. The firmware before version 4.0 does not support a web frontend for OpenVPN configuration.

The OpenVPN program has many parameters to setup a connection. This chapter describes a basic Client OpenVPN tunnel configuration. In the next example the VPN tunnel connection is made through an already running LTE interface providing the Internet gateway.

6.1.7.1 Configuration file generation on Windows

OpenVPN for Windows can use an OpenVPN-GUI, which allows managing OpenVPN connections from a system tray applet. It can be used to generate a complete client configuration (zip file) including the .ovpn configuration file.

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6.1.7.2 VPN interface setup – 3 methods

The VPN connection setup can be achieved by the three following methods.

Westermo

6.1.7.2.1 Copy Ready-to-use configuration with SCP

This is the easiest way to configure a VPN connection. It is assumed that the server side has a configured network environment. The server administrator should create a valid client configuration package, including certificates, client keys and preferably a myclient.ovpn config file. The VPN connection is built on this configuration file (myclient.ovpn). This example uses four files that have to be static stored on the CyBox RT 2-A to allow the openvpn program to build up a connection without user interaction. If the 'auth-user-pass' option is given to openvpn without a parameter, the connection setup is interrupted and will ask for a username and password. To make this run automatically a two-line file with username (in first line) and password (in second line) has to be provided. All four files, the 'auth_user_pass', the 'pfelt1-udp-vpnuser_fg.p12', the user key file 'pfelt1-udp-vpnuser_fg-tls.key' and the 'myclient.ovpn' config file have to copied from host system via 'scp' command to permanent storage located in '/etc/openvpn/' directory. Ensure that all files in '/etc/openvpn' have file permission 600 (cd /etc/openvpn; chmod 600 *).

The 'myclient.ovpn' configuration is:

```
dev tun
persist-tun
persist-key
cipher AES-256-CBC
auth SHA1
tls-client
client
resolv-retry infinite
remote 166.93.10.174 1194 udp
lport 0
verify-x509-name "VPN Server Cert" name
auth-user-pass auth\_user\_pass
pkcs12 pfelt1-udp-vpnuser\_fg.p12
tls-auth pfelt1-udp-vpnuser\_fg-tls.key 1
ns-cert-type server
comp-lzo
```

6.1.7.2.2 Upload configuration, certs, key-files with web interface

The second method is quite the same as the first. A modified 'myclient.ovpn' file is used. The difference is, that the certificate, the key files and the password files are uploaded from web interface. The default web interface upload directory is /etc/luci-uploads/ and the uploaded file is appended with service type and interface name e.g.:

/etc/luci-uploads/cbid.openvpn.my_vpn.myclient.ovpn

As a first step add your new VPN configuration using a predefinition.

Status	OpenVPN							
System	OpenVPN instances							
VPN	Below is a list of configured OpenVPN instances and their current state							
IPSecVPN	Name	Enabled	Started	Start/Stop	Port	Protocol		
OpenVPN	custom_config		no	start	-	-	Edit	Delete
Services	sample_server		no	start	1194	udp	Edit	Delete
Services	sample_client		no	start	-	udp	Edit	Delete
Network								
Statistics	Template based configuration							
	Instance name Select template							Add
Logout	OVPN configuration file upload							
	my_vpn		Browse pfelt1-udp-34447-vpnuser_fg.ovpn					Upload
							Save & Apply	Save Reset

1. New VPN configuration using a predefinition:



Edit your config.ovpn file and make sure that all certificates, key-files, user-name-pass files have the correct path including your config name, here 'my_vpn'.

The prepared 'myclient.ovpn' configuration looks like and is ready for upload:

(uploaded to /etc/luci-uploads/cbid.openvpn.my_vpn.myclient.ovpn)

```
dev tun
persist-tun
persist-key
cipher AES-256-CBC
auth SHA1
tls-client
client
resolv-retry infinite
remote 166.93.10.174 1194 udp
lport 0
verify-x509-name "VPN Server Cert" name
auth-user-pass
/etc/luci-uploads/cbid.openvpn.my\_vpn.auth\_user\_pass
pkcs12
/etc/luci-uploads/cbid.openvpn.my\_vpn.pfelt1-udp-vpnuser\_fg.p12
tls-auth
/etc/luci-uploads/cbid.openvpn.my\_vpn.pfelt1-udp-vpnuser\_fg-tls.key
1
ns-cert-type server
comp-lzo
```

6.1.7.2.3 Manual configuration with web interface

The third method does not use a preconfigured .ovpn file. You will have to enter each single parameter in the web interface. As the service is started, all given parameter are passed to the 'openvpn' program. This method may be useful for fast switching of parameters for server and client.

6.1.7.3 VPN host configuration (on console)

After the VPN client part configuration has been done, it's time to configure the rest of the system and start a first connection. This configuration can be done at console (via SSH) with 'uci' commands.

The openvpn program execution on the CyBox RT 2-A is managed with the '/etc/init.d/openvpn' script.

The following configuration is done at the command prompt:

Create the VPN interface: (if not running server-bridge)

```
uci set network.vpn0=interface
uci set network.vpn0.ifname=tun0
uci set network.vpn0.proto=none
uci set network.vpn0.auto=1
```

Allow inbound VPN traffic:

```
uci add firewall rule
uci set firewall.@rule[-1].name=Allow-OpenVPN-Inbound
uci set firewall.@rule[-1].target=ACCEPT
uci set firewall.@rule[-1].src=\*
uci set firewall.@rule[-1].proto=udp
uci set
`firewall.@rule[-1].dest\_port=1194 <mailto:firewall.@rule[-1].dest_port=1194>`__
```

Allow OpenVPN tunnel utilization: (not needed when bridging using tap)



```
uci set firewall.@zone[-1].input=REJECT
uci set firewall.@zone[-1].forward=REJECT
uci set firewall.@zone[-1].output=ACCEPT
uci set
`firewall.@zone[-1].network=vpn0 <mailto:firewall.@zone[-1].network=vpn0>`___
uci set firewall.@zone[-1].masq=1
uci set firewall.@zone[-1].mtu\_fix=1
uci add firewall forwarding
uci set firewall.@forwarding[-1].src='lan'
uci set firewall.@forwarding[-1].dest='vpn'
```

Commit the changes:

```
uci commit network
/etc/init.d/network reload
uci commit firewall
/etc/init.d/firewall reload
```

Enable the start flag and setup configuration file:

```
echo > /etc/config/openvpn
uci set openvpn.vpn=openvpn
uci set openvpn.vpn.enabled=1
uci set openvpn.vpn.config='/etc/openvpn/myclient.ovpn'
uci commit openvpn
```

Finally do a first test and start manually the openvpn connection:

/etc/init.d/openvpn start

Use the 'logread' command to watch the connection progress.

```
Nov 26 15:59:05 CyBoxAP daemon.notice openvpn(vpn)[8040]: OpenVPN 2.3.4
powerpc-openwrt-linux-gnu [SSL (OpenSSL)] [LZO] [EPOLL] [MH] [IPv6]
built on Nov 12 2015
Nov 26 15:59:05 CyBoxAP daemon.notice openvpn(vpn)[8040]: library
versions: OpenSSL 1.0.1i 6 Aug 2014, LZO 2.08
Nov 26 15:59:06 CyBoxAP daemon.notice openvpn(vpn)[8040]: Control
Channel Authentication: using 'pfelt1-udp-vpnuser\_fg-tls.key' as a
OpenVPN static key file
Nov 26 15:59:06 CyBoxAP daemon.notice openvpn(vpn)[8040]: UDPv4 link
local (bound): [undef]
Nov 26 15:59:06 CyBoxAP daemon.notice openvpn(vpn)[8040]: UDPv4 link
remote: [AF\_INET] 166.93.10.174:1194
Nov 26 15:59:06 CyBoxAP daemon.warn openvpn(vpn)[8040]: WARNING: this
configuration may cache passwords in memory -- use the auth-nocache
option to prevent this
Nov 26 15:59:08 CyBoxAP daemon.notice openvpn(vpn)[8040]: [VPN Server
Cert] Peer Connection Initiated with [AF\_INET] 166.93.10.174:1194
Nov 26 15:59:11 CyBoxAP daemon.notice openvpn(vpn)[8040]: TUN/TAP device
tun0 opened
Nov 26 15:59:11 CyBoxAP daemon.notice openvpn(vpn)[8040]: do\_ifconfig,
tt->ipv6=0, tt->did\_ifconfig\_ipv6\_setup=0
```



Nov 26 15:59:11 CyBoxAP daemon.notice openvpn(vpn)[8040]: /usr/sbin/ip link set dev tun0 up mtu 1500 Nov 26 15:59:11 CyBoxAP daemon.notice openvpn(vpn)[8040]: /usr/sbin/ip addr add dev tun0 local 192.168.20.6 peer 192.168.20.5 Nov 26 15:59:11 CyBoxAP daemon.notice netifd: Interface 'vpn0' is enabled Nov 26 15:59:11 CyBoxAP daemon.notice netifd: Network device 'tun0' link is up Nov 26 15:59:11 CyBoxAP daemon.notice netifd: Interface 'vpn0' has link connectivity Nov 26 15:59:11 CyBoxAP daemon.notice netifd: Interface 'vpn0' is setting up now Nov 26 15:59:11 CyBoxAP daemon.notice netifd: Interface 'vpn0' is now up Nov 26 15:59:11 CyBoxAP daemon.notice openvpn(vpn)[8040]: Initialization Sequence Completed Nov 26 15:59:11 CyBoxAP user.notice firewall: Reloading firewall due to ifup of vpn0 (tun0

6.1.8 QoS

In the following example, a networking interface LAN or WLAN is prepared to use the Quality of Service function (QoS). The CyBox RT 2-A implements a QoS function with scripts to configure traffic control ('tc' command), which reduces throughput at a selected interface. To see the effect, a performance test can be started with the built-in 'iperf' program to measure the throughput.

- Select Network $\rightarrow QoS$
- The default 'Interface' WAN is not activated and can be deleted.
 - In box Interfaces enter an existing interface name e.g. 'lan' an click button Add
 - Enter 1024 in the Download speed (kbit/s) field
 - Enter 1024 in the Upload speed (kbit/s) field
 - Activate checkbox Enable
 - Click Save && Apply

Do an 'iperf' performance test. The throughput should be about 10 Mbits/s. If a WLAN interface is bridged with the LAN port, the traffic control can even work on a single part of the bridge. To reduce the wireless traffic only, a new interface label must be added to $Network \rightarrow Interfaces$ menu e.g. WLAN. Then the new interface label has to be used in the QoS menu.



6.2 Modem

The Modem Connection 3G/4G/5G web page provides status information about a selected modem interface. The information is updated cyclically (about every 10 seconds). This page is divided into four sections, where the first section shows the connection status to the provider and the SIM card data. In the second section static modem parameters are displayed, such as type and firmware version.

The third section shows the current signal strengths as bar graphs. At the end of the page the output of a QMI command function is provided as text. Several QMI command functions can be configured, but only one is displayed at a time.

Modem Monitor

System A Services Ser	Status	Configuration Monitor	
Services Network Network Network Network Connection Information Connection Services Signal Strength Generation Connection Status Connection Connection Status Connection Connection Status Conne	System	Modem in Slot 4	
Network: Interfact of the second	Services		
Modem Signal sergific Signal sergific 3004000 Operator Voltorio de (8000) VPN 600 modem of allalis Connection dallalis Connection statistica 0 do 0.00.212 [1.2 K M5]3 1 K B Logout 100 modem of allalis Connection statistica Connection statistica SiliConne SM630200-All2 Pinneer Revision SiliConne SM630200-All2 Pinneer Revision Modem of allalis Connection statistica allower 2g, 9, 4g, 5g preferrer: 5g Connection statistica allower: 2g, 5g, 4g, 5g preferrer: 5g Modem formation silicone Pinneer Revision silicone RSIS Silicone RSIS Silicone RSIS Silicone <th>Network</th> <th></th> <th></th>	Network		
VPN Operation Oper	Modem	Signal strength	100%
VPN Operation Oper	3G/4G/5G Connection Info		•860L
Statistics Connection status connection Logout Connection status 0.00.002/12/12.04.09.31.16.00 Logout Life - 60-hoststandione: EUTRAN-BAD20 + NRSG_BAD075 Intille Bearer (APR), IP-Type) Web.volation.e.d., juol. Bearlos WCDMAnone Life available - 60 65 Anone - 60 NSA available yes Meder Information MPSS-N12.5-01106-5D055, CPEALL PACK-1.486794.2.49776.2.1 [May 17 2022 07:00:00] Current Modes advator Bille Gearer (APR) Service Commer Revision MPSS-N12.5-01106-5D055, CPEALL PACK-1.486794.2.49776.2.1 [May 17 2022 07:00:00] Current Modes advator Bille Gearer (APR) Service Comminication port mmi_0008_01.04.00_pipe_32.01() House Bearlow Service Commer Bearlow Service Bille Gearer (APR) Service Bille Information			
Logout Connection statistics © 00,000:212 2.6 KB 3.1 KB Logout Technology (Banr) LTF + 50-konstituations: EUTRAH-BAND20 + NRSG_BAND75 Hill blacker (APN, IP-Type) web.oddine.de, lpvA Registration Nome Services WCDMAnnone LTE-available 56 SAnnon 56 NSA available;yes Modern Information MPSSH12:50-1106-50X55_CPEALL_PACK-1.486794.2.497578.2 1 [May 17 2022 07:00:00] Current Modes allowed: 2a, 3a, 4a, 5g; preferred: 5g MEI Sel234040291633 Communication port ml (Dago) (1.94.00, pipe.32 (at)) Puipin stimber Notes sel234040291633 Communication port ml (Dago) (1.94.00, pipe.32 (at)) Puipin stimber Model temperature Signal Information RSSI genetiments (at Notes the late) 0.025 Mid cell RSSI genetiments (at Notes the) 0.025 Mid cell RSR Q 40 0.025 Mid cell Bibbers Registration 1.025 min (Nwy genetic) RSR Q 40 1.025 min (Nwy genetic) Bibbers Registration 1.025 min (Nwy genetic) RSR Q 40 1.025 min (Nwy genetic) Bibbers Registration 1.025 min (Nwy genetic) Bibbers Registration 1.025 min (Nwy genetic) Bibbers Registration 1.025 min (Nwy genetic)<	Statistics		
Lopott Technology (Band) LTE + 50-HonStandalone: EUTRAH-BAND29 + NR56_BAND79 Initial Baser (AN, IP-Type) web.vodafine. do., ipuid BarNo BorNo SarNos WCDMAnone LTE available 305 SAnone 305 NSA available.yes Hommann Memory Def Marcone LTE available 305 SAnone 305 NSA available.yes Memory Jone SarNos Adden Information MPSS H12.501106-SDX55_CPEALL_PACK-14.86794.2497576.21 [May 17 202 07.00.00] Current Modes allowed: 2g. 3g. 4g. 5g: proferred: 5g Mell 6024040201695 Communication port mtl 3056_01.04.00 pipe_32 (at) Housine Barter Mandal 367 C Starl Information allowed: 2g. 3g. 4g. 5g: proferred: 5g Models Importante 367 C Starl Information allowed: 2g. 3g. 4g. 5g: proferred: 5g Models Importante 367 C Starl Information allowed: 2g. 3g. 4g. 5g: proferred: 5g Models Importante allowed: 2g. 3g. 4g. 5g: proferred: 5g Models Importante allowed: 2g. 3g. 4g. 5g: proferred: 5g Models Importante allowed: 2g. 3g. 4g. 5g: proferred: 5g Model Information allowed: 2g. 3g. 4g. 5g: proferred: 5g Model Information allowed: 2g. 3g. 4g. 5g: proferred: 5g Model Information allowed: 2g. 3g. 4g. 5g: profered: 5	Clanonos		
Lögöuft tollal Berner (APR, IP-Type) web.volatione.de, ipv4 Registration home Services WCMAnone LTE-available 50 SAnone 50 NSA available.yes Modern Information Type SIMCom SIM82020-M2 Type SIMCom SIM82020-M2 Type Berler Revision MPS3-RL2.501106-SDX55_OPEALL_PACK-1.486794.2.497576.2.1 [May 17 2022 07:00:00] Current Modes allowed: 2g, 3g, 4g, 5g; proferred: 5g IMEI Berler			
Registration home Services WCDM.Anone LTE.available 5G SA.none 5G NSA availableryes Modem Information Type Type SIMCom SIM50202-M2 Firmware Revision MPSS.H12.501106-5DXS3_CPEALL_PACK-1.486794.2.497376.2.1 [May 17 2022 07.00.00] Current Modes allower: 2g, 3g, 4g, 6g; prefered: 5g IMEI S64280.402291503 Communication port mil 0036 01.04.00_pipe_32 (al) Pligin sintech Module temperature 38''C Signal Information S2.05m1 (Vary good ResSI (feemed System broken) 52.05m1 (Vary good RSSA CA GG 0.05m (Mid cell) (feemed System broken) 52.05m1 (Vary good RSSA CA GG 1.12 dB [Good RSSA CA GG 1.12 dB [Good RSSA CA GG 1.12 dB [Good RSSA CG Good 1.32 dB [Go	Logout		-
Modem Information Type SIMCons SIM2200-M2 Firmware Revision MPSS.H12.5-01106-SX55_CPEALL_PACK-1.486794.2.497578.2.1 [May 17.2022 07:00:00] Current Modes allowed: 2g. 3g. 4g. 5g. preferred: 5g IMEI 66423040291853 Communication port ml (3006 01:04.00 pipe_32 (at)) Plugin simtech Module temperature 39°C Sgal Information 900 01:04.00 pipe_32 (at) Plugin simtech Module temperature 39°C Sgal Information 900 08] Mid cell RSSR 4G 900 08] Mid cell RSSR 4AG 900 08] Mid cell RSSR 4AG 900 08] Mid cell RSSR 4G 900 080 RSSR 4G 900 080 RSSR 4G 13.5 dB Good Status: "none" 13.5 dB Good If/dev/dc/ugfi Skell Successfully got system info: "True Status: "none" VGMA service: "status: "none" "True Status: "none" If Status: "none" "True Status: "none" True Status: "none" "Status: "none" Status: "none" "Status: "none" True Status: "none" "Status: "none" Status: "none" "Status: "none" Corrent Cell Die True Status: "none" Status: "none" "Status:			home
Type SIMCom SIM8202G-M2 Firmware Revision MPSS.H12.501106-SDX55_CPEALL_PACK-1.465794.2.497376.2.1 [May 17 2022 07.00.00] Current Modes allowed: 2g, 3g, 4g, 5g; preferred: 5g IMEI 664236040201553 Communication port ml, 0306_01.04.00_pipe_32 (al) Plugin simmech Module temperature 36*C Signal Information 522 dBin [Very good Rest of the second System Lendon 60.005 [Mid cell (Bupt of the second System Lendon 60.005 [Mid cell (Bupt of the second System Lendon 60.005 [Mid cell (Bupt of the second System Lendon 60.005 [Mid cell (Bupt of the second System Lendon 60.005 [Mid cell (Bupt of the second System Lendon 60.005 [Mid cell (Bupt of the second System Cally) 1.02.08 [Likes good (Bupt of the second Cally) 1.02.08 [Likes good (Bupt of the second Cally) 1.02.08 [Likes good (Bupt of the second Cally) 1.02.08 [Good (Bupt of the second Cally) 1.03.08 [Good <th></th> <th>Services</th> <th>WCDMA:none LTE:available 5G SA:none 5G NSA available:yes</th>		Services	WCDMA:none LTE:available 5G SA:none 5G NSA available:yes
Immune Revision MPSB.H12.5-01106-SDX55_CPEALL_PACK-1.486794.2.497576.2.1 [May 17 2022 07:00:00] Current Modes allowed: 2a, 3a, 4g, 5g, preferrerd: sg IME 664294040291535 Communication port ml_0006_01.04.00_pipe_32 (a) Plugin simtech Module temperature 3°C Signal Information RSSI [Immedigue temperature RSSI [Immedigue tempera		Modem Information	
Firmware Revision MPSB.H12.5-01106-SDX55_CPEALL_PACK-1.486794.2.497376.2.1 [May 17 2022 07.00.00] Current Modes allowed: 2aj, 3a, 4g, 5g, preferrerd: sg IME 66420400291503 Communication port mll_0306_01.04.00_pipe_32 (a) Plugin sintech Module temperature 3PC Signal Information RSSI (momed figure theter) Signal Information 502.0001 [Mid cell Rinker Gala States 90.000 [Mid cell Rinker Gala States 90.000 [Mid cell Rinker Galant Galanty) -0.000 [Mid cell Rinker Galanty -0.000 [Mid cell Rinker Galanty -0.000 [Mid cell Rinker Galanty) -1.000 [Mid cell Rinker Galanty) -1.000 [Mid cell Rinker Galanty) -1.000 [Mid cell Rinker Galanty -1.000 [Mid cell		Type	SIMCom SIM8202G-M2
IMEI 964284040291933 Communication port ml_030_01.04.00_pipe_32 (at) Plugin simmlech Module temperature 36°C Signal Information 92.04mm [Very oped.] Present give themes housen; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe; 92.04mm [Very oped.] Resent give themes form laction Pawe;			MPSS.HI.2.5-01106-SDX55 CPEALL PACK-1.486794.2.497576.2 1 [May 17 2022 07:00:00]
Communication port mN_0306_01.04.00_pipe_32 (al) Piggin simtech Module temperature 36"C Signal Information Signal Information <t< th=""><th></th><th>Current Modes</th><th>allowed: 2g, 3g, 4g, 5g; preferred: 5g</th></t<>		Current Modes	allowed: 2g, 3g, 4g, 5g; preferred: 5g
Plugin similach Module temperature 36°C Signal Information 582 dbm [Vary good] RSS / G 90 dbm [Access] RSS / AG 90 dbm [Access]		IMEI	864284040291853
Module temperature 36°C Signal Information		Communication port	mhi_0306_01.04.00_pipe_32 (at)
Signal Information RSS (serversd ignal finding in fording in fordin			
RSS1 (Reviewed Signal Strength Industrie) 52:dBm Verry good SIN R 4G (Bignal to Entertwork Signal Reviewed Custor) 0.0 dBl, Mid cell RSR-0.4G (Reference Signal Reviewed Custor) 0.0 dBl, Mid cell RSR-0.4G (Reference Signal Reviewed Custor) 0.0 dBl, Excellent RSR-0.4G (Reference Signal Reviewed Custor) 0.1 dBl, Excellent RSR-0.5G (Reference Signal Reviewed Custor) 0.1 dBl, Excellent RSR-0.5G (Reference Signal Reviewed Custor) 0.1 dBl, Excellent SIN F 5G (Reference Signal Reviewed Custor) 0.1 dBl, Bl, Good System Info 13.5 dB Good If / dev/cdc_wdm 54.0 {Sl, Oliccessfully got system info:			36°C
(Notice Signal Enclose) Co.c.d.E.III. (Very VgCo.c.) (Not Add) (Signal Is Interference Signal Enclose) Co.d.E.III. (Very VgCo.c.) RSRP 4d (Reference Signal Enclose) Prever) Co.d.E.III. (Very VgCo.c.) RSRP 4d (Reference Signal Enclose) Prever) Co.d.E.III. (Very VgCo.c.) RSRP 4d (Reference Signal Enclose) Prever) Co.d.E.III. (Very VgCo.c.) RSRP 5d (Reference Signal Enclose) Prever) EDC.E.III. (Very VgCo.c.) RSRP 5d (Reference Signal Enclose) Prever) EDC.E.III. (Very Vgcco.c.) System Info 13.3.d.B.J.G.God VCOWA (arrivics: 'none' 'True Status: 'none' 'True Status: 'none' 'True Status: 'none' 'True Status: 'available' 'True Status: 'available'		Signal Information	
(Byord to Enderwood States) 1000000000000000000000000000000000000		(Received Signal Strength Indicator)	-52 dBm Very good
(Induces Synthesized Cushy) Club (Induced Sum) RSRP 43 CTrickIm (Vary good) RSRP 53 CTrickIm (Vary good) (Upper biose Prave) CTrickIm (Vary good) SNR 56 CTrickIm (Vary good) (Upper biose Arau) CTrickIm (Vary good) System Info CTrickIm (Vary good) [/deviced synthesize Cushy) CTrickIm (Vary good) System Info CTrickIm (Vary good) [/deviced synthesize Cushy) CTrickIm (Vary good) System Info CTrickIm (Vary good) [/deviced synthesize Cushy) CTrickIm (Vary good) [/deviced synthesize Cushy) CTrickIm (Vary good) Status: 'none' Preferred data path: 'no' Preferred data path: 'no' CTrickIm (Vary good) Status: 'available' Trice Status: 'available' Trice Status: 'available' Trice Status: 'available' Preferred data path: 'no' Device Status: 'available' Preferred data path: 'no' Device Status' 'available' Preferred data path: 'no' Device Status' 'available' Preferred data path: 'no' Device Status' 'available' Preferred data path: 'no' Device Statu		(Signal to Interference plus Noise Ratio)	9.0 dB Mid cell
(Hetmore Synchronia Synchronia Found and and and and and and and and and a		(Reference Signal Received Quality)	
(Nutriend Signal Research Custor) -11.0.00000 RSRP PG (Reference Signal Research Pauer) 110.0000 mil (Very Weakk) Sint SG (Signal to block Rate) 13.5.dB Good System Info 13.5.dB Good (I/dev/cdc_wdm S4.8] Successfully got system info: WCDM service: Status: 'none' True Status: 'none' True Status: 'available' True Status: 'available' True Status: 'available' Frefered data path: 'no' Dervice capability: 'cs-ps' Roaming status: 'off' Forbidden: 'no' Cell ID: '1537666'		(Reference Signal Receive Power) RSRQ 5G	
(Number Supplement Press) (Number II) Very Yweek SNt 5G (Upget to block Rate) 13.5 dB Good System Info (/dev/cdc_wdm.54.8] Successfully got system info: VCDM service: Status: 'none' True Status: 'none' True Status: 'none' Status: 'available' True Status: 'available' True Status: 'available' Frefered data path: 'no' Service capability: 'cs-ps' Rosaning status: 'off' Forbidden: 'no' Cell ID: '15337666'		(Reference Signal Received Quality)	-12 dB Good
Operative Notes IS-So db Good System Info [/dev/cdc_wdm.54.0] Successfully got system info:		(Reference Signal Receive Power)	-109.dBm Very weak
/ //dev/cdc.wdm_54.01 Successfully got system info: WOMM service: Status: 'none' Preferred data path: 'no' LTE service: Status: 'available' True Status: 'available' Preferred data path: 'no' Service capability: 'tc=ps' Roaming status: 'off' Forbidden: 'no' Cell ID: '1535666'		(Signal to Noise Ratio)	13.5 dB Good
<pre>WCMM service: Status: 'none' True Status: 'none' Preferred data path: 'no' LTE service: Status: 'available' True Status: 'available' Domain: 'aspPathable' Generation: 'no' Bomain: 'aspPathable' Service capability: 'tc-ps' Roaming status: 'off' Forbidden: 'no' Cell ID: '1537666'</pre>			
PNC: 202' PNC: 22'		<pre>WCDMA service: Status: 'none' True Status: 'none' IT Freferred data path: 'no' Status: 'available' True Status: 'available' Preferred data path: 'no' Domain: 'cs-pa' Service capability: 'cs-ps' Romming status: 'off' Coll ID: '15537666' MCC: '262'</pre>	nfo:

6.2.1 Modem Configuration

Use the Modem \rightarrow Modem Connection $3G/4G/5G \rightarrow$ Configuration tab to enter the configuration section.

Only one modem interface can be displayed on the monitor page. After a configuration factory reset the first modem found in the system is used. Only network modem interfaces can be selected.

Modem Interface Configuration



Status	Configuration Monitor		
System	Configuration Modem-Info		
Services	Configuration panel for the Modern-Info application.		
Network			
Modem	Interface	modem_S4	~
3G/4G/5G Connection Info	-	Select Modem interface to monitor.	
VPN	QMI Command	Get System Info (default)	~
Statistics		Select a QMI command to call in more	nitor page.
			Save & Apply 🚔 🔻 Save Reset
Logout			

Modem Interface Select

Status	Configuration Monitor	
System	Configuration Modem-Info	
Services	Configuration panel for the Modem-Info application.	
Network	1	
Modem		modem_S4 v modem_S4
3G/4G/5G Connection Info		modem_S3
VPN	QMI Command	modem_S1
Statistics		Select a QMI command to call in monitor page.
		Save & Apply 🖨 🔻 Save Reset
Logout		

The call of the QMI function, which can be seen on the Monitor page, is also selected on the configuration page. With these QMI commands special connection parameters like TAC, LAC, Cell ID, rx/tx data-rates etc. can be read out. For detailed information about these QMI Command functions please refer to https://www.freedesktop.org/software/libqmi/man/latest/qmicli.1.html.

QMI Command Select

Status	Configuration Monitor		
System	Configuration Modem-Info		
Services	Configuration panel for the Modern-Info application.		
Network			
Modem	Interface	modem_S4	~
3G/4G/5G Connection Info	-	Select Modem interface to monitor.	
VPN	QMI Command	Get System Info (default)	¥.
Statistics		Get System Info (default) Get Current IP Settings	page.
	L	Get Channel Rates Get Card Status	Save & Apply 🚔 🔻 Save Reset
Logout		Get Slot Status	
		Get Home Network Get Cell Location Info	
		Get Serving System	
		Get LTE CPHY CA Info	
		Get Technology Preference Get Preferred Networks	
		Get Rf Band Info	

6.2.2 Modem Monitor

Use the Modem \rightarrow Modem Connection $3G/4G/5G \rightarrow$ Monitor tab to enter the monitoring section.

6.2.2.1 Connection Information

Modem Connection Section

Status	Configuration Monitor	
System	Modem in Slot 4	
Services	Connection Information	
Network		100%
Modem	Signal strength	- ntil
3G/4G/5G Connection Info	Operator	vodafone.de (26202)
VPN	SIM status	
Statistics	Connection status	connected
	Connection statistics	⑦ 0d, 00:03:02 ↓3.7 KiB ↑4.2 KiB
Logout	Technology (Band)	LTE + 5G-NonStandalone: EUTRAN-BAND20 + NR5G_BAND78
Logour	Initial Bearer (APN, IP-Type)	web.vodafone.de, ipv4
	Registration	home
	Services	WCDMA:none LTE:available 5G SA:none 5G NSA available:yes



The signal strength is shown here in percent as an increasing bar graph. The basis for the display is the measured **RSSI** value. The display is always shown, even if no provider is connected.

If the connection was successful, the provider and the *mobile country codes (MCC)* as well as *mobile network codes (MNC)* are displayed in brackets in the operator line.

In the connection status line shows the individual phases of the connection establishment such as **searching**, **registered**, **connected**, ... but also a possible error message such as for example: **SIM missing**.

The connection statistics shows the duration of the connection and the amount of data for download and upload.

In the technology line the 3G/4G/5G network registration mode and the occupied frequency bands are displayed. The type of network registration can also change within the **connected** phase without the connection being interrupted. e.g. LTE+5GNSA => LTE => LTE+5GNSA.

The next two lines show the APN used, the IP type and the registration mode (here: home).

The last line provides information about the registered cell and the services available in it, such as **WCDMA**, **UMTS**, **LTE**, **5G-SA** and **5G-NSA**. The availability of a certain service does not mean, however, that this service mode is also registered. For example, a 5G connection will not be established without a corresponding SIM card contract.

To display the SIM card information, move the mouse cursor over the SIM card icon. The used SIM **card slot**, the corresponding **PIN** and **APN** are read from the current configuration for the selected modem interface. The **Status** of the SIM card is listed in last line, is normally **SIM Ready**, but may also indicate a card problem e.g. Card busy, PIN error, ...

Modem SIM Card Information

Connection Information	
Signal strength	51%
Operator	vodafone.de (26202)
SIM status	Slot: 1 PIN: 0000
Connection status	COT APN: web.vodafone.de IMSI: 262022807743483
Connection statistics	C (ICCID: 89492028216030448909 Status: SIM Ready
Technology (Band)	LTE + 5G-NonStandalone: EU1
Initial Bearer (APN, IP-Type)	web.vodafone.de, ipv4
Desistation	h

The **IMSI** number stands for International Mobile Subscriber Identity. That uniquely identifies every user of a cellular network. It is stored as a 64-bit field and is sent by the mobile device to the network.

The **ICCID** stands for Integrated Circuit Card Identification Number. It's a unique 18-22 digit code that includes a SIM card's country, home network, and identification number. Usually the ICCID is printed on the back of a SIM card, but sometimes it's included in the packaging materials instead.

If no SIM card is installed for a modem interface or if there is no configuration, the modem still returns the signal strength values.

Modem SIM Card Missing

Modem in Slot 3	
Connection Information	
Signal strength	38%
Operator	
SIM status	
Connection status	sim-missing
Connection statistics	
Technology (Band)	
Initial Bearer (APN, IP-Type)	
Registration	
Services	WCDMA:none LTE:limited 5G SA:none 5G NSA available:no

6.2.2.2 Modem Information

The modem information section displays the type of modem and the active modem firmware version. The **Current Modes** line shows the connection technologies currently allowed and preferred in the modem.

The communication port, which is used to send AT-Commands to the modem, and the software plugin are defined by the ModemManager. The module temperature is e.g. read out by an AT-Command.

The **EMEI** (International Mobile Station Equipment Identity) is a 15-digit serial number that is used to uniquely identify each GSM or UMTS terminal worldwide.

Modem Static Information

SIMCom SIM8202G-M2
MPSS.HI.2.5-01106-SDX55_CPEALL_PACK-1.486794.2.497576.2 1 [May 17 2022 07:00:00]
allowed: 2g, 3g, 4g, 5g; preferred: 5g
864284040291853
mhi_0306_01.04.00_pipe_32 (at)
simtech
37°C

6.2.2.3 Signal Information

Modem Signal Information

Signal Information		
RSSI (Received Signal Strength Indicator)	-52 dBm Very good	
SINR 4G (Signal to Interference plus Noise Ratio)	9.0 dB Mid cell	
RSRQ 4G (Reference Signal Received Quality)	-13 dB G <mark>o</mark> od	
RSRP 4G (Reference Signal Receive Power)	-77 dBm Very good	
RSRQ 5G (Reference Signal Received Quality)	-12 dB Good	
RSRP 5G (Reference Signal Receive Power)	-109 dBm Very weak	
SNR 5G (Signal to Noise Ratio)	12.5 dB Mid cell	

RSSI (Signal strength) The signal strength value indicates the level of the signal received by the modem. These values correspond to the RSSI (Received Signal Strength Indication) readings of the connection. The value is measured in [dBm]. RSSI is typically displayed in a range from -94 dBm (very weak) up to >74 dBm (very good).

SINR 4G (Signal Interference + Noise Ratio), is the ratio of the signal level to the noise level (or simply the signal-to-noise ratio). The SINR value is measured in *[dB]* and ranges from 0 very low (cell edge) to 21 and higher (excellent). It is quite simple: the higher the value, the better the signal quality. With SINR values below 0, the connection speed is very low (cell edge), as this means that the received signal contains more noise than the useful part, and there is also a probability of losing an LTE connection.

RSRQ 4G/5G (Reference Signal Received Quality) The RSRQ is a calculated ratio value that results from the value for RSRP and the RSSI. It is enormously important for assessing the reception quality of a 5G or LTE connection. The value is measured in [dBm]. RSRQ is typically displayed in a range from -19 dB (cell edge) up to -9 dB (excellent).

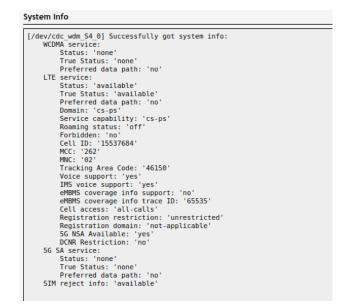
Westerma

RSRP 4G/5G (Reference Signal Received Power) The average power of the received pilot signals (Reference Signal) or the level of the received signal from the Base Station. The RSRP value is measured in [dBm]. RSRP is typically displayed in a range from -100 dB (very weak) up to >79 dB and higher (very good).

SNR 5G (Signal to Noise Ratio) It is the ratio of signal power to that of all other electrical signals in the area, known as the noise level. Noise is measured by the Root-Mean-Square (RMS) value of the fluctuations over time. This ratio is expressed in decibels *[dB]*. With SNR value is only shown for 5G environments and ranges from <=15 dB (cell edge) up to >=40 dB (excellent).

6.2.2.4 QMI Command Information

QMI Command Output



This text area shows the QMI function call returned output. For detailed information about qmilib functions please refer to https://www.freedesktop.org/software/libqmi/man/latest/qmicli.1.html.

6.3 System

6.3.1 System Properties

The **System Properties** are managed in the tab System \rightarrow System. These menus handle logging options, NTP time synchronisation and the appearance, language of the web interface. In the General Settings tab the operating system time, that is always stored as UTC time can be synchronized with current browser time. Note that the shell console time, of a serial or a remote SSH connection, is always reported as UTC time stamp.

Status	System	
System	Here you can configure the basic aspects of your device like its hostname or the timezone.	
System		ke its hostname of the unitezoite.
Administration	System Properties	
Software	General Settings Logging Time Synchronization	Language and Style
Startup	Local Time	23.9.2021, 11:59:34
Scheduled Tasks		Sync with browser Sync with NTP-Server
Mount Points	Hostname	CvBoxAP-2
LED Configuration		-,
Backup / Flash Firmware	Description	CyBoxAP-2_CYLTE-1050V0_21.38.00
Custom Commands		An optional, short description for this device
Reboot	Notes	
Services		
Network		Optional, free-form notes about this device
VPN		Save & Apply V Save Reset





6.3.2 Configuration Backups

Configuration is managed in the tab System → Backup/Flash Firmware.

Status	Flash operations	
System		
System	Actions Configuration	
Administration	Backup	
Startup	Click "Generate archive" to download a tar archive of the current configuration files	L
Scheduled Tasks	Download backup	Generate archive
Mount Points	Restore	
Backup / Flash Firmware		
Custom Commands	To restore configuration files, you can upload a previously generated backup archive	re here. To reset the firmware to its initial state, click "Perform reset" (only possible with squashfs images).
License	Reset to defaults	Perform reset
Reboot	Restore backup	Durchsuchen Keine Datei ausgewählt. Upload archive
VPN		
Services	Oustom files (certificates, scripts) may remain on the system. To prevent this, perform a factory-reset first.	
Network	Save mtdblock contents	
Statistics	Click "Save mtdblock" to download specified mtdblock file. (NOTE: THIS FEATURE	E IS FOR PROFESSIONALS!)
	Choose mtdblock	u-boot 💌
Logout	Download mtdblock	Save mtdblock
	Flash new firmware image	
	Upload a sysupgrade-compatible image here to replace the running firmware. Check "Keep settings" to retain the current configuration (requires a compatible firmware image).	
	Keep settings	♥
	Image	Durchsuchen Keine Datei ausgewählt. Flash image

Configuration Backup Settings

a. Restore factory settings

Perform reset restores factory settings and performs a reboot.

b. Export configuration

Use the Generate archive button to export a configuration backup.

The generated configuration tar archive is not hardware-specific and may be distributed to other access points, as long as they share the same model and the same firmware version.

Note: Configuration archives are not compatible between firmware revisions 4.x and 17.xx.yy.

With the Upload archive... button you can restore a previously saved configuration. After restoring a configuration, the access point will reboot.

c. Import configuration

Before restoring a configuration archive, make sure that the factory settings have been restored in order to avoid any conflict between your old and new configuration. The configuration file must be named according to the pattern backup-*.tar.gz and can then be uploaded in the Restore backup field.

6.3.3 Firmware Upgrade

The procedure to update the device firmware with a new image is shown below.





Firmware Update Settings

Firmware Updates are provided as binary images with the extension .itb and will be uploaded from the host computer. Keep settings should always be **cleared** to ensure not to mixup old and new config switches. The uploaded image has a MD5 checksum that must be confirmed in the following dialog.

WARNING: Do NOT POWER OFF the access point while upgrading/restoring firmware to flash. Remember that if ``Keep settings`` checkbox is cleared, the device will revert to its network default address after restart.

6.3.4 Reboot

The device can be rebooted on the System \rightarrow Reboot tab.

6.3.5 Reset Button

The operations which can be done with the reset button are: reboot, triggering the emergency mode, restoring factory settings.

a. Restore factory settings

After booting, a factory reset can be triggered by pressing the reset button with a pin for more than 5 seconds. The Fail LED will blink in green and after a few seconds the device will reboot with the default configuration.

A reboot can be triggered by pressing the reset button with a pin for less than 2 seconds.

6.3.6 Emergency Mode

Emergency mode should only be needed in case of system firmware upgrade or crash restore.

The CyBox AP family uses at least five partitions in flash memory. The first flash device contains the low level firmware U-Boot. The second flash device holds an emergency image of OpenWrt/Linux and the third device contains the standard image of OpenWrt/Linux. The fourth flash device contains a journaling flash file system partition with user configuration settings and a customer partition. Normally the standard OpenWrt/Linux image is loaded with U-Boot and checked with MD5 sum against errors. If checksums are valid the linux boots and access point service starts. User configuration parameters are loaded and applied from the JFFS partition.

In case of a damaged standard image (OpenWrt/Linux in third flash) U-Boot detects a MD5 checksum error and tries to start the emergency system image from second flash. While booting no user configuration settings are applied. The CyBox RT 2-A comes up with network default address 192.168.100.1 (user=root, password=root) and Wifi disabled. The Fail LED blinks orange (red and green on) and the web interface background is orange, as Figure indicates. All configuration settings are volatile. This system should only be used to Upgrade/Restore a working firmware image to second flash via *Backup / Flash Firmware* menu.

Status	Flash operations	
System	Actions Configuration	
System	Backup	
Startup	Click "Generate archive" to download a tar archive	of the current configuration files.
Scheduled Tasks Mount Points	Download backup	Generate archive
Backup / Flash Firmware	Restore	
Custom Commands	To restore configuration files, you can upload a pre- squashfs images).	viously generated backup archive here. To reset the firmware to its initial state, click "Perform reset" (only possible with
License Reboot VPN Services Network	Reset to defaults Restore backup	Durchsuchen Keine Datei ausgewählt. Upload archive © Custom files (certificates, scripts) may remain on the system. To prevent this, perform a factory-reset first. To prevent this, perform a factory-reset first.
Statistics	Save mtdblock contents	
	Click "Save mtdblock" to download specified mtdblo	ock file. (NOTE: THIS FEATURE IS FOR PROFESSIONALS!)
Logout	Choose mtdblock	u-boot -
	Download mtdblock	Save mtdblock
Flash new firmware image Upload a sysupgrade compatible image here to replace the running firmware. Check "Keep settings" to retain the current configuration (requires a compatible firm mage).		
		place the running firmware. Check "Keep settings" to retain the current configuration (requires a compatible firmware
	Keep settings	
	Image	Durchsuchen Keine Datei ausgewählt. Flash image
Powered by LuCI (V20.14)		





Emergency System Indication

Emergency mode can also be entered by holding the reset button pressed for 5 seconds at the beginning of the boot phase.

Note: Normally, the blue background indicates the standard mode and the orange background indicates emergency mode. But many web browsers keep the colours in cache, which means that the wrong colour can be displayed. To ensure that the correct one is shown, open a new window in private or incognito mode before consulting the web interface.



7 SNMP

7.1 SNMP Protocol Support

Firmware implementations before 2020 only have protocol support for version **v1** and **v2c**. Since 2020 the SNMP protocol **v3** is also included in every CyBox firmware. The **v1**, **v2c** protocol variants are present with factory default setup. In factory default setup only read access is permitted.

Status	SNMPD			
System				
VPN	configuration.			
Services	Protocol activation			
Customize	Enable v1 protocol			
SNMPD	Enable v2c protocol			
SNMPD Edit SNMP-Trap	Enable v3 protocol	0		
GPS Info	Agent settings			
GPSD	The address the agent should listen on			
ICCP	The address the agent should lister of	UDP:161		
Softflowd		Bg: UDP:161, or UDP:10.5.4.3:161 to only listen on a given interface		
Network Statistics	AgentX settings			
Statistics	The address the agent should allow agentX connections to	/var/run/agentx.sock		
Logout		This is only necessary if you have subagents using the agentX socket protocol. Note that agentX requires TCP transport		
	Protocol V3 settings			
	Create Protocol V3 User This section contains no values yet Add com2sec security			
	PUBLIC			
	secname	n		
	source	default		
	community	public		
	PRIVATE			

SNMPD factory default settings with protocol v1 and v2c enabled

7.2 SNMP V3 Protocol Support

Before any **v3** protocol access can be executed one or more V3 User Accounts have to be created. To add a new **v3** User Account, the name must be entered case sensitve. Later the WUI is showing the User Account name in upper case.

Protocol V3 settings	
Create Protocol V3 User	
This section contains no values yet	
SHAAESUser Add	

Add new v3 User Account

The new User Account can be created as read-only, or with read-write permission. The authentication protocol is either **MD5** or **SHA** (preferred). If a authentication protocol is selected the authentication passphrase must also be given. For data paket encryption select **DES** or **AES** (preferred) and also apply a passphrase. For demonstration use the same settings as in figure below to copy and paste them in examples.



Protocol V3 settings		
Create Protocol V3 User		
		Delete
SHAAESUSER		
User Name	SHAAESUser	
User Access	Read-Write User -	
Authentication Protocol	SHA	
Authentication Passphrase	sha_password	
Privacy Protocol	AES	
Privacy Passphrase	aes_passphrase	
Add		

Demo user account settings

The default protocols v1 and v2c should be disabled, when using SNMP-V3 protocol.

Services	Protocol activation	
Customize	Enable v1 protocol	
SNMPD SNMPD Edit	Enable v2c protocol	
SNMP-Trap	Enable v3 protocol	

Activate only SNMP-V3 protocol

After all new settings are entered press the Save & Apply. Then the SNMPD service will restarted automatically.

7.2.1 SNMP V3 Protocol Examples

Read access with snmpget: Get order identifier

The command:

Returns:

iso.3.6.1.4.1.2021.8.1.2.100.101.1 = STRING: "CYAPW-1057PO"

Read access with **snmpwalk**: Get firmware version

The command:

```
snmpwalk -v 3 -n "" -u SHAAESUser -a SHA -A "sha_password" -x AES -X "aes_passphrase" -l authPriv
192.168.100.1 1.3.6.1.4.1.2021.8.1.2.103
```

Returns:

```
iso.3.6.1.4.1.2021.8.1.2.103.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.103.2.1 = STRING: "firmware_version"
iso.3.6.1.4.1.2021.8.1.2.103.3.1 = STRING: "/usr/bin/eltec_version"
```



```
iso.3.6.1.4.1.2021.8.1.2.103.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.103.101.1 = STRING: "20.14"
iso.3.6.1.4.1.2021.8.1.2.103.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.103.103.1 = ""
```

Write access with snmpset: Set a new system hostname and reload system settings

Use the following sequence to set the new hostname:

The new system hostname can be checked on web Status page.

7.3 SNMP Basic Functions

The SNMP service is included in CyBox RT 2-A Starting with firmware Version 2.6. The service is enabled, if a valid configuration file '/etc/config/snmpd' is present and service startup is not disabled. On system start this configuration file is parsed and translated into a 'snmpd.conf' file which is required by the SNMP daemon. The 'snmpd.conf' is stored in '/var/run' and a symbolic link is available under '/etc/snmp'.

There is a basic web interface provided for SNMP private / public configuration under Services \rightarrow SNMPD. The whole configuration file is quite large (~120KB) and can be modified on command line with UCI commands or by editing the configuration file with Services \rightarrow SNMPD-Edit edit window. The current implementation is automatically generated from a build script.

The OpenWrt default configuration provides a set of standard MIB files with OID .1.3.6.1.2.1 (iso.org.dod.internet.mgmt.mib-2). Westermo Eltec also provides an extension for the default configuration, using the UC DAVIS (University of California, Davis) MIB object (UCD-SNMP-MIB MIB document as .1.3.6.1.4.1.2021) to map many configuration settings with a wrapper shell for reading '/usr/sbin/get_snmp' and one for writing '/usr/sbin/get_snmp' single entries in the configuration files located under '/etc/config'. The 'get_snmp' script provides also information about WLAN to SSID assignment, WLAN bitrates, signal quality, etc. Most of this information is gained via UCI commands for reading and writing system configuration settings.

/etc/snmp/snmpd.conf # Symlink to SNMPD config file (automatically created)

/etc/config/snmpd # OpenWrt configuration file

See Appendix 10 for a SNMP command OID overview.

7.4 SNMP Read and Write Authorizations

The CyBox RT 2-A runs a local SNMP daemon, which currently is configured for two access groups:

- By default, group "public" allows unrestricted read-only access
- Group "private" allows a single specified host to read and write. By default, "localhost" is specified i.e. only the local administrative user on CyBox RT 2-A is allowed for SNMP write operations.



This address can be changed by means of an UCI command. Assuming to be logged-in on a CyBox RT 2-A via SSH as administrative user, the following command would allow re-specifying the IP address of the "private" group:

```
root@CyBoxAP:~# uci set snmpd.private.source=<ccu>
root@CyBoxAP:~# uci commit snmpd
root@CyBoxAP:~# /etc/init.d/snmpd restart
```

Where *<ccu>* refers to the IP address (or hostname) of the remote host which is allowed to perform SNMP write operations. The keyword "default" instead of a specific address allows any hosts to access the SNMP demon.

Similarly, the address of the "public" group can be changed:

```
root@CyBoxAP:~# uci set snmpd.public.source=<ccu>
root@CyBoxAP:~# uci commit snmpd
root@CyBoxAP:~# /etc/init.d/snmpd restart
```

Note: Generally local UCI commands on the CyBox RT 2-A should be used for handling the configuration of the SNMP demon. Run '*uci show snmpd*' to view the current settings.

Alternatively, the public and private sources can be modified with the web interface in the field '*com2sec security*' of the tab '*Services*' \rightarrow '*SNMPD*'.

com2sec security		
PUBLIC		
secname	го]
source	default]
community	public]
PRIVATE		
secname	rw]
source	localhost]
community	private]

SNMPD change 'com2sec security' for write access

7.5 SNMP Commands

The CyBox RT 2-A SNMP demon supports the following commands:

- snmpget
- snmpset
- snmpstatus
- snmptest
- snmptrap
- snmpwalk

A special case arises when snmpset writes to non-MIB extensions. In this case, there is an asymmetry between snmpget and snmpset with respect to OIDs. Reading (snmpget) requires the complete numeric identifier including the server-specific extension. Writing (snmpset) accepts only the "extEntry" trunk "iso.3.6.1.4.1.2021.8.1", while the server-specific name of the object must be passed as first argument.

The assignment of names and OID numbers can be found by executing snmpwalk.



7.6 SNMP Read (snmpwalk and snmpget)

The following chapters describe the read and write access via console commands.

7.6.1 Reading System Information

```
boardname 1.3.6.1.4.1.2021.8.1.2.100
serial_number 1.3.6.1.4.1.2021.8.1.2.101
uboot_version 1.3.6.1.4.1.2021.8.1.2.102
firmware_version 1.3.6.1.4.1.2021.8.1.2.103
config_version 1.3.6.1.4.1.2021.8.1.2.104
uptime 1.3.6.1.4.1.2021.8.1.2.105
loadavg 1.3.6.1.4.1.2021.8.1.2.106
temperature 1.3.6.1.4.1.2021.8.1.2.107
uci_get 1.3.6.1.4.1.2021.8.1.2.108
custom1 1.3.6.1.4.1.2021.8.1.2.109
custom2 1.3.6.1.4.1.2021.8.1.2.110
custom3 1.3.6.1.4.1.2021.8.1.2.111
mpstat 1.3.6.1.4.1.2021.8.1.2.112
```

The command

snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.100

will deliver

```
iso.3.6.1.4.1.2021.8.1.2.100.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.100.2.1 = STRING: "boardname"
iso.3.6.1.4.1.2021.8.1.2.100.3.1 = STRING: "/bin/cat /tmp/sysinfo/eeprom/BOARDNAME"
iso.3.6.1.4.1.2021.8.1.2.100.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.100.101.1 = STRING: "CYAP.-V-W8IRQWWEUPX"
iso.3.6.1.4.1.2021.8.1.2.100.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.100.103.1 = ""
```

MIB name:

iso.3.6.1.4.1.2021.8.1.2.100.2.1 = STRING: "boardname"

Function executed on CyBox RT 2-A:

iso.3.6.1.4.1.2021.8.1.2.100.3.1 = STRING: "/bin/cat /var/BOARDNAME"

Error code from function call:

iso.3.6.1.4.1.2021.8.1.2.100.100.1 = INTEGER: 0

Return value from function call:

iso.3.6.1.4.1.2021.8.1.2.100.101.1 = STRING: "CYAP.-V-W8IRQWWEUPX"

7.6.2 Reading SNMP Object Information

The main problem to access a network device (WLAN or LAN) is that the listing order depends on the creation order made by user when the config file is being edited. The fact that network/interface naming is free to choose and that UCD MIB object names are static, makes it necessary to use predefined names like:



- network0, network1 ... network9
- wireless0, wireless1 ... wireless19

Note: A normal CyBox RT 2-A configuration consists of six wireless interfaces, but there are up to twenty interfaces possible, so snmpwalk will result in up to 80 percent of undefined (Empty UCI entry) values.

The following objects are available to determine the actual network/wireless ordering.

7.6.2.1 Readout current Network Device Order

The command

snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.150

delivers

```
iso.3.6.1.4.1.2021.8.1.2.150.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.150.2.1 = STRING: "network_order"
iso.3.6.1.4.1.2021.8.1.2.150.3.1 = STRING: "/etc/snmp/get_cyboxap network_order"
iso.3.6.1.4.1.2021.8.1.2.150.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.150.101.1 = STRING: "loopback=lo" **<--- network0**
iso.3.6.1.4.1.2021.8.1.2.150.101.2 = STRING: "lan=eth0" **<--- network1**
iso.3.6.1.4.1.2021.8.1.2.150.101.3 = STRING: "vlan007=eth0.7" **<--- network2**
iso.3.6.1.4.1.2021.8.1.2.150.101.4 = STRING: "vlan007=eth0.123" **<--- network3**
iso.3.6.1.4.1.2021.8.1.2.150.101.5 = STRING: "vlan500=eth0.500" **<--- network4**
iso.3.6.1.4.1.2021.8.1.2.150.101.6 = STRING: "cfg_net=eth0.999" **<--- network5**
iso.3.6.1.4.1.2021.8.1.2.150.103.1 = ""</pre>
```

Example:

IP address of LAN interface 'cfg_net' will be (network5 starts at 550):

network5.ipaddr 1.3.6.1.4.1.2021.8.1.2.552

The command

snmpget -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.552.101.1

delivers

iso.3.6.1.4.1.2021.8.1.2.552.101.1 = STRING: "192.168.99.98"

7.6.2.2 Readout SSID / WIFI Interface Order

The following command shows the order of the Wifi interfaces.

```
snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.151
iso.3.6.1.4.1.2021.8.1.2.151.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.151.2.1 = STRING: "ssid_order"
iso.3.6.1.4.1.2021.8.1.2.151.3.1 = STRING: "/etc/snmp/get_cyboxap ssid_order"
iso.3.6.1.4.1.2021.8.1.2.151.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.151.101.1 = STRING: "CyAPO_00486889_00486886_ESTO" **<--- wireless0**
iso.3.6.1.4.1.2021.8.1.2.151.101.2 = STRING: "Guest_007" **<--- wireless1**
iso.3.6.1.4.1.2021.8.1.2.151.101.3 = STRING: "CyAPO_00486889_00486886_vlan007" **<--- wireless2**
iso.3.6.1.4.1.2021.8.1.2.151.101.4 = STRING: "CyAPO_00486889_00486886_vlan007" **<--- wireless3**
iso.3.6.1.4.1.2021.8.1.2.151.101.5 = STRING: "CyAPO_00486889_00486886_vlan123**" <--- wireless4**
iso.3.6.1.4.1.2021.8.1.2.151.101.5 = STRING: "CyAPO_00486889_00486886_vlan500" **<--- wireless4**
iso.3.6.1.4.1.2021.8.1.2.151.101.5 = STRING: "CyAPO_00486889_00486886_vlan500" **<--- wireless5**</pre>
```



```
iso.3.6.1.4.1.2021.8.1.2.151.101.7 = STRING: "Guest_123" **<--- wireless6**
iso.3.6.1.4.1.2021.8.1.2.151.101.8 = STRING: "VIP_500" **<--- wireless7**
iso.3.6.1.4.1.2021.8.1.2.151.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.151.103.1 = ""</pre>
```

7.6.2.3 Readout Network Device to SSID Assignment

The following command shows the order of the Wifi interfaces.

```
snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.152
iso.3.6.1.4.1.2021.8.1.2.152.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.152.2.1 = STRING: "wlan_ssid"
iso.3.6.1.4.1.2021.8.1.2.152.3.1 = STRING: "/etc/snmp/get_cyboxap wlan_ssid"
iso.3.6.1.4.1.2021.8.1.2.152.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.152.101.1 = STRING: "wlan0 : \\"CyAP0_00486889_00486886_EST0\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.2 = STRING: "wlan0 : \\"CyAP0_00486889_00486886_EST0\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.2 = STRING: "wlan0-1 : \\"CyAP0_00486889_00486886_vlan007\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.3 = STRING: "wlan0-2 : \\"CyAP0_00486889_00486886_vlan123\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.4 = STRING: "wlan0-3 : \\"CyAP0_00486889_00486886_vlan500\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.5 = STRING: "wlan0-4 : \\"CyAP0_00486889_00486886_cfg_net\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.6 = STRING: "wlan0-1 : \\"Guest_123\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.7 = STRING: "wlan1-1 : \\"Guest_123\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.7 = STRING: "wlan1-2 : \\"VIP_500\\""
iso.3.6.1.4.1.2021.8.1.2.152.101.8 = TRING: "wlan1-2 : \\"VIP_500\\""
iso.3.6.1.4.1.2021.8.1.2.152.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.152.103.1 = ""
```

Note 1: This assignment may change every time a specific SSID is disabled or enabled and the wireless interface is restarted. The corresponding Linux WLAN device for a SSID is needed to readout current assoclist, bitrates and signal quality values.

Note 2: The order/assignment functions 150, 151 and 152 should not be polled in an application, since they require some CPU resources. The network status should only be readout once after system start and every time operator causes a change in the network layout.

Example:

Readout assoclist, bitrate and signal quality from wlan0-2 (CyAP0_00486889_00486886_vlan123)

```
assoclist_wlan0-2 1.3.6.1.4.1.2021.8.1.2.202
bitrate_wlan0-2 1.3.6.1.4.1.2021.8.1.2.242
signal_wlan0-2 1.3.6.1.4.1.2021.8.1.2.282
```

The command

snmpget -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.202.101.1

returns the assoclist

iso.3.6.1.4.1.2021.8.1.2.202.101.1 = STRING: "06:0E:8E:67:08:64"

The command

snmpget -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.242.101.1

returns the bitrate information

iso.3.6.1.4.1.2021.8.1.2.242.101.1 = STRING: "65.0 Mbit/s"

The command



snmpget -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.282.101.1

returns the signal quality information

iso.3.6.1.4.1.2021.8.1.2.282.101.1 = STRING: "Link Quality: 70/70 Signal: -33 dBm Noise: -95 dBm "

7.7 SNMP Write (snmpset)

By default all SNMP write control is restricted to localhost. Refer to chapter 8.1 to enable write access.

A write command to the CyBox RT 2-A is always done on the same UCD MIB OID '1.3.6.1.4.1.2021.8.1'. The write operation requires a string parameter, which is parsed with '/etc/snmp/set_cyboxap' and translated into a system internal call on the CyBox RT 2-A. Consider that all writes to a configuration item are permanently stored in the overlay file system and will be present after next power cycle.

Usage of the SNMPSET system call:

snmpset -c private -v 2c <IPv4> 1.3.6.1.4.1.2021.8.1 s <command string or set entry string>

The given parameter string can be for example:

Command Type	Parameter String
Direct command	"radio0_up" "radio0_down" "modem0_up" "modem0_down" see Appendix for all commands "reboot"
System service action	"service <name> <action>"</action></name>
UCI configuration call	"uci <command/> <config>.<section> [<option>]=<value>"</value></option></section></config>
Configuration set to new value	"network <index>.<entry> <value>" "radio<index>.<entry> <value>" "wireless<index>.<entry> <value>"</value></entry></index></value></entry></index></value></entry></index>

7.7.1 Direct command

7.7.1.1 Reboot

snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "reboot"

7.7.2 Edit configuration using Object Identifier (OID)

7.7.2.1 Set a new IP address

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "network5.ipaddr 192.168.20.20"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci commit network"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "service network reload"
```

7.7.2.2 Set a new SSID

```
snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.151
iso.3.6.1.4.1.2021.8.1.2.151.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.151.2.1 = STRING: "ssid_order"
iso.3.6.1.4.1.2021.8.1.2.151.3.1 = STRING: "/etc/snmp/get_cyboxap ssid_order"
iso.3.6.1.4.1.2021.8.1.2.151.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.151.101.1 = STRING: "CyAP0_00486889_00486886_EST0"
iso.3.6.1.4.1.2021.8.1.2.151.101.2 = STRING: "Guest_007"
iso.3.6.1.4.1.2021.8.1.2.151.101.3 = STRING: "CyAP0_00486889_00486886_vlan007"
iso.3.6.1.4.1.2021.8.1.2.151.101.4 = STRING: "CyAP0_00486889_00486886_vlan007"
iso.3.6.1.4.1.2021.8.1.2.151.101.5 = STRING: "CyAP0_00486889_00486886_vlan007"
iso.3.6.1.4.1.2021.8.1.2.151.101.6 = STRING: "CyAP0_00486889_00486886_vlan500"
iso.3.6.1.4.1.2021.8.1.2.151.101.7 = STRING: "Guest_123" <= change index 6
iso.3.6.1.4.1.2021.8.1.2.151.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.151.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.151.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.151.103.1 = ""</pre>
```

Get radio module from wireless6.device=1.3.6.1.4.1.2021.8.1.2.1440 (may be omitted if SSID-radio is known):

snmpget -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.1440.101.1

delivers

```
iso.3.6.1.4.1.2021.8.1.2.1440.101.1 = STRING: "radiol"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "wireless6.ssid New_345"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci commit wireless"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "service network reload"
```

7.7.2.3 Set a new Macfilter

Apply a new 'macfilter' on the access point "VIP_500". Specific user mac is excluded.

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s
"wireless7.macfilter deny"
```

Single user:

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s
"wireless7.maclist 11:22:33:44:55:66"
```

Multiple user:

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci
add_list wireless.@wifi-\ face[7].maclist=11:22:33:44:55:66"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci
add_list wireless.@wifi-face[7].maclist=22:33:44:55:66:77"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci
commit wireless"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "service
network reload"
```



7.7.3 Edit configuration parameters, create new fields and delete items

If a 'config.section.option' is known, the 'uci set' command call can be used to read and modify any existing configuration item. If a snmpset command with a string "uci <command> config-item=new-value" is executed, it marks the config-item. The next snmpget call with '1.3.6.1.4.1.2021.8.1.2.108' (uci_get) remembers the last config-item and returns the curre nt value (read-back function). If the snmpset was executed without the string part "=new-value" only the config-item marker is set. This can be used to readout an item (no OID) without modifying it.

Note: Remember to commit changes in order to save then with the command 'uci commit'.

7.7.3.1 Set new Hostname

Hostname is configured in '/etc/config/system' (no OID).

The commands

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci set
system.@system[0].hostname"
```

snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.108

will deliver

```
iso.3.6.1.4.1.2021.8.1.2.108.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.108.2.1 = STRING: "uci_get"
iso.3.6.1.4.1.2021.8.1.2.108.3.1 = STRING: "/usr/sbin/get_snmp
uci_get"
iso.3.6.1.4.1.2021.8.1.2.108.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.108.101.1 = STRING:
"system.@system[0].hostname=CyBoxAP"
iso.3.6.1.4.1.2021.8.1.2.108.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.108.103.1 = ""
```

Use the following sequence to set the new hostname

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci set
system.@system[0].hostname=CYAP-14"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci
commit system"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "service
system reload"
```

7.7.3.2 Creating a system configuration description text

The regular firmware configuration does not provide such information. The following command sequence

snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci set system.@system[0].config_description=Version 1.1 Beta ABC"

snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.108

delivers



```
iso.3.6.1.4.1.2021.8.1.2.108.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.108.2.1 = STRING: "uci_get"
iso.3.6.1.4.1.2021.8.1.2.108.3.1 = STRING: "/usr/sbin/get_snmp
uci_get"
iso.3.6.1.4.1.2021.8.1.2.108.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.108.101.1 = STRING:
"system.@system[0].config_description=Version 1.1 Beta ABC"
iso.3.6.1.4.1.2021.8.1.2.108.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.108.103.1 = ""
```

Commit this change from UCI temporary storage to permanent overlay file system.

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci
commit system"
```

No service reload is required.

7.7.3.3 Delete system configuration description text

The following command sequence

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci
delete system.@system[0].config_description"
```

```
snmpwalk -c public -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.108
```

delivers

```
iso.3.6.1.4.1.2021.8.1.2.108.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.108.2.1 = STRING: "uci_get"
iso.3.6.1.4.1.2021.8.1.2.108.3.1 = STRING: "/usr/sbin/get_snmp
uci_get"
iso.3.6.1.4.1.2021.8.1.2.108.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.108.101.1 = STRING: "uci: Entry not found"
iso.3.6.1.4.1.2021.8.1.2.108.101.2 = STRING:
"system.@system[0].config_description="
iso.3.6.1.4.1.2021.8.1.2.108.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.108.103.1 = ""
```

Commit this change from UCI temporary storage to permanent overlay file system.

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "uci commit system"
```



7.8 SNMP Applications

7.8.1 SNMP Support for GPS

The following information data structure can be obtained via SNMP command 'snmpwalk' from a host system.

The command

```
user@host:~$ snmpwalk -c public -v2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.155
```

delivers

```
iso.3.6.1.4.1.2021.8.1.2.155.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.155.2.1 = STRING: "gps_info"
iso.3.6.1.4.1.2021.8.1.2.155.3.1 = STRING: "/bin/cat
/var/run/gps/gps.info"
iso.3.6.1.4.1.2021.8.1.2.155.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.155.101.1 = STRING: "Status: A"
iso.3.6.1.4.1.2021.8.1.2.155.101.2 = STRING: "Quality: 1"
iso.3.6.1.4.1.2021.8.1.2.155.101.3 = STRING: "Sat: 9"
iso.3.6.1.4.1.2021.8.1.2.155.101.4 = STRING: "Wed Jul 5 09:45:15
2017"
iso.3.6.1.4.1.2021.8.1.2.155.101.5 = STRING: "N: 49.960107"
iso.3.6.1.4.1.2021.8.1.2.155.101.6 = STRING: "E: 8.258518"
iso.3.6.1.4.1.2021.8.1.2.155.101.7 = Hex-STRING: 4E 3A 20 34 39 C2
B0 35 37 27 33 36 2E 33 38 34
22
iso.3.6.1.4.1.2021.8.1.2.155.101.8 = Hex-STRING: 45 3A 20 38 C2 B0
31 35 27 33 30 2E 36 36 36 22
iso.3.6.1.4.1.2021.8.1.2.155.101.9 = STRING: "Alt: 175.75m"
iso.3.6.1.4.1.2021.8.1.2.155.101.10 = STRING: "Speed: 1 km/h"
iso.3.6.1.4.1.2021.8.1.2.155.101.11 = ""
iso.3.6.1.4.1.2021.8.1.2.155.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.155.103.1 = ""
```

The values "Latitude DMS" and "Longitude DMS" are returned as Hex strings because they contain quote and double quotes.

This converted NMEA 0183 data struct is supplied with default configuration (after factory reset). The configuration can be adapted to supply the raw NMEA 0183 protocol. Following steps are necessary to switch over to raw protocol.

Open a remote root console with 'ssh' access and apply following commands.

Westermo

```
root@CyBoxAP:/# uci set system.@gps[0].raw='1'
root@CyBoxAP:/# uci commit
root@CyBoxAP:/# reboot
```

After reboot the GPS subsystem is configured to supply raw NMEA 0183 data. Note that this data is not shown in web interface, but can be readout via SNMP (different OID than converted GPS info).

The command

```
user@host:~$ snmpwalk -c public -v2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.156
```

will return

```
iso.3.6.1.4.1.2021.8.1.2.156.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.156.2.1 = STRING: "gps_raw"
iso.3.6.1.4.1.2021.8.1.2.156.3.1 = STRING: "/bin/cat
/var/run/gps/gps.raw"
iso.3.6.1.4.1.2021.8.1.2.156.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.156.101.1 = STRING:
"$GPRMC,094908.000,A,4957.5942,N,00815.4955,E,0.2,194.2,050717,,A\*6E"
iso.3.6.1.4.1.2021.8.1.2.156.101.2 = STRING:
"$GPGGA,094908.000,4957.5942,N,00815.4955,E,1,07,1.3,149.90,M,47.9,M,,\*6E"
iso.3.6.1.4.1.2021.8.1.2.156.101.3 = STRING:
"$GNGSA,A,3,24,25,32,29,31,02,,,,,,2.2,1.3,1.8\*2C"
iso.3.6.1.4.1.2021.8.1.2.156.101.4 = STRING:
"$GNGSA,A,3,77,,,,,,,,,,,,2.2,1.3,1.8\*27"
iso.3.6.1.4.1.2021.8.1.2.156.101.5 = STRING:
"$GPGSV,3,1,10,02,39,076,17,06,13,033,,12,40,086,13,14,30,267,\*7F"
iso.3.6.1.4.1.2021.8.1.2.156.101.6 = STRING:
"$GPGSV,3,2,10,24,12,151,34,25,79,051,21,26,02,280,,29,61,213,25\*77"
iso.3.6.1.4.1.2021.8.1.2.156.101.7 = STRING:
"$GPGSV,3,3,10,31,40,305,25,32,22,244,32,,,,,,,\*7D"
iso.3.6.1.4.1.2021.8.1.2.156.101.8 = STRING:
"$GLGSV,2,1,07,81,19,201,,70,11,350,,77,42,124,33,79,34,317,\*6F"
iso.3.6.1.4.1.2021.8.1.2.156.101.9 = STRING:
"$GLGSV,2,2,07,69,08,297,,88,69,171,,87,52,044,,,,\*59"
iso.3.6.1.4.1.2021.8.1.2.156.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.156.103.1 = ""
```

7.8.2 SNMP Support for Second GPS Source

On some CyBox AP models the LTE modem can also provide additional GPS information. If the modem GPS is activated, and an additional GPS antenna is plugged in, these SNMP OIDs can be used to gather the additional GPS information.





gps_module0_info	1.3.6.1.4.1.2021.8.1.2.157
gps_module0_raw	1.3.6.1.4.1.2021.8.1.2.158
gps_module1_info	1.3.6.1.4.1.2021.8.1.2.159
gps_module1_raw	1.3.6.1.4.1.2021.8.1.2.160



7.9 GPS

Some CyBox family members are equipped with an additional GNSS hardware module. The GPS antenna is routed to the front panel. Once an appropriate antenna is attached, the GPS signal is received and can be processed, if a version V3.03 or newer is installed. The GPS hardware supplies NMEA 0183 protocol on the second serial port, which is converted into a human-readable form.

7.9.1 GPS activation

The GPS is disabled by default. It can be enabled via the web interface. Enter $System \rightarrow GPS$ Info and check Enable.

Status	GPS Information	
System VPN	Read GPS information from internal GPS chip and Modem	devices.
Services	Interfaces	
Customize	Enable	
SNMPD	Raw output	0
SNMPD Edit		Enable raw output from GPS source
SNMP-Trap	Interface name	gps
GPS Info		
GPSD		Ø Specifies the GPS Interface name
ICCP	Device name	ttyS1
Softflowd		
Network		Ø Specifies the serial output device of GPS source
Statistics	Speed unit	km/h 💌

GPS Activation

7.9.2 GPS status

The GPS information will show on the Status \rightarrow Advanced of the web interface. The next figure shows an example available immediately after startup. And the figure below provides the same status after the receiver has calibrated itself. The table below provides an interpretation of the GPS status data.



Status	Module Information Revision Information Temperature Sensors GPS Sensors ICCP Self Test License
Overview	GPS Information
Advanced	
Firewall	Internal GPS
Routes	Status: V
System Log	Quality: 0 Sat: 0
Kernel Log	Sun Jan 4 00:17:03 2009 N: 0.000000
Processes	E: 0.000000 N: 0°0'0.000"
Realtime Graphs	E: 0°0'0.000"
Load Balancing	Alt: 82.00m Speed: 0 km/h
System	
VPN	
Services	
Network	
Statistics	
Logout	

GPS Info immediately after startup

Status	Module Information Revision Information Temperature Sensors GPS Sensors
Overview	GPS Information
Advanced	
Firewall	Internal GPS
Routes	Status: A Quality: 1
System Log	Sat: 13
Kernel Log	Thu Sep 10 12:38:31 2020 N: 49.960240
Processes	E: 8.258405 N: 49°57'36.864"
Realtime Graphs	E: 8°15'30.258" Alt: 147.57m
Load Balancing	Speed: 0 km/h
System	

Reliable GPS Info after Hardware Calibration

GPS Status Data:

Data Item	Value	Description
Status	А	Active
	V	Void
Quality	0	Invalid
	1	GPS fix (SPS)



2	DGPS fix
3	PPS fix
4	Real Time Kinematic
5	Float RTK
6	Estimated
7	Manual input mode
8	Simulation mode

7.9.3 SNMP for GPS

See chapter SNMP Support for GPS



7.9.4 SNMP Support for LTE

A number of LTE connection and control parameters can be read and written using SNMP commands. It is also possible to start or stop the LTE modem card and to select a predefined SIM card slot.

The SNMP OIDs are listed twice. The first installed LTE modem card uses SNMP calls starting with **modem0_xxx**, and the second modem card uses calls starting with **modem1_xxx**. Since both lists are otherwise identical, the description refers only to **modem0_xxx**.

7.9.4.1 LTE SNMP Read Control

Get Current LTE Configuration: modem0_config 1.3.6.1.4.1.2021.8.1.2.3000

The command

```
user@host:~$ snmpwalk -c public -v2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.3000
```

returns

```
iso.3.6.1.4.1.2021.8.1.2.3000.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.3000.2.1 = STRING: "modem0_config"
iso.3.6.1.4.1.2021.8.1.2.3000.3.1 = STRING: "/usr/sbin/get_snmp
modem0_config"
iso.3.6.1.4.1.2021.8.1.2.3000.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.3000.101.1 = STRING:
"network.LTE=interface"
iso.3.6.1.4.1.2021.8.1.2.3000.101.2 = STRING:
"network.LTE.proto='qmi'"
iso.3.6.1.4.1.2021.8.1.2.3000.101.3 = STRING:
"network.LTE.ifname='wwan1'"
iso.3.6.1.4.1.2021.8.1.2.3000.101.4 = STRING:
"network.LTE.simslot='1'"
iso.3.6.1.4.1.2021.8.1.2.3000.101.5 = STRING:
"network.LTE.pincode1='4173'"
iso.3.6.1.4.1.2021.8.1.2.3000.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.3000.103.1 = ""
```

Get Current Modem Signal Quality: modem0_signal 1.3.6.1.4.1.2021.8.1.2.3010

The command

user@host:~\$ snmpwalk -c public -v2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.3010

returns

iso.3.6.1.4.1.2021.8.1.2.3010.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.3010.2.1 = STRING: "modem0_signal"
iso.3.6.1.4.1.2021.8.1.2.3010.3.1 = STRING: "/usr/sbin/get_snmp



```
CONFIGURATION M/
```

modem0_signal"

```
iso.3.6.1.4.1.2021.8.1.2.3010.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.3010.101.1 = STRING: "[/dev/cdc-wdm1]
Successfully got signal info"
iso.3.6.1.4.1.2021.8.1.2.3010.101.2 = STRING: "HDR:"
iso.3.6.1.4.1.2021.8.1.2.3010.101.3 = STRING: "RSSI: '-125 dBm'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.4 = STRING: "ECIO: '-2.5 dBm'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.5 = STRING: "IO: '-106 dBm'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.6 = STRING: "SINR (8): '9.0 dB'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.7 = STRING: "LTE:"
iso.3.6.1.4.1.2021.8.1.2.3010.101.8 = STRING: "RSSI: '-56 dBm'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.9 = STRING: "RSSI: '-66 dBm'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.10 = STRING: "RSRP: '-86 dBm'"
iso.3.6.1.4.1.2021.8.1.2.3010.101.11 = STRING: "SNR: '19.2 dB'"
iso.3.6.1.4.1.2021.8.1.2.3010.102.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.3010.103.1 = ""
```

Get Current Modem DHCP Settings: modem0_dhcp_status 1.3.6.1.4.1.2021.8.1.2.3015

Use command

user@host:~\$ snmpwalk -c public -v2c 192.168.100.1 1.3.6.1.4.1.2021.8.1.2.3015

returns

```
iso.3.6.1.4.1.2021.8.1.2.3015.1.1 = INTEGER: 1
iso.3.6.1.4.1.2021.8.1.2.3015.2.1 = STRING: "modem0_dhcp_status"
iso.3.6.1.4.1.2021.8.1.2.3015.3.1 = STRING: "/usr/sbin/get_snmp
modem0_dhcp_status"
iso.3.6.1.4.1.2021.8.1.2.3015.100.1 = INTEGER: 0
iso.3.6.1.4.1.2021.8.1.2.3015.101.1 = STRING:
"{\"up\":true,\"pending\":false,\"available\":true,\"autostart\":true,\"dynamic\":true,
\"uptime\":437,\"l3_device\":\"wwanl\",\"proto\":\"dhcp\",\"device\":\"wwanl\",
\"updated\":[\"addresses\",\"routes\",\"data\"],\"metric\":0,\"dns_metric\":0,
\"delegation\":true,\"ipv4-address\":[{\"address\":\"10.118.124.205\",\"mask\":30}],
\"ipv6-address\":[],\"ipv6-prefix\":[],\"ipv6-prefix-assignment\":[],
\"source\":\"10.118.124.205\\/32\"}, {\"target\":\"0.0.0.0\",\"mask\":0,
\"dns-server\":[\"62.109.121.17\",\"62.109.121.18\"],\"dns-search\":[],
\"inactive\":{\"ipv4-address\":[],\"ipv6-address\":[],\"route\":[],\"dns-server\":[],
\"dns-search\":[]},\"data\":{\"leasetime\":7200}}"
iso.3.6.1.4.1.2021.8.1.2.3015.102.1 = INTEGER: 0
```

Westermo

iso.3.6.1.4.1.2021.8.1.2.3015.103.1 = ""

7.9.4.2 LTE SNMP Write Control

By default SNMP write control is restricted to the localhost. Refer to chapter 8.1 to enable write access.

Any changes on provider settings e.g. APN, PIN, etc. must be done in the web interface. For SNMP writing only switching between preconfigured SIM cards is supported.

Activate/Deactivate Network Interface my_lte

Use commands

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s
"modem0_up"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s
"modem0_down"
```

Select another SIM card slot and restart network

Use commands

```
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s
"modem0_simslot 1"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s "
modem0_simslot 2"
snmpset -c private -v 2c 192.168.100.1 1.3.6.1.4.1.2021.8.1 s
"modem0_simslot 3"
```

8 HotSpot as Service

HotSpot as Service is a service by Telekom.

The service provides a solution to configure an infrastructure allowing to connect to the HotSpot platform via site-to-site IPSec/IKEv2 VPN tunnel.

To be able to use this service, you need a contract with Telekom.

The following recipe describes how to set up the service.

8.1 Setup data provided by the service provider

Telekom will provide a set of parameters (passwords, ip addresses, ...) for each single system.

The following table shows an example:

Example access parameters

Username	Password	Client netbase/prefix	Client netmask	Client gateway



Provided by Telekom	Provided	Provided by	Provided by	Provided by
	by Telekom	Telekom	Telekom	Telekom

Additionally there are configuration data independent of the single system:

Internet-facing IP address of the VPN load balancer

Provided by Telekom

DHCP IP address

Provided by Telekom

Remote identity of the VPN terminator

Provided by Telekom

Maximum segment size (MSS)

1320

8.2 Setting up the system

With the information provided, the system can now be set up using the web interface.

8.2.1 General assumptions

The current configuration assumes that the SIM card is inserted in the SIM 1 slot for LTE 1.

This procedure was tested with a CyBox RT 2-A with two Wi-Fi and two LTE modules, but only one Wi-Fi and LTE module was used.

On other system variants the dialogs may look differently.

8.2.2 Preliminary steps

Before the system-dependent data and the "Hotspot as Service" parameters can be set, some first steps have to be done.

8.2.2.1 Factory reset

First perform a factory reset as described in the corresponding chapter.

8.2.2.2 Remove not required interfaces

The two network interfaces *LAN_ALIAS* and *LAN_MAC* have an IP address in the range of *10.X.Y.Z*. These IPs conflict with the IP addresses provided by the network provider Telekom. Both have to be removed or changed to another IP-range except 10.X.Y.Z.



		twork options				
ystem	Interfaces					
ervices		Protocol: Static address				
etwork	LAN	Uptime: 0h 5m 49s MAC: 00:00:5B:05:2F:B6				
Interfaces	2-	RX: 224.09 KB (1628 Pkts.) TX: 2.19 MB (3097 Pkts.)	Restart	Stop	Edit	Delete
Wireless	eth0	IPv4: 192.168.100.1/24 IPv6: fd79:c7be:ff52::1/60				
DHCP and DNS		Protocol: Static address				
Hostnames	LAN_ALIAS	Uptime: 0h 5m 49s				
Static Routes	2	MAC: 00:00:5B:05:2F:B6 RX: 224.09 KB (1628 Pkts.)	Restart	Stop	Edit	Demte
Diagnostics	eth0	TX: 2.19 MB (3097 Pkts.) IPv4: 10.13.42.147/8				Delete
Firewall	LAN DHCP	Protocol: DHCP client				
Load Balancing		MAC: 00:00:5B:05:2F:B6 RX: 224.09 KB (1628 Pkts.)	Restart	Stop	Edit	Delete
Client Isolation	eth0	TX: 2.19 MB (3097 Pkts.)				
Connection Check	LAN MAC	Protocol: Static address Uptime: 0h 5m 49s				
QoS	LAN_MAC	MAC: 00:00:5B:05:2F:B6 RX: 224.09 KB (1628 Pkts.)	Restart	Stop	Edit	Delete
PN	eth0	TX: 2.19 MB (3097 Pkts.)				
atistics		IPv4: 10.5.47.182/8 Protocol: ModernManager				
	MODEM_S1	RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.)	Restart	Stop	Edit	Delete
ogout	modemmanager-modem_S1	Information: Not started on boot				
-	MODEM S2	Protocol: ModernManager RX: 0 B (0 Pkts.)				
		TX: 0 B (0 Pkts.)	Restart	Stop	Edit	Delete
	modemmanager-modem_S2	Information: Not started on boot Error: Unknown error (sim-missing)				
	Add new interface					

Remove networks LAN_ALIAS and LAN_MAC.

8.2.2.3 Setup MODEM_S1

Open the settings menu of *MODEM_S1* which is used for the LTE connection and set the checkbox "Bring up on boot".

General Settings	Advanced Settings	Firewall Settings	DHCP Server	SIM1	SIM2			
Status			Device: mode RX: 0 B (0 Pkt TX: 0 B (0 Pkt	s.)	jer-modem_S	51		
Protocol		N	lodemManager			~		
Bring up on boot		K	Ĺ					
Modem device		/sy	/s/devices/platfor 001:04:03.0/0001			0001:02/	0001:02:00	.0/0001:03:00.0
Select SIM Slot		S	lot #1			~		

Bring up MODEM_S1 on boot.

The firewall zone of *MODEM_S1* is "wan", it must be set to unspecific.

General Settings	Advanced Settings	Firewall Settings	DHCP Server SIM1 SIM2	
Create / Assign fir	ewall-zone		wan modem_S1: modem_S2: wodem_S2: wodem_	ign to this interface. Select the associated zone or fill out the ach the interface to it.
			wan modem_S1: modem_S2:	Dismiss Sav

Set the MODEM_S1 firewall zone to unspecific.

The SIM PIN and APN must be set in the following dialog. The APN for the Telekom connection is "internet.telekom". Of cause the proper PIN of the SIM card - usually not "4080" - must be used.

As always the changes must be saved, after all hit "Save & Apply".



General Settings	Advanced Settings	Firewall Settings	DHCP Server	SIM1	SIM2		
PIN		4	080				
APN		ir	nternet.telekom				
Username							
Password							
IP Type		Ī	Pv4 only			~	

Set PIN and APN for MODEM_S1.

After these steps *MODEM_S1* should be ready.

8.2.2.4 Wireless network

Navigate to "Network -> Wireless" and edit the wireless interface radio 0.

Status	Wireless Overvie	ew					
System							
Services	🙊 radio0	Qualcomm Atheros QCA9880 80 Device is not active	2.11nac		Restart	Scan	Add
Network	isabled	SSID: CyRTA-2000-radio0 Mode: Maste Wireless is disabled	ər		Enable	🔓 Edit	Remove
Interfaces	🙊 radio1	Qualcomm Atheros QCA9880 80 Device is not active	2.11nac		Restart	Scan	Add
Wireless							
DHCP and DNS	io disabled	SSID: CyRTA-2000-radio1 Mode: Maste Wireless is disabled	ər		Enable	Edit	Remove
Hostnames	Associated Statio	ons					
Static Routes	Network	MAC address	Host	Oinsel (Noise		RX Rate / TX R	-4-
Diagnostics	Network	MAC address	HUSI	Signal / Noise		KA Rate / IA R	ate
Firewall			No informa	ation available			
Load Balancing						Save & Apply	Save Reset
Client Isolation							
Connection Check							
QoS							
VPN							
Statistics							
Logout							

Edit the wireless radio setup.

Set the custom value for the Network setting to "wlan0" in the "Interface Configuration" dialog. Under "Interface Configuration", set the "ESSID" to "Telekom".

For "Network", unmark "lan" and set the custom value to "wlan0" as shown in the picture.

evice Configuration	
General Setup Advanced Settings	
Status	Mode: Master SSID: CyRTA-2000-radio0 dBmWireless is not associated
Wireless network is disabled	Enable
Operating frequency	Mode Channel Width AC ✓ 36 (5180 Mhz) ✓ 80 MHz ✓
Maximum transmit power	driver default Opending on regulatory requirements and wireless radio may use. Depending on regulatory requirements and wireless usage, the actual
	transmit power may be reduced by the driver.
	C-Filter Hotspot 2.0 Advanced Settings
General Setup Wireless Security MA	transmit power may be reduced by the driver.
General Setup Wireless Security MA	C-Filter Hotspot 2.0 Advanced Settings
General Setup Wireless Security MA Mode ESSID	C-Filter Hotspot 2.0 Advanced Settings
General Setup Wireless Security MA Mode	transmit power may be reduced by the driver.
General Setup Wireless Security MA Mode ESSID Network	C-Filter Hotspot 2.0 Advanced Settings C-Filter Hotspot 2.0 Advanced Settings C-Filter Telekom Inspecified Inan:
Aterface Configuration General Setup Wireless Security MA Mode ESSID Network Hide ESSID	transmit power may be reduced by the driver.
General Setup Wireless Security MA Mode ESSID Network	C-Filter Hotspot 2.0 Advanced Settings Access Point Telekom Telekom this wireless interface or fill out lan_dhcp:

Westermo

Set the ESSID and Network for radio 0.

When hitting "enter" on the keyboard, the dialog shows that the interface will be created.

evice Config	uration					
General Setup	Advanced Settings					
Status				lode: Master SSID: (Vireless is not associat		lioO
Wireless network is disabled			Enable]		
Operating frequency			Mode AC	Channel • 36 (5180 Mhz)	Width	
Maximum transm	nit power		driver de	afault 🗸 - Currei	nt power: unkno	own
			Depe		equirements and	wireless radio may use. I wireless usage, the actual rer.
terface Con	figuration					
	figuration Wireless Security	MAC-Filter	Hotspot 2.0	Advanced Settings		
terface Con General Setup Mode		MAC-Filter	Hotspot 2.0	0	v	
General Setup Mode		MAC-Filter		Point	~	
General Setup		MAC-Filter	Access	Point	~ -	
General Setup //ode ESSID		MAC-Filter	Access Telekom	Point create)		this wireless interface or fill out
General Setup Node ESSID Network		MAC-Filter	Access Telekom wlan0: (create)		this wireless interface or fill out
General Setup Node ESSID Network		MAC-Filter	Access I Telekom wlan0: (lan:	create)		this wireless interface or fill out
General Setup Mode ESSID		MAC-Filter	Access I Telekom Wan0: (Ian: Ian: Wand	create)		

Set the ESSID and the Network for radio 0.

Save the wireless network configuration and enable the interface in the "Wireless Overview" dialog.

Status	Wireless Overvie	ew					
System							
Services	👷 radio0	Qualcomm Atheros QCA9880 80 Device is not active)2.11nac		Restart	Scan	Add
Network	io disabled	SSID: CyRTA-2000-radio0 Mode: Mast Wireless is disabled	er		Enab	Edit	Remove
Interfaces	🙊 radio1	Qualcomm Atheros QCA9880 80 Device is not active	02.11nac		Restart	Scan	Add
Wireless		SSID: CyRTA-2000-radio1 Mode: Mast	or				
DHCP and DNS	io disabled	Wireless is disabled	BI		Enable	Edit	Remove
Hostnames	Associated Stati	ons					
Static Routes	Network	MAC address	Host	Signal / Noise		RX Rate / TX R	ate
Diagnostics	network	indo address	noat	olghai / Holse		Tox Tute / TAT	ute
Firewall			No inform	ation available			
Load Balancing						Save & Apply	Save Reset
Client Isolation							
Connection Check							
QoS							
VPN							
Statistics							
Logout							

Enable the network radio 0.

8.2.2.5 Wireless network settings

Navigate to "Network -> Interfaces" to edit the newly created wireless interface "WLAN0".

tatus	Interfaces Devices Global ne	twork options				
ystem	Interfaces					
ervices		Protocol: Static address				
etwork	LAN	Uptime: 0h 9m 37s MAC: 00:00:5B:05:2F:B6				
nterfaces	2	RX: 382.49 KB (2750 Pkts.) TX: 3.49 MB (5111 Pkts.)	Restart	Stop	Edit	Delete
Wireless DHCP and DNS	eth0	IPv4: 192.168.100.1/24 IPv6: fd53:8e51:352a::1/60				
lostnames	LAN_DHCP	Protocol: DHCP client MAC: 00:00:58:05:27:B6 RX: 382.49 KB (2750 Pkts.) TX: 3.49 MB (5111 Pkts.)	Restart	Stop	Edit	Delete
iagnostics rewall bad Balancing	MODEM_S1	Protocol: ModemManager Uptime: 0h 3m 53s RX: 7.33 KB (84 Pkts.) TX: 7.06 KB (88 Pkts.) IPv4: 10.133 203 81/30	Restart	Stop	Edit	Delete
ient Isolation onnection Check oS	MODEM_S2	Protocol: ModernManager RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.) Information: Not started on boot Error: Unknown error (sim-missing)	Restart	Stop	Edit	Delete
N tistics	WLAN0	Protocol: Unmanaged Uptime: 0h 0m 29s MAC: 04:F0:21:91:5D:B9 RX: 0 B (0 Pkts.) TX: 872 B (7 Pkts.)	Restart	Stop	Edit	Delete

Configure the wlan interface.

As this interface was newly created, the protocol must be changed to "Static Address".

General Settings	Firewall Settings	DHCP Server			
Status			Device: Master "Telekom" Uptime: 0h 0m 44s MAC: 04:F0:21:91:5D:B9 RX: 0 B (0 Pkts.) TX: 872 B (7 Pkts.)		
Protocol			Static address	~	
Really switch proto	ocol?		Switch puttocol		
Device			unspecified	•	
Bring up on boot					

Switch the protocol

Hit "Switch protocol" and choose for "Device" the entry "Wireless Network: Master "Telekom" (wlan0)" as shown in the following picture.



Dismiss Save

General Settings	Advanced Settings	Firewall Settings DHCP Server		
Status		Device: Master "Telekom" Uptime: 0h 0m 54s		
Protocol		Static address v		
Device		unspecified 🔻		
Bring up on boot		unspecified		
• •		Ethernet Adapter: "bond0" Ethernet Adapter: "bonding_masters"		
IPv4 address				
IPv4 netmask		🔊 Bridge: "br-lan"		
		Ethernet Adapter: "can0"		
IPv4 gateway		Ethernet Adapter: "dummy0"		
IPv4 broadcast		Ethernet Adapter: "erspan0"		
		Ethernet Adapter: "eth0" (lan, lan_dhcp)		
IPv6 address		Ethernet Adapter: "eth1"		
		Ethernet Adapter: "wwan_S1_0" (modem_S1)		
IPv6 gateway		Ethernet Adapter: "wwan_S1_1"		
IPv6 routed prefix		Ethernet Adapter: "wwan_S2_0"		
		Ethernet Adapter: "wwan_S2_1"		
		Mireless Network: Master "CyRTA-2000-radio"		
		Wireless Network: Master Telekom" (wlan0)		
		Alian Interfaces "@lan"		

Use the WLAN device.

-- custom --

Alias Interface: "@lan"
 Alias Interface: "@lan_dhcp"
 Alias Interface: "@modem_S1"
 Alias Interface: "@modem_S2"
 Alias Interface: "@wlan0"

Setup the "IPv4 adress" (client_gw) and "IPv4 netmask" (client_netmask) provided by the net provider Telekom. Set the checkbox "Bring up on boot" and "save" the changes. Hit "Save & Apply".

General Settings	Advanced Settings	Firewall Settings	DHCP Server			
Status			Device: Master "Telekom" Uptime: 0h 1m 45s MAC: 04:F0:21:91:5D:B9 RX: 0 B (0 Pkts.) TX: 872 B (7 Pkts.)			
Protocol		St	atic address	~		
Device		9	vlan0	_ _		
Bring up on boot						
IPv4 address		10	.227.61.30			
IPv4 netmask		25	5.255.255.192	_ _		
IPv4 gateway		10	.133.203.82 (modem_S1)			
IPv4 broadcast		10	0.227.61.63			
IPv6 address		Ac	dd IPv6 address	+]	
IPv6 gateway			*********************************			
Pv6 routed prefix						
		(2)	Public prefix routed to this device	for distribut	ution to clients.	





Setup IP address and "Bring up on boot" flag.

After a certain boot time (~30-60sec) the interfaces are active.

ystem	Interfaces					
ervices		Protocol: Static address				
letwork	LAN	Uptime: 0h 11m 35s MAC: 00:00:5B:05:2F:B6				
Interfaces	2	RX: 455.66 KB (3230 Pkts.) TX: 4.16 MB (6059 Pkts.)	Restart	Stop	Edit	Delete
Wireless	eth0	IPv4: 192.168.100.1/24				
DHCP and DNS		IPv6: fd53:8e51:352a::1/60				
Hostnames	LAN_DHCP	Protocol: DHCP client MAC: 00:00:5B:05:2F:B6	Restart	C1	Edit	Delete
Static Routes	eth0	RX: 455.66 KB (3230 Pkts.) TX: 4.16 MB (6059 Pkts.)	Restart	Stop	Ealt	Delete
Diagnostics		Protocol: ModemManager				
Firewall	MODEM_S1	Uptime: 0h 5m 51s RX: 10.22 KB (120 Pkts.)	Restart	Stop	Edit	Delete
Load Balancing	wwan_S1_0	TX: 9.91 KB (123 Pkts.)	Result	Stop	Edite	Delete
Client Isolation		Protocol: ModemManager				
Connection Check	MODEM_S2	RX: 0 B (0 Pkts.) TX: 0 B (0 Pkts.)			Edit	Delete
QoS	modemmanager-modem S2	Information: Not started on boot	Restart	Stop	Edit	Delete
PN		Error: Unknown error (sim-missing) Protocol: Static address				
tatistics	WLANO	Uptime: 0h 0m 26s				
		MAC: 04:F0:21:91:5D:B9 RX: 0 B (0 Pkts.)	Restart	Stop	Edit	Delete
gout	wian0	TX: 872 B (7 Pkts.) IPv4: 10.227.61.30/26				
	Add new interface					

MODEM_S1 and WLAN0 are active

8.2.2.6 Hotspot as Service Settings

Navigate to "Services" -> "Hotspot as a Service".

Set "Netbase" (client_netbase), username and password to the values are provided by the net provider Telekom.

The interfaces "Modem interface" and "Wireless interface" have to be set to "modem_S1" and "wlan0" as shown in the picture below.

The preset values in the category "Hotspot as a Service" (Internet facing IP address, DHCP IP address, Remote identity and Maximum segment size) are usually fixed for the VPN connection.

Mark "Enabled" and hit "Save & Apply".

Status	Hotspot as a Service	
System	Infrastructure configuration to connect to the "Hots	Spot" platform via a site-to-site IPSec/IKEv2 VPN tunnel.
Services		
Customize SNMP-Trap	Enabled Netbase	
GPS Info GPSD	Internet facing IP address	
Hotspot as a Service	DHCP IP address	
SMS Command	Remote identity	
AP Scanner Flying Controller	Username	
Rogue AP	Password	••••••
Wlan Sniffer SNMPD	Maximum segment size	1320
Softflowd	Modem interface	modem_S1:
letwork	Wireless interface	wlan0: 👷 💽
/PN Statistics	Status: DEACTIVATED	Save Apply - Save
ogout		

Setup the service Hotspot as Service.

If everything is ok, the status marker changes from *Status: DEACTIVATED* to *Status: OFFLINE* and finally *Status: ONLINE*.

This may last several minutes especially, when the connection is established for the first time.



Wireles	s interface
Status:	ONLINE

Final status display.

9 SSH / SERIAL CONSOLE

On a Windows PC, you can use the program PuTTY (http://www.putty.org).

a. Ethernet cable (SSH)

Ensure that an Ethernet cable is connected between your PC and the access point. The following instruction assumes that the default settings are used.

- If you are using a UNIX/Linux PC then run the command 'ssh root@192.168.100.1'.
- If you are using a Windows PC, PuTTY should be configured as follows:

Basic options for your PuTTY session		
Specify the destination you want to connect to		
Host Name (or IP address) Port		
192.168.100.1	22	
Connection type:		

PuTTY - SSH connection

b. Serial cable

Ensure that a serial cable is connected between your PC and the access point (a specific CyBox adapter plugged in the USB port is required).

- On a UNIX PC, install the program picocom, and run command picocom -b 115200 /dev/ttyUSB0 (*'ttyUSB0'* must be modified depending on your PC).
- If you are using a Windows PC, PuTTY should be configured as follows:

Basic options for your PuTTY session			
Specify the destination you want to connect to			
Serial line Speed			
COM11	115200		
Connection type:			

PuTTY - Serial connection

The value 'COM11' must be adapted for your PC. A list of the COM ports can be found in the device manager window as shown below.





Windows device manager showing COM ports

Once the connection is established, a login should be requested on serial console window.

If this is not the case, press Enter on the keyboard and/or disconnect and reconnect the USB serial adapter on the CyBox side. To edit files on target system the build-in text editor **nano** can be used.

9.1 UCI Configuration

This section describes the UCI (**Unified Configuration Interface**). UCI can be scripted for remote configuration using shell commands and scripts. UCI can be seen as the OpenWRT main configuration interface. It is best used for main network interface configuration, wireless settings, logging functionality and remote access configuration.

With OpenWrt, the user should change only UCI configuration file(s), which are read by individual programs.

For a more complete description of UCI commands and files used see https://wiki.openwrt.org/doc/uci.

9.1.1 UCI configuration files

The OpenWRT central configuration is split into several files located in the /etc/config/ directory. Each file is named according to the part of the system it configures. The configuration files can either be modified using a text editor or by using UCI. UCI configuration files are also modifiable through various programming APIs (like Shell, Lua and C), which is also how web interfaces like LuCI make changes to the UCI files.

After changing a UCI configuration file, the services affected must be restarted by an init.d call, so the updated UCI configuration is used. Many programs are made compatible with UCI by making their init.d script write their standard program-specific configuration files. The init.d script first writes the configuration file to the location expected by the software and it is read in again by restarting the executable. Note that just (re)starting the executable directly, without init.d calls, will not result in an UCI update. Changes in files in /etc/config/ then take no effect.

9.1.2 UCI Example

As an example, suppose you want to change the device's IP address from the default 192.168.100.1 to 192.168.2.1. Change the line in the file /etc/config/network:

option ipaddr 192.168.100.1

to:

option ipaddr 192.168.2.1

Next, commit the settings by running:

/etc/init.d/network restart

Remember to login again to the new IP address.

9.2 Other commands

a. Restore factory settings

The factory settings can be restored with the command factory_reset

b. Export configuration



The current configuration can be saved in the CyBox folder '/tmp/' with the command <code>sysupgrade -b /tmp/backup<mybackupname>.tar.gz</code>. It can then be exported to a PC with SCP (or the program WinSCP for Windows).

 ${\tt c}$. Import configuration

Restore the factory settings and then import your archived configuration to '/tmp/' with SCP (or WinSCP), the configuration can be installed with the command sysupgrade -r /tmp/backup-<mybackupname>.tar.gz ; reboot

Typing reboot in the command line will reboot the device.

USB stick is auto-mounted to /mnt/sda1.

10 SYSTEM MAINTENANCE

10.1 Remote Firmware Upgrade

The *standard_boot* flash partition, which contains the standard firmware binary image (.itb image), can be updated remotely. The new firmware image must be copied to the target system with **scp** command. Afterwards **ssh** calls will execute local target programs to install the new firmware.

While OpenWrt operating system is running, the *standard_boot* partition can be written at any time.

If firmware update does **not** require a configuration change, the current system configuration can be kept. Please contact support or sales department if a configuration reset is needed for your update purpose from an older version to a newer one.

The **Appendix: Script for Remote Firmware Update** provides a *Bash* script **rsysupgrade.sh** to demonstrate the remote update process from a Linux Host console.

10.1.1 Remote Firmware Upgrade without Config Change

Normally a firmware update should also include a configuration reset to the new version. Only in some few cases e.g. a small bug fix on a wireless driver, will not require to adapt and install a new configuration backup archive.

The following commands may be executed from a Linux console or with similar Windows **Putty** utils.

1. Copy the new firmware image to the target system

```
scp <new_firmware.itb> root@<target_ipv4>:/tmp/firmware.img
```

2. Flash new firmware to the **standard_boot** flash partition (mtd2) and reboot the target system

```
ssh root@<target_ipv4>: "/sbin/sysupgrade -t /tmp/firmware.img; reboot"
```

10.1.2 Remote Firmware Upgrade with New Config

In most cases an adapted or new configuration archive must also be installed, to match the new firmware version. The overlay partition is used to keep the configuration settings made by user to be present after power cycle. If the firmware detects an empty (cleared) overlay partition, the target directory **/mnt/custom/** is checked for a single **backup-<target>-<cfg>.tar.gz** archive to be installed as a new configuration. If a **/mnt/custom/backup-<target>-<cfg>.tar.gz** archive does **not** exist, the factory default settings are applied.

To create your custom configuration for a new firmware, the old system firmware should be updated to the new version with deleted configuration and factory settings applied. Make your complete system configuration setup with the new firmware version and save the **backup-<target>-<cfg>.tar.gz** archive to your Host System. The uploaded backup archive can then be exported to other (stationary) targets with the same hardware components equipped.

The following commands may be executed from a Linux console or with similar Windows **Putty** utils.



1. Copy the new firmware image to the target system

scp <new_firmware.itb> root@<target_ipv4>:/tmp/firmware.img

- 2. Flash new firmware to the standard_boot flash partition (mtd2)
 ssh root@<target_ipv4>: "/sbin/sysupgrade -t /tmp/firmware.img"
- 3. Ensure that no backup configuration is stored in /mnt/custom/ ssh root@<target_ipv4>: "rm -rf /mnt/custom/backup*"
- 4. Optionally, export your new custom configuration to /mnt/custom/. Note that the target system will perform a extra reboot cycle, to activate your new configuration setup. If no configuration is exported, the default configuration of the new firmware will automatically be applied.
 - scp backup-<my_config>.tar.gz root@/<target_ipv4>:/mnt/custom/
- 5. Delete the current configuration and reboot:

ssh root@<target_ipv4>: "rm -rf /mnt/jffs2/*; reboot"

WARNING: Do NOT POWER OFF the access point while upgrading/restoring firmware to flash



10.2 USB Possibilities

Via USB stick it is possible to update configuration and firmware.

A USB stick can be connected to the device, it needs a dedicated USB adapter.

a. Export configuration

Archived configurations can be exported from the command line to an empty USB stick by copying the configuration to '*/mnt/sda1*'.

b. Import configuration

To import an archived configuration to the access point, wait until booting is completed, then connect a USB stick with a configuration file on it named like '*backup-<mycustomname>.tar.gz*' No other file or folder must be present on the stick. Once plugged in, the configuration will be automatically read in and two reboots will successively happen in order to apply your settings. The USB stick can safely be removed at the beginning of a boot phase (when all LEDs are turned off), or when the boot sequence is completed.

A USB hotplug script is triggered if the USB stick is plugged in after booting. It reads the root directory of the stick and checks for a list of known file types:

File Type (wildcard=*)	Description	Board	Action	Who ?
"backup*tar.gz"	New configuration archive	ALL	Untar to Overlay FS (/dev/mtd3)	End user
"factory*reboot"	Marker to do a factory reset and reboot after upgrade operation.	ALL	Execute factory_reset	End user
"config*reboot"	Marker to do a perform a normal reboot.	ALL	Execute reboot	End user
"cyap*upgrade*tgz" "cyap*upgrade*zip"	Upgrade archive must contain an 'install.sh' script (executable) in archive root. The archive is unpacked to /tmp/usb_upgrade and 'install.sh' is executed.	ALL	Shell script execution	System Integrator

Files on upgrade USB stick:

Every install is executed only once for each file on the USB stick; updates already installed are not tried again. Check *'System Log'* in web interface or logread on console for upgrade messages.

For a firmware upgrade with *.zip archive the USB stick should only provide one archive file in USB root directory:

Example:

cyap-upgrade-V20.36.3.zip

This upgrade archive file must contain the new *V20.36.3-cyap2-lzma.itb* firmware image and an executable install script named *install.sh*. The install script executes commands to flash the new firmware into the desired partition. The upgrade archive may also include a new configuration backup archive, suitable for the new firmware version. After firmware upgrade, the new configuration may also applied with commands from the install script.

Example for an *install.sh* script:

#!/bin/sh

```
sysupgrade -t V20.36.3-cyap2-lzma.itb
sysupgrade -r backup-cyap2-20.36.3.tar.gz
exit 0
```

10.3 Status LED Blink Codes

While the upgrade process is running or has finished the 'Fail LED' (red/green) is used as status indicator. Blink codes in upgrades:

Westermo

Blink Code repeated	Description
RED 0.2sec on - GREEN 0.2sec on	Upgrade process running
GREEN continuous on	Upgrade successful
RED continuous on	USB stick mount failed
RED 3sec on - OFF 0.5sec	Mount of overlay FS failed
GREEN 3sec on – OFF 0.5sec	Some Upgrade is already one
RED 0.2sec – OFF 0.5sec – RED 0.2sec – OFF 2sec	Copy to flash failed
RED 0.2sec – OFF 0.5sec – RED 0.2sec – OFF 0.5sec – RED 0.2sec OFF 2sec	'install.sh' missing
GREEN 0.2sec – OFF 0.5sec – RED 0.2sec – OFF 0.5sec – RED 0.2sec - OFF 0.5sec	Password missing
GREEN 0.2sec – OFF 0.5sec – RED 0.2sec – OFF 0.5sec – RED 0.2sec - OFF 0.5sec – RED 0.2sec - OFF 0.5sec	Password invalid
OFF	USB stick is removed

Westermo

11 APPENDIX: GPL LICENSE

GNU GENERAL PUBLIC LICENSE

Version 3, 29 June 2007

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12 APPENDIX: SNMP OID OVERVIEW

This overview is also available with factory settings via the web interface using the URL: http://192.168.100.1/snmpd.txt.

SNMP command overview for the CyBox AP family (automatically generated)

#

#

- #
- # SNMPSET commands:
- #
- # radio0_up
- # radio0_down
- # radio1_up
- # radio1_down
- # modem0_up
- # modem1_up
- # modem2_up
- # modem3_up
- # modem4_up
- # modem0_down
- # modem1_down
- # modem2_down
- # modem3_down
- # modem4_down
- # modem0_simslot <value>
- # modem1_simslot <value>
- # modem2_simslot <value>
- # modem3_simslot <value>
- # modem4_simslot <value>
- # network<index>.<entry> <value>
- # radio<index>.<entry> <value>



```
# wireless<index>.<entry> <value>
# uci <command> <config>.<section>[.<option>]=<value>
# service <name> <action>
# reboot
#
# SNMPSET system call:
#
# snmpset -c private -v 2c <IPv4> 1.3.6.1.4.1.2021.8.1 s <command string
or set entry string>
#
#
#
# SNMPGET/SNMPWALK objects:
#
# see list below
#
# SNMPGET system call:
#
# snmpget -c public -v 2c <IPv4> 1.3.6.1.4.1.2021.8.1.2.<ID>.101.1
#
# SNMPWALK system call:
#
# snmpwalk -c public -v 2c <IPv4> 1.3.6.1.4.1.2021.8.1.2.<ID>
#
##### system Table0 objects #####
boardname 1.3.6.1.4.1.2021.8.1.2.100
serial_number 1.3.6.1.4.1.2021.8.1.2.101
uboot_version 1.3.6.1.4.1.2021.8.1.2.102
firmware_version 1.3.6.1.4.1.2021.8.1.2.103
config_version 1.3.6.1.4.1.2021.8.1.2.104
uptime 1.3.6.1.4.1.2021.8.1.2.105
loadavg 1.3.6.1.4.1.2021.8.1.2.106
temperature 1.3.6.1.4.1.2021.8.1.2.107
uci_get 1.3.6.1.4.1.2021.8.1.2.108
```



```
customl 1.3.6.1.4.1.2021.8.1.2.109
custom2 1.3.6.1.4.1.2021.8.1.2.110
custom3 1.3.6.1.4.1.2021.8.1.2.111
mpstat 1.3.6.1.4.1.2021.8.1.2.112
###### system Table0 objects #####
network_order 1.3.6.1.4.1.2021.8.1.2.150
----listing not printed here, see console command on top of this page
for live listing. The editor.----
```

13 APPENDIX: DEFAULT FACTORY SETTINGS

When shipped, the device has the following default settings:

Defaults for Ethernet 1 (all models):

Interface	IPV4 address type	Address	Remark
lan	static IPv4 address	192.168.100.1/24	
lan_alias	static IPv4 address	Calculated based on serial number	See chapter 4.1 IP Addresses of the CyBox RT 2-A
lan_dhcp	IPv4 DHCP client		
lan_mac	static IPv4 address	Calculated based on eth0 MAC address	See chapter 4.1 IP Addresses of the CyBox RT 2-A

Defaults for Ethernet 2:

Interface	IPV4 address	Address	Remark
wan	IPv4 DHCP client		
wan6	IPv6 DHCP client		

Other Defaults (all models):

Interface	Parameter	Remark
Password for user 'root'	root	Be sure to change it before deployment
WLAN, LTE, GPS	disabled	
Bridge	disabled	
DHCP/DNS server	disabled	
Firewall	<i>'Input</i> ' and <i>'Output'</i> are set to <i>ACCEPT</i> , <i>'Forward'</i> is set to <i>REJECT</i>	
VLAN	Not configured	



Default Network Configuration