LCOS 10.94

Addendum

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LANCOM SYSTEMS

Contents

Copyright

LANCOM Systems GmbH

A Rohde & Schwarz Company

Adenauerstr. 20/B2

52146 Wuerselen

Germany

www.lancom-systems.com

1 Addendum to LCOS version 10.94

This document describes the changes and enhancements in LCOS version 10.94 since the previous version.

2 Configuration

2.1 Support for aliases on the CLI

As of LCOS 10.94, command aliases can be configured on the CLI. With these command aliases, CLI commands can be shortened or predefined on the console.

2.1.1 Additions to the Setup menu

2.1.1.1 Command-Aliases

Here you can configure command aliases on the CLI. With these command aliases, CLI commands on the console can be shortened or predefined. For example, setting parameters or displaying a (status) table.

To do this, define pairs of a new alias and the corresponding command to be executed. Examples:

- In the following example, the user-defined alias “show wwan” should display the status of the cellular modem from the status tree using the command “ls /status/modem-mobile”.

```
root@:/Setup/Config/Command-Aliases
> add "show wwan" "ls /status/modem-mobile"
set ok:
Command                          Definition
=================================-======================================
show wwan                        ls /status/modem-mobile
```

- An alias is created to make the command Ping send two packets to the IP address 8.8.8.8:

```
root@:/Setup/Config/Command-Aliases
> add "pingtest" "ping 8.8.8.8 -c2"
set ok:
Command                          Definition
=================================-======================================
pingtest                         ping 8.8.8.8 -c2

root@:/Setup/Config/Command-Aliases
> pingtest

56 Byte Packet from 8.8.8.8 seq.no=0 time=6.687 ms
56 Byte Packet from 8.8.8.8 seq.no=1 time=6.425 ms

---8.8.8.8 ping statistic---
56 Bytes Data, 2 Packets transmitted, 2 Packets received, 0% loss
```

SNMP ID:

2.11.98

Console path:

Setup > **Config**

2.1.1.1.1 Command

Define the new alias here as the command of this alias entry.

SNMP ID:

2.11.98.1

Console path:

Setup > **Config** > **Command-Aliases**

Possible values:

Max. 32 characters from `[a-z][0-9]`

2.1.1.1.2 Definition

Define here the command to be executed for this alias entry.

SNMP ID:

2.11.98.2

Console path:

Setup > **Config** > **Command-Aliases**

Possible values:

Max. 128 characters from `[A-Z][a-z][0-9]#@{|}~!"$%&'()*+-,/:;<=>?[\]^_. ``

2.2 Support for history in the console

As of LCOS 10.94, entered CLI commands are persistently saved by default and are therefore available after a reboot. The entered commands can be displayed with the "history" command and recalled with the "up arrow" and "down arrow" keys on the keyboard. Persistent storage can be disabled via configuration.

Command	Description
`history [options][<count>]`	Displays a list of the last executed commands. With the command `!#`, commands from the list can be called directly by their number (#): For example, `!3` executes the third command in the list. The history is saved persistently across reboots. See also *2.11.99 Persistent-History* on page 8. › `-c`: Clears the stored history. › `-w`: Writes the current history to a file. › `-a`: Appends the commands from this session's history to the end of a file. › `<count>`: Outputs only the number of commands specified in <count> on the command line.

2.2.1 Additions to the Setup menu

2.2.1.1 Persistent-History

When persistent CLI history is enabled, entered CLI commands are persistently saved by default and are therefore available after a reboot. The entered commands can be displayed with the “history” command and recalled using the “up arrow” and “down arrow” keys on the keyboard. Persistent storage can be disabled here.

You can define the number of entries in the history list in *2.11.100 History-File-Size-Limit* on page 8.

SNMP ID:

2.11.99

Console path:

Setup > **Config**

Possible values:

No

Persistent CLI history is disabled.

Yes

Persistent CLI history is enabled.

Default:

Yes

2.2.1.2 History-File-Size-Limit

Defines the number of entries in the history list.

See also *2.11.99 Persistent-History* on page 8.

SNMP ID:

2.11.100

Console path:

Setup > **Config**

Possible values:

Max. 4 characters from `[0–9]`

Default:

100

2.3 Show Command for PPPoE user detail

As of LCOS 10.94, you can use the command `show pppoe-user-detail <user-name>` to display status information about the respective active user or the peer on the PPPoE server.

2.4 Manually override the service status display

The open services (e.g. WEBconfig, SSH) of the device can be displayed in various ways, such as the CLI status table, WEBconfig, or LMC. This display provides an easy way to obtain an overview of the open services. In certain cases, for technical reasons, it is not possible for the display to provide complete information, for example when firewall rules are used for the DNS service. In this case, it is not possible for the firewall rules to be fully evaluated or interpreted for this display.

As of LCOS 10.94, if the compliance status of a service has been manually checked by the administrator, there is an option to correct the display status via the CLI in order to suppress possible false alarms.

2.4.1 Additions to the Setup menu

2.4.1.1 Manual-Service-Status-Override

The open services (e.g. WEBconfig, SSH) of the device can be displayed in various ways, such as the CLI status table, WEBconfig, or LMC. This display provides an easy way to obtain an overview of the open services. In certain cases, for technical reasons, it is not possible for the display to provide complete information, for example when firewall rules are used for the DNS service. In this case, it is not possible for the firewall rules to be fully evaluated or interpreted for this display.

If the compliance status of a service has been manually checked by the administrator, there is an option to correct the display status in order to suppress possible false alarms.

SNMP ID:

2.11.102

Console path:

Setup > **Config**

2.4.1.1.1 Service

The name of the service for which a corrected display is to be configured. These are the services available on the router.

SNMP ID:

2.11.102.1

Console path:

Setup > **Config** > **Manual-Service-Status-Override**

2.4.1.1.2 Override-active

Specifies whether a corrected display is to be configured for this service.

SNMP ID:

2.11.102.2

Console path:

Setup > **Config** > **Manual-Service-Status-Override**

Possible values:

No

No manual status change for this service.

Yes

The status of this service is manually adjusted using the following settings.

Default:

No

2.4.1.1.3 LAN

Changes the display for this service depending on *2.11.102.2 Override-active* on page 10 to the status configured here for LAN.

SNMP ID:

2.11.102.3

Console path:

Setup > **Config** > **Manual-Service-Status-Override**

Possible values:

No

Status of the service is “No”.

Yes

Status of the service is “Yes”.

Default:

No

2.4.1.1.4 WAN

Changes the display for this service depending on *2.11.102.2 Override-active* on page 10 to the status configured here for WAN.

SNMP ID:

2.11.102.4

Console path:

Setup > **Config** > **Manual-Service-Status-Override**

Possible values:

No

Status of the service is “No”.

Yes

Status of the service is “Yes”.

Default:

No

2.4.1.1.5 VPN

Changes the display for this service depending on *2.11.102.2 Override-active* on page 10 to the status configured here for VPN.

SNMP ID:

2.11.102.5

Console path:

Setup > **Config** > **Manual-Service-Status-Override**

Possible values:

No

Status of the service is “No”.

Yes

Status of the service is “Yes”.

Default:

No

2.4.1.1.6 WLAN

Changes the display for this service depending on *2.11.102.2 Override-active* on page 10 to the status configured here for WLAN.

SNMP ID:

2.11.102.6

Console path:

Setup > **Config** > **Manual-Service-Status-Override**

Possible values:

No

Status of the service is “No”.

Yes

Status of the service is “Yes”.

Default:

No

3 Security

3.1 Two-Factor Authentication (2FA) for Device Access

Access to management protocols (e.g., WEBconfig, SSH, Telnet) can be secured using two-factor authentication (2FA) in addition to the regular password. The feature can be configured separately for additional administrators or for the default root user.

In certain cases, management protocols must be allowed over unsecure channels, such as the Internet. To provide additional protection and safeguard the device against brute-force attacks, two-factor authentication can be enabled granularly for different access paths.

Common authenticator apps for mobile devices, such as smartphones, are supported.

Note that in the event of loss of the authenticator, a complete device reset may be required in the worst case. It is therefore recommended not to require 2FA for all configuration access methods — for example, not for serial console access or local LAN access — so that in the event of loss or misconfiguration, the device can still be accessed through normal means without 2FA.

It is especially recommended to enable 2FA protection for access via the WAN interface, including the use of encrypted protocols such as HTTPS or SSH.

Using 2FA requires the device to have the correct time. Therefore, the time reference should always be configured via the NTP client on the router in LANconfig under **Date & Time** > **Synchronization**.

The basic configuration process for two-factor authentication is as follows:

1. Create an entry in the "Admin-OTPs" table (LANconfig: **Management** > **Admin** > **Device configuration** > **Admin OTPs**), specifying the administrator account name to which this entry applies.
2. Open WEBconfig under **Extras** > **Admin-OTPs**. From there, the generated QR code for the user can be displayed, saved, or scanned by an external authenticator app.
3. When the management connection for the admin user is initiated, the user will be prompted to enter the one-time password (OTP) after entering their regular password.

The use of 2FA with OTPs is currently not natively supported by LANconfig/LANmonitor or LANtracer, i.e., through a separate OTP input field. However, it is possible to enter the OTP directly after the password in the password input field (without spaces or separators). The password must then not be saved, because the OTP will already have expired the next time it is used. Each time the password is entered, the currently valid OTP must be appended. In this way, the procedure also enables the use of OTPs with external applications that do not natively support OTPs.

Generating QR Codes for Connection with the Authenticator

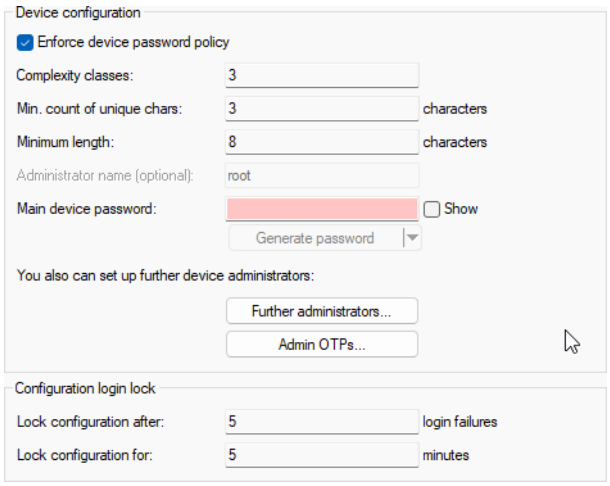
The QR codes used to connect the authenticator with the device are generated in WEBconfig under **Extras** > **Admin-OTPs** or alternatively via the CLI command "show Admin-OTP-QR".

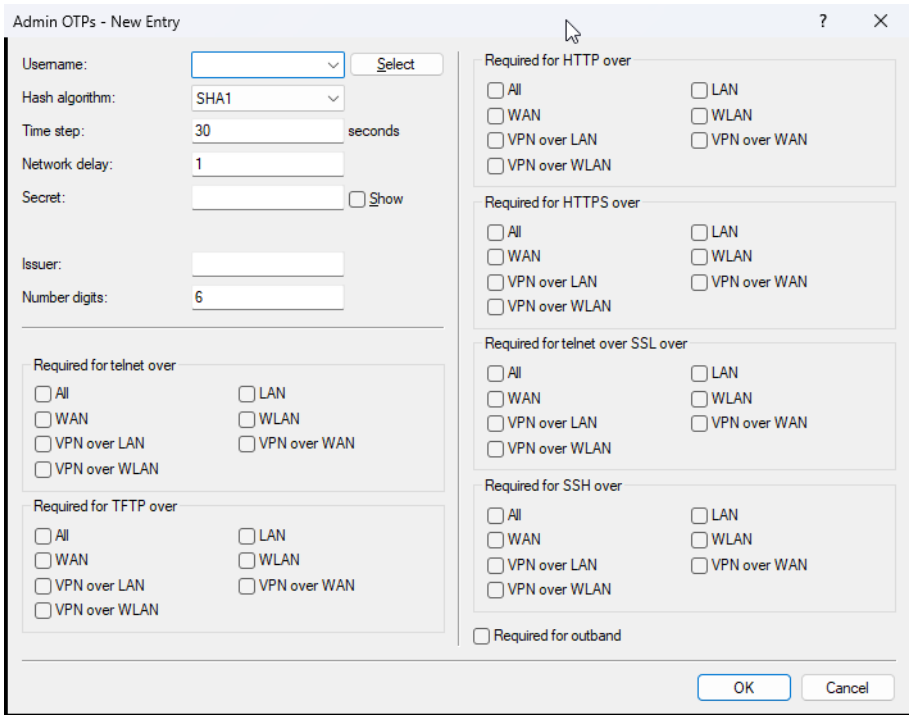
Show Commands

- Admin-OTP – Displays the administrator OTP profiles
- Admin-OTP-CODES – Displays the administrator OTP profiles (codes only)
- Admin-OTP-QR – Displays the administrator OTP profiles (QR code only)
- Admin-OTP-URI – Displays the administrator OTP profiles (URI only)

3.1.1 Admin OTPs

The settings for OTPs for administrator accounts can be found in LANconfig under **Management** > **Admin** > **Device configuration** > **Admin OTPs**.





Username

Username of the administrator for whom two-factor authentication is to be enabled, e.g., “root”.

Hash algorithm

Defines the hash algorithm to be used.

Make sure that the authenticator app supports the highest possible hash algorithm.

Time step

Defines the interval in seconds after which a new OTP is generated.

Network delay

Defines the maximum number of time steps by which the client's clock may differ. The device checks the OTP that is older or newer by this value.

Secret

Defines the actual shared secret that must be shared with the authenticator app. The secret must be unique for each user. There are currently three input options in the table:

Base32 (Default)

Prefix "base32:" followed by the Base32-encoded secret. The prefix may also be omitted.

Hexadecimal

Prefix "hex:" followed by an even number of hex digits.

Plain text passphrase

Prefix "ascii:" followed by the characters.

For Google Authenticator, the secret must be 16 characters long (80 bits, Base32 encoded), e.g. E3U5IDWEE3KFCJ7G.

Issuer

Freely definable text used in the authenticator to distinguish between multiple keys or for general display purposes when the same username is used. The value must not contain a colon.

Number digits

Length of the OTPs.

For Google Authenticator, the value should be set to 6.

Required for *protocol* over

Defines whether two-factor authentication is required for this user when logging in via this *protocol* and whether the device should prompt for it. You can configure granularly over which access paths two-factor authentication is required, e.g., only via a WAN connection.

All

Two-factor authentication is required for all access protocols.

WAN

Two-factor authentication is required for access via "WAN".

VPN over LAN

Two-factor authentication is required for access via "VPN over LAN".

VPN over WLAN

Two-factor authentication is required for access via "VPN over WLAN".

LAN

Two-factor authentication is required for access via "LAN".

WLAN

Two-factor authentication is required for access via "WLAN".

VPN over WAN

Two-factor authentication is required for access via "VPN over WAN".

Required for outband

Defines whether two-factor authentication is required for this user when logging in via the serial interface, or whether the device should request it.

3.1.2 Additions to the Setup menu

3.1.2.1 Admin-OTPs

Access to management protocols (e.g., WEBconfig, SSH, Telnet) can be secured using two-factor authentication (2FA) in addition to the regular password. The feature can be configured separately for additional administrators or for the default root user.

In certain cases, management protocols must be allowed over unsecure channels, such as the Internet. To provide additional protection and safeguard the device against brute-force attacks, two-factor authentication can be enabled granularly for different access paths.

Common authenticator apps for mobile devices, such as smartphones, are supported.

Note that in the event of loss of the authenticator, a complete device reset may be required in the worst case. It is therefore recommended not to require 2FA for all configuration access methods — for example, not for serial console access or local LAN access — so that in the event of loss or misconfiguration, the device can still be accessed through normal means without 2FA.

It is especially recommended to enable 2FA protection for access via the WAN interface, including the use of encrypted protocols such as HTTPS or SSH.

Using 2FA requires the device to have the correct time. Therefore, the time reference should always be configured via the NTP client on the router in LANconfig under **Date & Time** > **Synchronization**.

The basic configuration process for two-factor authentication is as follows:

1. Create an entry in the "Admin-OTPs" table (LANconfig: **Management** > **Admin** > **Device configuration** > **Admin OTPs**), specifying the administrator account name to which this entry applies.
2. Open WEBconfig under **Extras** > **Admin-OTPs**. From there, the generated QR code for the user can be displayed, saved, or scanned by an external authenticator app.
3. When the management connection for the admin user is initiated, the user will be prompted to enter the one-time password (OTP) after entering their regular password.

This table defines the OTP administrators.

SNMP ID:

2.11.101

Console path:

Setup > **Config**

3.1.2.1.1 Administrator

Username of the administrator for whom two-factor authentication is to be enabled, e.g., "root".

SNMP ID:

2.11.101.1

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

Max. 16 characters from `[A-Z][a-z][0-9]@{|}~!$%&'()+-,/;<=>?[\]^_.`

3.1.2.1.2 Hash-Algorithm

Defines the hash algorithm to be used.

Make sure that the authenticator app supports the highest possible hash algorithm.

SNMP ID:

2.11.101.2

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

SHA1
SHA256
SHA512

3.1.2.1.3 Time-Step

Defines the interval in seconds after which a new OTP is generated.

SNMP ID:

2.11.101.3

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

Max. 10 characters from `[0-9]`

3.1.2.1.4 Network-Delay

Defines the maximum number of time steps by which the client's clock may differ. The device checks the OTP that is older or newer by this value.

SNMP ID:

2.11.101.4

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

Max. 3 characters from `[0-9]`

3.1.2.1.5 Secret

Defines the actual shared secret that must be shared with the authenticator app. The secret must be unique for each user. There are currently three input options in the table:

Base32 (Default)

Prefix "base32:" followed by the Base32-encoded secret. The prefix may also be omitted.

Hexadecimal

Prefix "hex:" followed by an even number of hex digits.

Plain text passphrase

Prefix "ascii:" followed by the characters.

For Google Authenticator, the secret must be 16 characters long (80 bits, Base32 encoded), e.g. E3U5IDWEE3KFCJ7G.

SNMP ID:

2.11.101.5

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

Max. 32 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_. ``

3.1.2.1.6 Issuer

Freely definable text used in the authenticator to distinguish between multiple keys or for general display purposes when the same username is used. The value must not contain a colon.

SNMP ID:

2.11.101.6

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

Max. 32 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_. ``

3.1.2.1.7 Num-Digits

Length of the OTPs.

For Google Authenticator, the value should be set to 6.

SNMP ID:

2.11.101.7

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

Max. 3 characters from `[0-9]`

3.1.2.1.8 Request-on-Outband

Defines whether two-factor authentication is required for this user when logging in via the serial interface, or whether the device should request it.

SNMP ID:

2.11.101.11

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

No
Yes

3.1.2.1.9 Request-on-Telnet

Defines whether two-factor authentication is required for this user when logging in via Telnet, or whether the device should request it. It can be configured granularly to specify which access paths require two-factor authentication, e.g., only via a WAN connection.

SNMP ID:

2.11.101.12

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

never
LAN
WAN
WLAN
VPN-over-LAN
VPN-over-WAN
VPN-over-WLAN
always

3.1.2.1.10 Request-on-TFTP

Defines whether two-factor authentication is required for this user when logging in via TFTP, or whether the device should request it. It can be configured granularly to specify which access paths require two-factor authentication, e.g., only via a WAN connection.

SNMP ID:

2.11.101.13

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

never
LAN
WAN
WLAN
VPN-over-LAN
VPN-over-WAN
VPN-over-WLAN
always

3.1.2.1.11 Request-on-HTTP

Defines whether two-factor authentication is required for this user when logging in via HTTP, or whether the device should request it. It can be configured granularly to specify which access paths require two-factor authentication, e.g., only via a WAN connection.

SNMP ID:

2.11.101.14

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

never
LAN
WAN
WLAN
VPN-over-LAN
VPN-over-WAN
VPN-over-WLAN
always

3.1.2.1.12 Request-on-HTTPS

Defines whether two-factor authentication is required for this user when logging in via HTTPS, or whether the device should request it. It can be configured granularly to specify which access paths require two-factor authentication, e.g., only via a WAN connection.

SNMP ID:

2.11.101.16

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

never
LAN
WAN
WLAN
VPN-over-LAN
VPN-over-WAN
VPN-over-WLAN
always

3.1.2.1.13 Request-on-Telnet-SSL

Defines whether two-factor authentication is required for this user when logging in via Telnet-SSL, or whether the device should request it. It can be configured granularly to specify which access paths require two-factor authentication, e.g., only via a WAN connection.

SNMP ID:

2.11.101.17

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

never
LAN
WAN
WLAN
VPN-over-LAN
VPN-over-WAN
VPN-over-WLAN
always

3.1.2.1.14 Request-on-SSH

Defines whether two-factor authentication is required for this user when logging in via SSH, or whether the device should request it. It can be configured granularly to specify which access paths require two-factor authentication, e.g., only via a WAN connection.

SNMP ID:

2.11.101.18

Console path:

Setup > **Config** > **Admin-OTPs**

Possible values:

never
LAN
WAN
WLAN
VPN-over-LAN
VPN-over-WAN
VPN-over-WLAN
always

4 Routing and WAN connections

4.1 eSIM

To gain access to mobile networks, mobile network operators (MNOs) issue so-called SIM cards (Subscriber Identity Module Cards) to their customers. Each MNO issues its own SIM cards per customer. SIM cards consist of a plastic carrier and a security chip with security keys that grant access to the mobile network. If a customer wanted to change operators, the old SIM card had to be replaced with a new SIM card from the new MNO in the device. SIM cards are usually sent by the MNO via postal mail, which the customer receives a few days after signing the contract.

An eSIM is, simply put, the digital version of the classic SIM card. It consists of a chip (e.g., in the M2FF form factor) that is permanently installed in the mobile phone or router, and a solution for managing mobile profiles, referred to as eUICC (embedded Universal Integrated Circuit Card). eUICC functionality can be provided in different form factors. In the following, the terms eSIM and eUICC are used synonymously for simplicity.

Basically, three different types or solution architectures of eSIMs exist:

1. M2M eSIM: Machine-to-Machine (M2M) eSIMs are designed for machines and device types without a user interface or user interaction on the device. M2M eSIMs are centrally managed by a management portal or provisioning system and can be transferred to the end device over-the-air (OTA) via SMS. Typically, these are closed systems provided by solution vendors for customers with many end devices. M2M eSIMs are specified according to the SGP.02 standard.
2. Consumer eSIMs: Consumer eSIMs are issued by MNOs and are used in mobile phones, smartwatches, or routers. Typically, the MNO supplies a QR code or activation code that the customer can use to install the eSIM or profile on the device. Closed or proprietary provisioning systems also exist from certain smartphone manufacturers, enabling the MNO to notify the customer that the eSIM is ready for download. Unlike the M2M eSIM, the end customer must initiate the installation of the eSIM. End devices have software called the Local Profile Assistant (LPA), which establishes encrypted communication between the embedded eSIM/mobile chip and the MNO's system. Downloading the eSIM profile always requires an existing internet connection, e.g., through the phone's integrated WLAN. Consumer eSIMs are defined in the SGP.22 standard.
3. IoT eSIM: IoT eSIMs are designed for a large number of IoT devices and combine part of the LPA functionality on the device with a server for managing the eSIMs. IoT eSIMs are defined in the SGP.32 standard and are the newest of the solution architectures.

LANCOM routers include an eSIM chip in the M2FF form factor with eUICC functionality. This is a consumer eSIM according to the SGP.22 standard. This solution is compatible with common eSIMs issued by MNOs for mobile phones. The eSIM can be used with all mobile profiles for consumer eSIMs according to the SGP.22 standard and is not technically restricted. In principle, eSIMs must be supported by the MNO and must not be limited to specific devices or device types.

As of LCOS 10.94, LANCOM routers support, in addition to classic plastic SIM cards, an eSIM solution in cellular routers. Several prerequisites are required:

1. At least LCOS 10.94 firmware
2. Cellular router with integrated on-board eSIM chip
3. Possibly an update of the WWAN firmware to the minimum version supporting eSIM functionality

The general process of installing an eSIM on a LANCOM router is as follows:

1. Sign a mobile contract with an MNO.
2. The MNO supplies a QR code or activation code (both contain the same information, just in different formats) for the eSIM.
3. The activation code is entered via WEBconfig or the router's command line. The router then downloads the corresponding profile from the MNO's server via an existing internet connection (e.g., DSL or fiber) to the integrated

chip. The profile is stored permanently in the chip. The activation code contains both the server URL and a code for retrieving the eSIM.

4. The successfully downloaded eSIM is configured in the router's WWAN profile table for use.

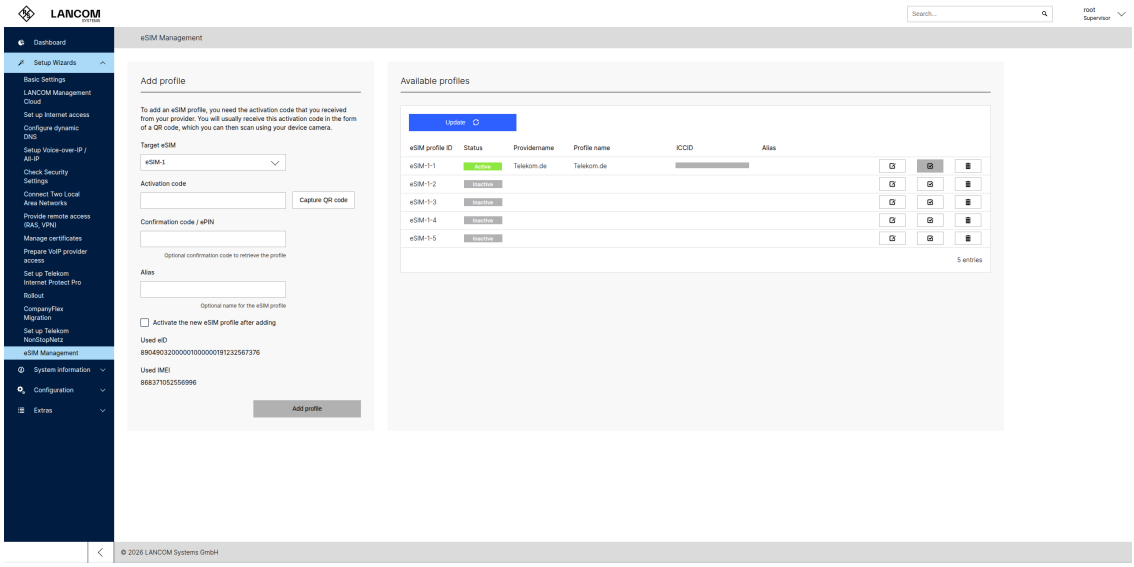
To download the eSIM, the router requires an existing internet connection, e.g., via DSL or fiber, similar to a mobile phone that requires a WLAN connection. It is technically not possible to download the eSIM via the same device's WWAN modem, as the eSIM installation process is an exclusive, continuous operation in the mobile chip and the router must switch access from the physical SIM card to the eSIM during this process.

Further notes on usage:

- Up to eight eSIM profiles can be stored on the integrated eSIM
- eSIMs can be installed and managed via WEBconfig or CLI commands
- An optional GSMA test profile, if present on the eSIM, can be safely deleted and serves to simplify testing for MNOs, developers, or certification/test procedures
- The eSIM is implemented as a "virtual SIM slot" that can hold up to eight profiles
- Only the active eSIM profile is used when the eSIM is referenced as "eSIM-1" in the SIM slot configuration
- If the internal cellular modem is unavailable, the eSIM management cannot be accessed
- A device reset is not a secure method for deleting eSIM profiles, as it cannot be guaranteed that the modem has access to the eSIM at that moment
- To securely delete eSIMs, the profiles must be manually removed via eSIM management. If this is not possible, the corresponding eSIM profile can, as a last resort, be disabled by the MNO, as is already the case with physical SIM cards
- eSIMs can generally only be downloaded once and cannot be re-downloaded. eSIMs must explicitly be re-enabled by the MNO for download.
- Downloaded eSIMs are permanently tied to the embedded chip and cannot be transferred between different devices.

4.1.1 Configuration

In the device's WEBconfig, open the section **Add profile** under **Setup Wizards** > **eSIM Management**.



Target eSIM

Select the desired target eSIM, e.g., eSIM-1.

Activation code

Insert here the eSIM activation code provided by your mobile network operator (MNO), e.g., `LPA:1$prov.example.com$ABCDEFGH12345`.

This is the so-called LPA string ("Local Profile Assistant" string). It is a character string that contains the address of the SM-DP+ server (Server for Profile Management) and an activation code to manually install an eSIM profile on a device. It is identical to the content of the QR code. The string follows the format LPA:1$SM-DP+address$activation-code and is used by the LPA in the device to download and install the eSIM profile from the SM-DP+ server over an existing Internet connection.

The activation code can either be entered as text or scanned from a QR code if the device has a camera.

Confirmation code / ePIN

Optional confirmation code that is entered together with the activation code. Some MNOs refer to this as an ePIN. The code is provided by your mobile network operator along with the QR code/activation code.

Alias

The alias is an optional label for the eSIM profile. It allows easier identification of the profile in the profile table.

Used eID

Displays the eID (Embedded Identity Document). The eID is the globally unique identifier of the eSIM installed in the device. This information is for reference only.

Used IMEI

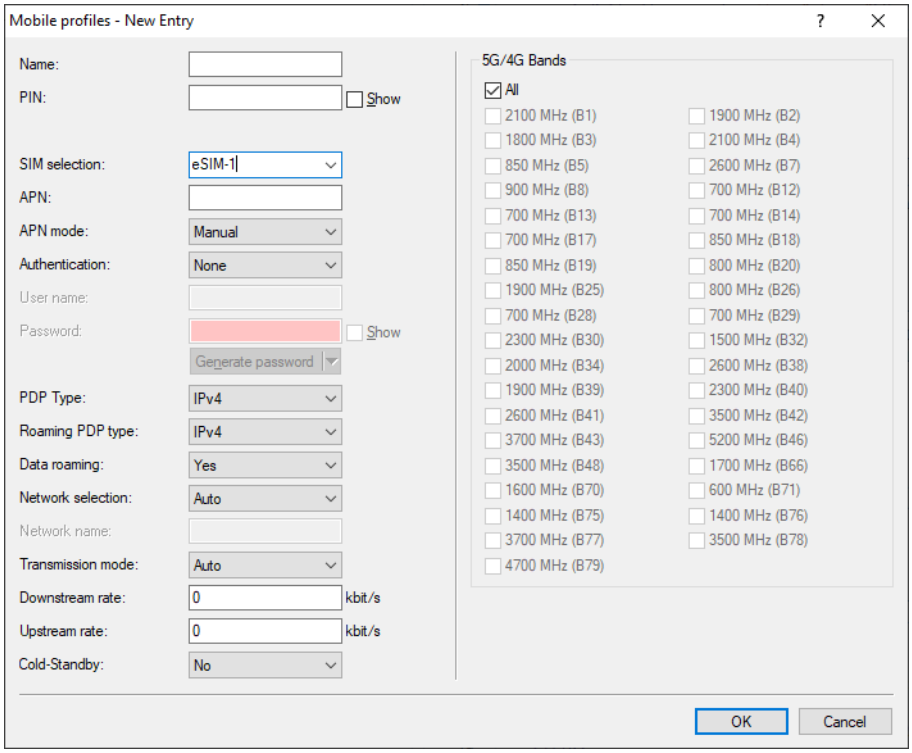
Displays the IMEI (International Mobile Equipment Identity). The IMEI is a 15-digit number assigned to your LANCOM cellular router that uniquely identifies it worldwide. This information is for reference only.

Section "Available profiles"

This area displays the eSIM profiles stored on the local device. In principle, only one eSIM profile out of a maximum of eight profiles can be active at any one time. The active profile can be used as "eSIM-1" in the SIM selection of the WWAN profile configuration. The three icons on the right-hand side allow the actions "Edit profile", "Activate profile", and "Delete profile".

Assign WWAN profile in LANconfig

In LANconfig, open **Interfaces** > **WAN** > **Mobile settings** > **Mobile profiles**.



SIM selection

Defines the SIM slot or eSIM of the device to be used. Possible values (depending on the device):

- SIM-1 (Default): first SIM slot in the device
- SIM-2: second SIM slot in the device
- eSIM-1: embedded eSIM in the device. The currently active profile configured in WEBconfig is used.
- Iccid:<iccid of the SIM card or eSIM profile>: With this value, the SIM card or eSIM profile can be explicitly selected via the unique ICCID (Integrated Circuit Card Identifier). The ICCID of the installed eSIM profiles can be found in the eSIM management section of WEBconfig.

4.1.2 CLI Configuration

In addition to management via WEBconfig, eSIMs can also be managed via the command line. This allows eSIM profiles to be downloaded or deleted.

Under **Status** > **Modem-Mobile** > **eSIM** you will find the status table **eSIM Profiles**, which displays the currently installed eSIMs.

You will also find the actions Change-Alias, Enable-Profile, Disable-ProfileDelete-Profile, and Download-Profile here.

Change-Alias

This command allows you to change the alias or user-defined label of the eSIM.

Usage: do Change-Alias "<eSIM Profile ID>" "<New alias>"

Enable-profile

Use this command to enable the profile.

Usage: do Enable-Profile "<eSIM Profile ID>"

Disable-profile

Use this command to disable the profile.

Usage: do Disable-Profile "<eSIM Profile ID>"

Delete-Profile

This command allows you to delete an eSIM profile.

Usage: do Delete-Profile <eSIM Profile ID>

Download-Profile

This command allows you to download an eSIM profile.

Usage: do Download-Profile [Option]... "<eSIM activation code>"

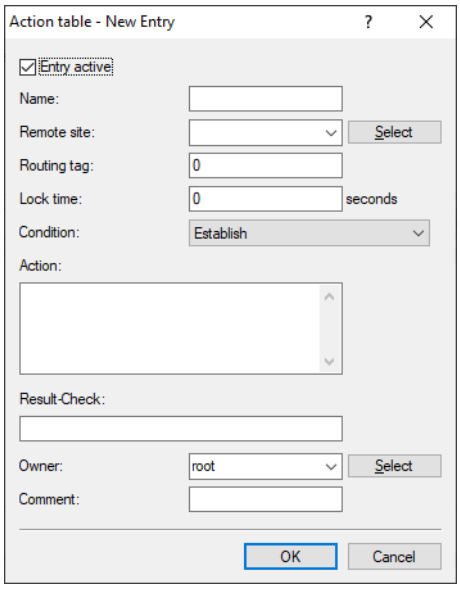
Options:

- -a "<Alias>" – Set alias for the profile after download
- -c "<Confirmation code>" – Provide confirmation code
- -s "<Target SIM>" – Set target SIM (Default: eSIM-1)

4.2 Additional IPv6 variable for the action table

As of LCOS 10.94, an additional variable for IPv6 can be used in the action table.

In LANconfig, you can find the action table under **Communication** > **General** > **Action table**.



Under **Action**, you can use this variable to extend the actions:

%w

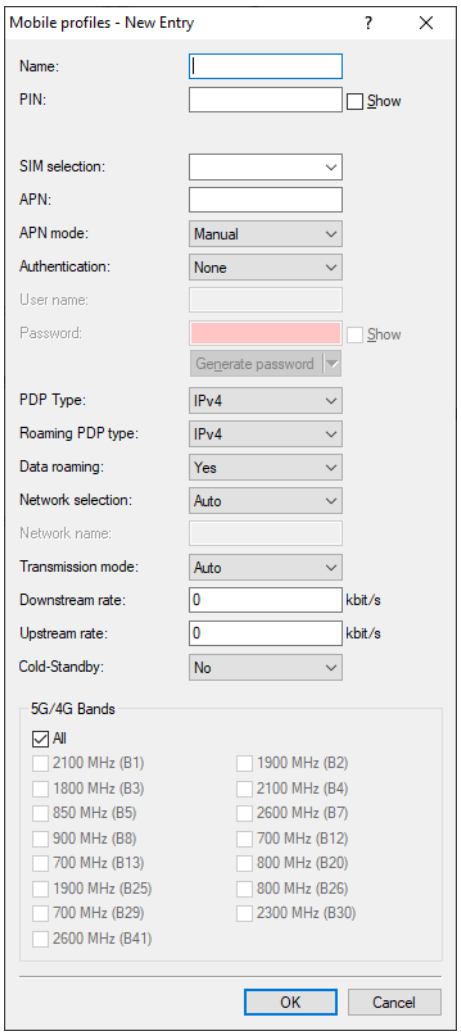
Variable for IPv6. With the variable %w, together with the network name, e.g., %{wINTRANET}, a static address with a fixed host identifier can be assigned to any station in the local network.

Example: `%{wINTRANET}dd06:57b3:f1ee:201e` together with the prefix `2003:c9:1703:5b51::/64` on the INTRANET network results in: `2003:c9:1703:5b51:dd06:57b3:f1ee:20ff`

The prefix is formatted so that only the 64-bit host portion needs to be appended to form a complete 128-bit address. The prefix length "::64/" is truncated in the process.

4.3 APN credentials in the WWAN profile table

As of LCOS 10.94, you can define in the WWAN profile table under **Interfaces** > **WAN** > **Mobile profiles** whether authentication is required for logging in to the APN.



Authentication

Specify whether authentication is required for logging in to the APN. Possible values: None, PAP, CHAP.

User name

If authentication is required for logging in to the APN, enter the user name here.

Password

If authentication is required for logging in to the APN, enter the password here.

4.3.1 Additions to the Setup menu

4.3.1.1 Authentication

Specify whether authentication is required for logging in to the APN.

SNMP ID:

2.23.41.1.19

Console path:

Setup > **Interfaces** > **Mobile** > **Profiles**

Possible values:

None
PAP
CHAP

Default:

None

4.3.1.2 Username

If authentication is required for logging in to the APN, enter the user name here.

SNMP ID:

2.23.41.1.20

Console path:

Setup > **Interfaces** > **Mobile** > **Profiles**

Possible values:

Max. 64 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_.`

Default:

empty

4.3.1.3 Password

If authentication is required for logging in to the APN, enter the password here.

SNMP ID:

2.23.41.1.21

Console path:

Setup > **Interfaces** > **Mobile** > **Profiles**

Possible values:

Max. 32 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_.`

Default:

empty

4.4 WWAN Bridge Mode

The cellular modem integrated into the router can be used in two operating modes: Router mode and Bridge mode. In router mode, the router establishes the mobile connection itself and receives an IP address on its WWAN connection (e.g., IPv4 address and/or IPv6 address/prefix), allowing a downstream network to access the Internet via Network Address Translation (NAT). The IP address assigned by the provider is shared with multiple LAN clients in this case.

In bridge mode, the router acts as a simple network bridge and forwards all IP packets from the mobile network to exactly one downstream device. This device therefore receives the IP address assigned by the provider directly and must establish the WAN connection (via DHCP) to the provider and handle NAT and routing for the internal network.

Bridge mode is useful when the device is intended to operate purely as a modem, for example, to avoid double NAT in a router cascade. The WWAN bridge mode is conceptually comparable to the bridge mode of DSL modems.

The device providing bridge mode itself does not have an IP address on the WWAN interface and therefore cannot establish a direct connection to the mobile network, as data packets are transparently forwarded. If the device is to be managed via the LMC, for example, Internet access must be established through an alternative route.

Only the first client that connects to the device in bridge mode receives the IP address assigned by the mobile network. Packets from the cellular modem are passed on without VLAN tagging.

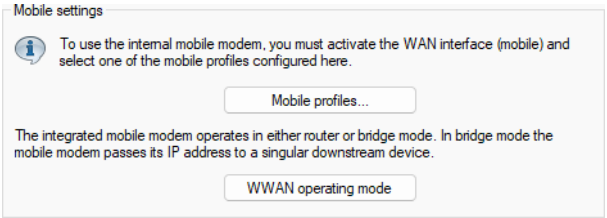
It is recommended to configure ICMP polling on the WAN connection of the downstream device, as it is not possible by design for the modem to notify the downstream device of a connection loss or address change. ICMP polling allows the downstream device to detect an interruption in the mobile connection.

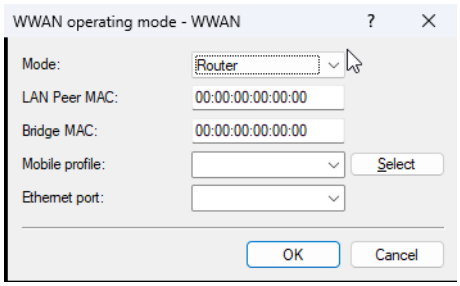
Configuration of the WWAN bridge mode is generally performed in the following steps:

1. The operating mode of the WWAN modem is set to “Bridge”, and an appropriate WWAN profile for the cellular parameters must also be specified.
2. The “WWAN” interface is configured together with a LAN interface (e.g., LAN-2) in a common bridge group. The corresponding LAN interface is assigned to an ETH port.

4.4.1 Configuration

You can find the configuration of the WWAN Bridge Mode in LANconfig under **Interfaces** > **WAN** > **Mobile settings** > **WWAN operating mode**.





Mode

Defines the operating mode of the device's internal mobile interface. Possible values:

Router

In Router Mode, the device establishes the cellular connection itself and obtains an IP address on its WWAN interface. A downstream network gains Internet access via Network Address Translation (NAT).

Bridge

In Bridge Mode, the device acts as a transparent network bridge and forwards all IP packets from the mobile network to exactly one downstream device. Detailed bridge configuration is performed in the LAN Bridge settings.

LAN Peer MAC

MAC address of the device or client in the LAN that should receive the IP address directly from the mobile network. If the MAC address is 0, the MAC address learned from received packets is used automatically.

Bridge MAC

MAC address to be used as the sender address. If the MAC address is 0, a "locally administered" address derived automatically from the device's MAC address is used.

Mobile profile

Defines the WWAN profile to be used.

Ethernet port

Defines the Ethernet port, e.g. ETH-1, on which the device signals in WWAN bridge mode by briefly bringing the Ethernet port up and down that the WWAN connection has been interrupted or re-established.

In bridge mode, the WWAN router acts solely as a modem and transparently forwards the cellular connection (WWAN) to the downstream router. The downstream router then assumes all routing functionality (NAT, DHCP, firewall, etc.). In this case, the WWAN router is not responsible for address assignment or routing.

If the WWAN connection is disconnected or re-established while the router is operating in bridge mode, the following problems may occur: The downstream router may incorrectly assume that the WWAN connection is still active and therefore display incorrect status information and attempt to send data over this connection. For WWAN connections with a dynamic IP address, the router uses the old, no longer valid IP address while in the error state.

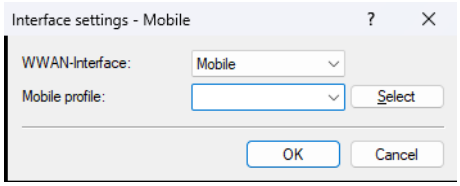
To avoid these problems, the WWAN bridge router must send an "Ethernet Port Down / Port Up" signal to the Ethernet port that is connected to the downstream router in the event of a connection failure. When the cellular modem changes state (disconnecting and establishing the cellular connection), the WWAN router physically switches off the Ethernet port for a few seconds.

This mechanism reliably informs the downstream router that the connection has been interrupted, allowing it to delete the default route, restart the DHCP client or mark the old IP address as no longer valid, and signal the failure of the cellular connection to the user.

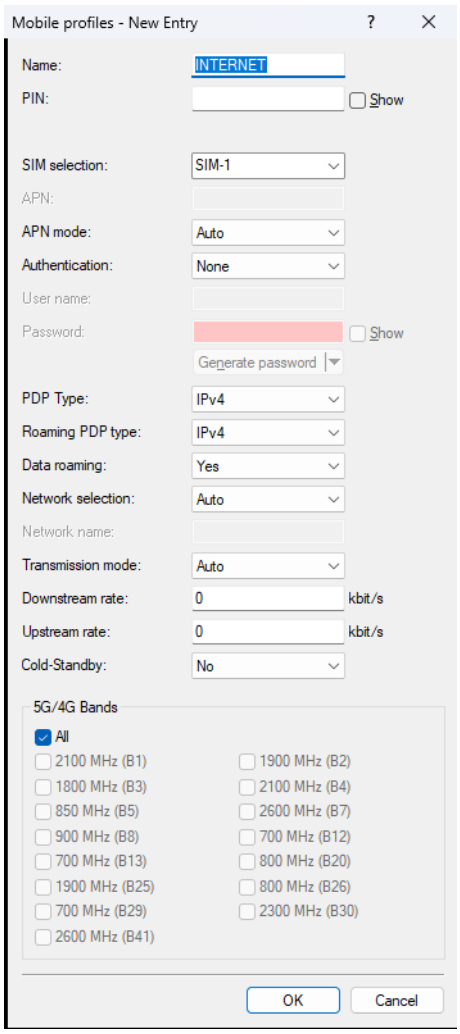
Ideally, the WWAN bridge device should be connected directly to the downstream router via an Ethernet cable so that the downstream router reliably detects the state change. If this type of installation is not possible, the downstream router should perform IP polling to actively monitor the logical Internet connection.

4.4.2 WWAN Bridge Mode Tutorial

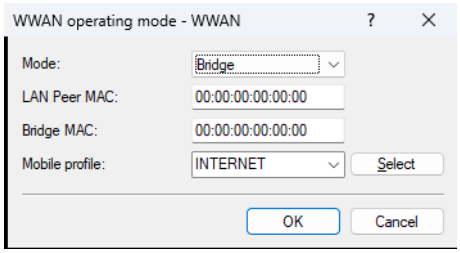
1. Open the configuration in LANconfig under **Interfaces** > **WAN** > **Interface Settings** > **Interface Settings** > **Mobile**. Set **Mobile Profile** to “empty”.



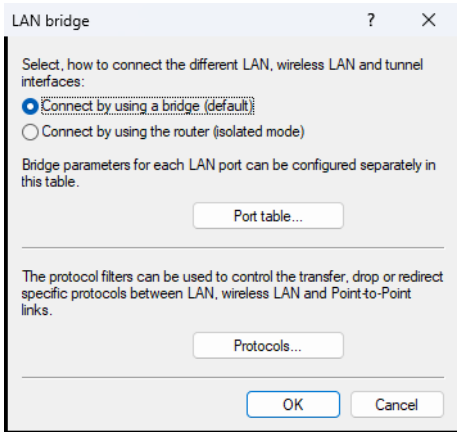
2. Open the configuration under **Interfaces** > **WAN** > **Mobile Settings** > **Mobile Profiles**. Configure the required settings for your mobile provider here.



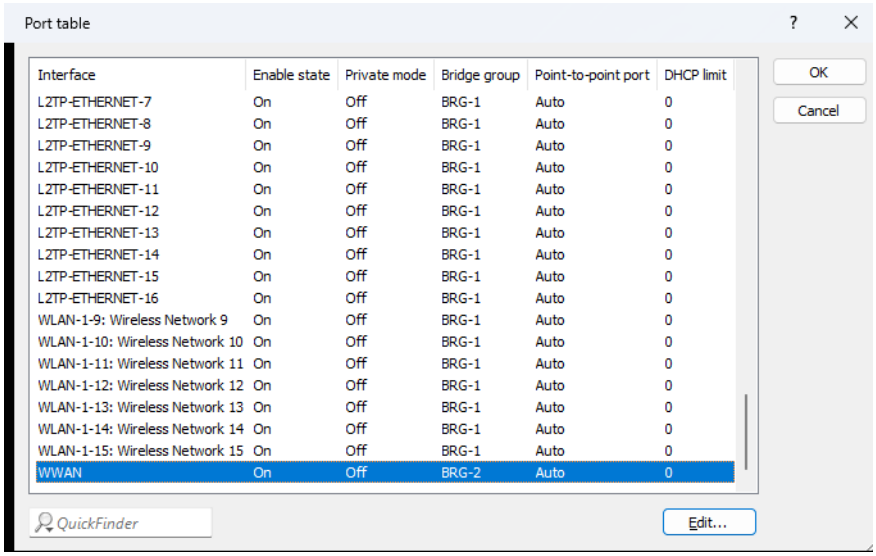
3. Open the configuration under **Interfaces** > **WAN** > **Mobile Settings** > **WWAN Operating Mode**. Set the **Mode** to "Bridge", set **LAN Peer MAC** and **Bridge MAC** to "00:00:00:00:00:00", and select the **Mobile Profile** created in step 2.



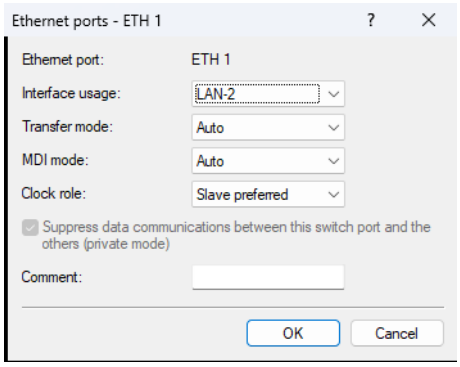
4. Enable the LAN bridge under **Interfaces** > **LAN** > **LAN Bridge Settings** > **LAN Bridge**.



5. Open the **Port Table** . To forward traffic from the mobile modem to an Ethernet port, the WWAN interface and a corresponding LAN interface must be configured together in a common bridge group. In this example, LAN-2 and WWAN are configured in bridge group BRG-2. Use a different bridge group if BRG-2 is already in use for WLAN or other functions.



6. Open **Interfaces** > **LAN** > **Ethernet Switch Settings** > **Ethernet Ports**. Configure one Ethernet port to use the LAN interface that belongs to the shared bridge group with the WWAN interface. In this example, LAN-2 is bound to Ethernet port ETH-1, which is grouped together with WWAN in bridge group BRG-2.



Please observe the following:

- No route or WWAN peer configuration is required for a WWAN device in bridge mode, because the device does not operate as a router and only requires a bridge configuration. It is recommended to delete any existing WWAN peer configurations (including the default WWAN zero-touch peer) to avoid configuration issues and unnecessary error messages caused by failed peer connection attempts.
- The router cannot reach the Internet itself via the mobile modem when operating in bridge mode.
- Ensure that only a single endpoint device is connected to the Ethernet port used for bridge mode, because only one device can obtain an IP address from the mobile network. The LAN Peer MAC address configuration ensures that only one fixed MAC address receives the IP address.
- No internal or external DHCP server may be active in the WWAN bridge group.

4.4.3 Additions to the Setup menu

4.4.3.1 WWAN

Settings for WWAN.

SNMP ID:

2.46

Console path:

Setup

4.4.3.1.1 WAN-Bridge

The cellular modem integrated into the router can be used in two operating modes: Router mode and Bridge mode. In router mode, the router establishes the mobile connection itself and receives an IP address on its WWAN connection (e.g., IPv4 address and/or IPv6 address/prefix), allowing a downstream network to access the Internet via Network Address Translation (NAT). The IP address assigned by the provider is shared with multiple LAN clients in this case.

In bridge mode, the router acts as a simple network bridge and forwards all IP packets from the mobile network to exactly one downstream device. This device therefore receives the IP address assigned by the provider directly and must establish the WAN connection (via DHCP) to the provider and handle NAT and routing for the internal network.

Bridge mode is useful when the device is intended to operate purely as a modem, for example, to avoid double NAT in a router cascade. The WWAN bridge mode is conceptually comparable to the bridge mode of DSL modems.

The device providing bridge mode itself does not have an IP address on the WWAN interface and therefore cannot establish a direct connection to the mobile network, as data packets are transparently forwarded. If the device is to be managed via the LMC, for example, Internet access must be established through an alternative route.

Only the first client that connects to the device in bridge mode receives the IP address assigned by the mobile network. Packets from the cellular modem are passed on without VLAN tagging.

It is recommended to configure ICMP polling on the WAN connection of the downstream device, as it is not possible by design for the modem to notify the downstream device of a connection loss or address change. ICMP polling allows the downstream device to detect an interruption in the mobile connection.

Configuration of the WWAN bridge mode is generally performed in the following steps:

1. The operating mode of the WWAN modem is set to "Bridge", and an appropriate WWAN profile for the cellular parameters must also be specified.
2. The "WWAN" interface is configured together with a LAN interface (e.g., LAN-2) in a common bridge group. The corresponding LAN interface is assigned to an ETH port.

SNMP ID:

2.46.2

Console path:

Setup > **WWAN**

Interface

Specifies the name of the internal cellular modem, e.g., WWAN, that should be used.

SNMP ID:

2.46.2.1

Console path:

Setup > **WWAN** > **WAN-Bridge**

Mode

Defines the operating mode of the internal cellular interface in the device.

SNMP ID:

2.46.2.2

Console path:

Setup > **WWAN** > **WAN-Bridge**

Possible values:

Router

In router mode, the router establishes the mobile connection itself and receives an IP address on its WWAN interface, allowing a downstream network to access the Internet via Network Address Translation (NAT).

Bridge

In bridge mode, the router acts as a simple network bridge and forwards all IP packets from the mobile network to exactly one downstream device. The detailed bridge configuration is performed in the LAN bridge.

Default:

Router

LAN-Peer-MAC

MAC address of the device or client in the LAN that should receive the IP address directly from the mobile network. If the MAC address is 0, the MAC address learned from received packets is used automatically.

SNMP ID:

2.46.2.3

Console path:

Setup > **WWAN** > **WAN-Bridge**

Possible values:

Max. 12 characters from `[a-f][0-9]`

Default:

000000000000

Bridge-MAC

MAC address to be used as the sender address. If the MAC address is 0, a “locally administered” address derived automatically from the device’s MAC address is used.

SNMP ID:

2.46.2.4

Console path:

Setup > **WWAN** > **WAN-Bridge**

Possible values:

Max. 12 characters from `[a-f][0-9]`

Default:

000000000000

Profile

Defines the WWAN profile to be used.

SNMP ID:

2.46.2.5

Console path:

Setup > **WWAN** > **WAN-Bridge**

Possible values:

Max. 12 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Ethernet-Port

Defines the Ethernet port, e.g. ETH-1, on which the device signals in WWAN bridge mode by briefly bringing the Ethernet port up and down that the WWAN connection has been interrupted or re-established.

In bridge mode, the WWAN router acts solely as a modem and transparently forwards the cellular connection (WWAN) to the downstream router. The downstream router then assumes all routing functionality (NAT, DHCP, firewall, etc.). In this case, the WWAN router is not responsible for address assignment or routing.

If the WWAN connection is disconnected or re-established while the router is operating in bridge mode, the following problems may occur: The downstream router may incorrectly assume that the WWAN connection is still active and therefore display incorrect status information and attempt to send data over this connection. For WWAN connections with a dynamic IP address, the router uses the old, no longer valid IP address while in the error state.

To avoid these problems, the WWAN bridge router must send an "Ethernet Port Down / Port Up" signal to the Ethernet port that is connected to the downstream router in the event of a connection failure. When the cellular modem changes state (disconnecting and establishing the cellular connection), the WWAN router physically switches off the Ethernet port for a few seconds.

This mechanism reliably informs the downstream router that the connection has been interrupted, allowing it to delete the default route, restart the DHCP client or mark the old IP address as no longer valid, and signal the failure of the cellular connection to the user.

Ideally, the WWAN bridge device should be connected directly to the downstream router via an Ethernet cable so that the downstream router reliably detects the state change. If this type of installation is not possible, the downstream router should perform IP polling to actively monitor the logical Internet connection.

SNMP ID:

2.46.2.6

Console path:

Setup > **WWAN** > **WAN bridge**

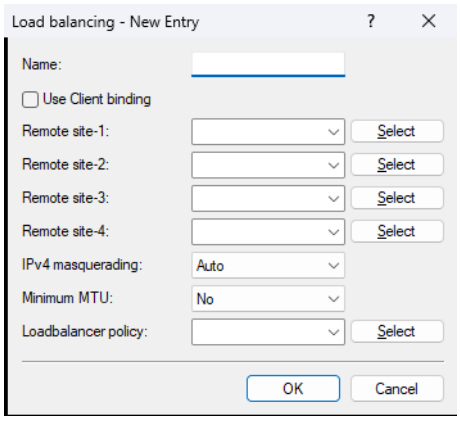
Possible values:

Max. 15 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

4.5 Using a common minimum MTU for all channels of a load balancer

As of LCOS 10.94, you can specify a common minimum MTU for all channels of a load balancer.

In LANconfig, you can find the new parameter under **IP Router** > **Routing** > **Load balancing**.



Minimum MTU

This value can be used to specify the use of a common minimum MTU for all channels of a load balancer. When using Dynamic Path Selection (DPS), it is recommended to set this parameter to "Yes".

If the MTU of the load balancer is explicitly overridden by an entry under **Communication** > **Protocols** > **MTU list**, then all channels use exactly the MTU specified there—regardless of how the "minimum-MTU" switch is set and regardless of what may have been negotiated on the channels.

Under **Status** > **WAN** > **MTU**, the MTU of the load balancer is only displayed if it has been explicitly configured.

4.5.1 Additions to the Setup menu

4.5.1.1 Minimum-MTU

This value can be used to specify the use of a common minimum MTU for all channels of a load balancer.

If the MTU of the load balancer is explicitly overridden by an entry under *2.2.26 MTU-List*, then all channels use exactly the MTU specified there – regardless of the position of the "minimum-MTU" switch and also regardless of what may have been negotiated on the channels.

Under **Status** > **WAN** > **MTU**, the MTU of the load balancer is only displayed if it has been explicitly configured.

SNMP ID:

2.8.20.2.14

Console path:

Setup > **IP-Router** > **Load-Balancer** > **Bundle-Peers**

Possible values:

No

All channels have individual MTUs.

Yes

The MTUs of all channels are set to the minimum MTU of all channels. When using Dynamic Path Selection (DPS), it is recommended to set the parameter to "Yes".

Default:

No

5 Virtual Private Networks – VPN

5.1 WireGuard

WireGuard is a simple and lightweight VPN protocol. Unlike IKEv2/IPSec, WireGuard focuses on simplicity, speed, and ease of use. It is also a protocol with a very compact code base and functionality, making it ideal for use on IoT and embedded devices.

IKEv2 is an IETF-standardized protocol offering many extensions and high flexibility, but also significant complexity. While IKEv2, for example, supports crypto agility—meaning encryption algorithms can be exchanged or negotiated between endpoints—WireGuard uses a fixed key exchange (Curve25519) and a fixed encryption protocol (ChaCha20/Poly1305). In WireGuard, authentication is only possible via public/private keys, whereas IKEv2 allows flexible authentication methods such as PSK, certificates, or EAP. IKEv2 also supports many extensions, such as RADIUS or two-factor authentication, which are not available in WireGuard. Furthermore, WireGuard only supports transmission over UDP but includes built-in roaming functionality similar to MOBIKE in IKEv2.

IKEv2/IPSec continues to be the recommended standard protocol for branch connectivity and SD-WAN due to its wide range of configuration and deployment scenarios in LCOS. WireGuard on LANCOM router platforms does not provide hardware acceleration for ChaChaPoly1305, meaning encryption is handled in software. For scenarios requiring high VPN throughput, IKEv2/IPSec remains the preferred option.

Within LCOS, IKEv2/IPSec is based on many years of practical use in VPN site connectivity and numerous protocol and feature extensions for medium, large, and complex VPN or SD-WAN scenarios. WireGuard in LCOS is therefore an ideal addition for simpler use cases where only basic encrypted connections are needed. Another scenario for WireGuard use is when the VPN protocol is specified by a service provider or VPN vendor.

Conceptually, WireGuard is a “silent” protocol—no control or negotiation packets are exchanged until user data needs to be transmitted. In contrast, IKE tunnels can be configured to initiate immediately. WireGuard supports both IPv4 and IPv6, as transport protocols and for data transmission within the tunnel.

For IPv6, the inbound UDP ports used for the tunnel must be configured manually in the IPv6 firewall inbound table, since the ports in WireGuard are freely configurable.

WireGuard tunnels in LCOS can be defined as either “Unnumbered”—i.e., without a configured IP address—or with assigned IP addresses under **Communication** > **Protocols** > **IP parameters**.

In LCOS, WireGuard is classified as an interface type “VPN”. This classification is relevant, for example, in connection with the access list for management protocols to the device itself under **Management** > **Admin** > **Access settings**.

If WireGuard is used to connect to a VPN provider that, for example, routes public IP addresses or subnets to the router via WireGuard, the classification as a secure interface type “VPN” applies.

In this case, the ports of management protocols or the Voice Call Manager (VCM) that allow access “only via VPN” will be open and reachable via the public IP address of the WireGuard tunnel. If this is not desired, additional rules must be configured for access stations (for management protocols) or the setting must be changed to “from WAN denied”.

This behavior also applies when an IPSec / IKE / IKEv2 interface has a public IP address.

The features “Additional remote or alternative gateways” and “Gateway groups” are not supported with WireGuard.

If dynamic routing protocols such as BGP are to be used over WireGuard tunnels, the configuration parameter **Connect automatically** must be set to “Yes”, because for technical reasons BGP cannot initiate the establishment of the WireGuard tunnel.

5.1.1 Licensing

In LCOS, WireGuard counts as a VPN tunnel and is included in the device's VPN license count, sharing the same license pool with other VPN tunnels such as IKE/IPSec or PPTP-MPPE. A WireGuard license is consumed as soon as data is transmitted through the WireGuard tunnel. Any number of WireGuard tunnels can be configured.

Additional WireGuard licenses can be added through the VPN option upgrade.

Example:

If a device is licensed for 5 VPN tunnels and 3 IPSec tunnels are already active, two additional WireGuard tunnels can still be used.

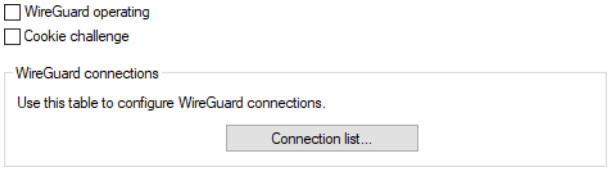
5.1.2 Configuration

A WireGuard configuration in LCOS consists of at least two configuration elements, as well as additional optional elements:

1. An entry in the WireGuard tunnel configuration table.
2. An entry in the IPv4 and/or IPv6 routing table. This entry corresponds to the concept of "Allowed IP Addresses" in WireGuard on other platforms.
3. (Optional) Configure local IP addresses for the WireGuard peer via the IP Parameters table in LANconfig under **Communication** > **Protocols** > **IP Parameters**.
4. (Optional) Firewall configuration for granular control of network access rights.

5.1.3 Configuration with LANconfig

WireGuard is configured in LANconfig under **VPN** > **WireGuard**.



WireGuard operating

Enables or disables the WireGuard function on the device.

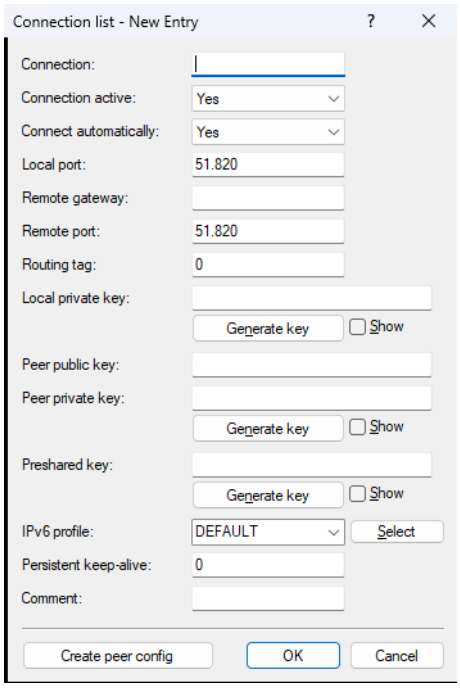
Cookie challenge

The cookie challenge is a protection mechanism against CPU exhaustion attacks during the handshake process. The computation of the Diffie-Hellman (DH) function during the WireGuard handshake is inherently CPU-intensive. An attacker could attempt to overload the router by sending a large number of handshake requests to crash it or severely impact its performance (CPU exhaustion attack). This mechanism forces the attacker to perform an additional network round trip and respond to the cookie for each handshake attempt. This significantly increases the cost of the attack, making it much less effective, while allowing the server to limit the number of DH computations it must perform, thus protecting its resources.

When the cookie challenge is enabled, the device always sends a cookie-reply message during the handshake.

Connection list

This section defines the WireGuard connections.



Connection

Name of the WireGuard connection or WireGuard peer.

Connection active

Enables or disables this connection.

Connect automatically

Defines whether the WireGuard tunnel should be established automatically—e.g., after the device starts or after the WAN connection has been established—or only when actual user data is being transmitted. This switch must be configured together with the "Persistent-Keepalive" option so that the WireGuard peer behaves like other peers that are intended to remain permanently active.

If set to "Yes", the WireGuard connection is established permanently, regardless of whether user data is transmitted. If set to "No", the connection is established only when user data is present.

Local port

Defines the local (UDP) port on which this connection should be accepted by the device. The configured local private key must be identical for all connections using the same port. Multiple configured connections using the same local port but different private keys are not supported and will prevent connections from being established or the internal configuration from being created. If the value "0" is entered for the local port, a dynamic port is created.

For a WireGuard tunnel using IPv6 as a transport protocol, the incoming UDP ports for the tunnel must be manually configured or allowed in the IPv6 firewall's inbound table.

Remote gateway

IPv4, IPv6, or DNS address of the remote gateway or client. If the IP address of the remote side is unknown or dynamic, the field can be left blank. In this case, the connection must be initiated from the remote side.

Allowed values: IPv4 address, IPv6 address, 0.0.0.0, ::, or empty. The values 0.0.0.0 and :: for IPv6 have the same effect as an empty entry.

Remote port

Port number on the remote gateway side. If the remote port for incoming connections is dynamic or unknown, it can be left empty or set to 0. If an explicit port is configured, it must exactly match during connection setup; otherwise, the connection will be rejected or discarded.

Allowed values: Port, 0, or empty entry.

Routing tag

Defines the routing tag through which the WireGuard connection is established.

Local private key

Local private key for the WireGuard connection in Base64 format. Hex-formatted keys are not supported. The device automatically derives its public key from the local private key.

The configured local private key must be identical for all connections using the same local port. Multiple configured connections using the same port but different private keys are not supported and will prevent connections from being established or the internal configuration from being created.

The local private key is confidential and is generally not shared with the remote side—unless an administrator generates key pairs for managed devices. In this case, the administrator knows all device key pairs.

Peer public key

Public key of the remote gateway in Base64 format. Hex-formatted entries are not supported.

Each communication partner in the WireGuard connection must generate its own unique public/private key pair and share its public key with the remote side.

Peer private key

The peer private key is optional and only configured when LANconfig is used to generate a configuration or QR code for the remote side. It is not required for LCOS functionality and is only stored so that the configuration for the remote side can be displayed or regenerated later.

Preshared key

An optional additional key used alongside the public/private key pair for the connection. The key must be configured identically on both communication partners.

IPv6 profile

This entry defines the IPv6 WAN profile. An empty entry disables IPv6 for this interface.

IPv6 WAN profiles are configured under **IPv6** > **General** > **IPv6 interfaces** > **WAN profiles**.

Persistent Keepalive

Defines the time in seconds in which the remote device (peer) should send WireGuard keepalive packets. A value of 0 disables the sending of keepalive packets.

The "Persistent Keepalive" function in WireGuard ensures that the connection remains active even when no data is being transmitted. By regularly sending keepalive packets, the connection is kept alive across intermediate NAT gateways, for example, and this helps prevent unintentional connection drops.

Comment

Enter a comment for this entry.

5.1.3.1 Configuration Profiles for Clients

Within the WireGuard configuration page, LANconfig can generate minimal configuration profiles for remote WireGuard clients in the WireGuard configuration format, either as plain text or as a QR code. This configuration can be imported into compatible WireGuard clients via copy & paste or scanned directly from a mobile app using the QR code.

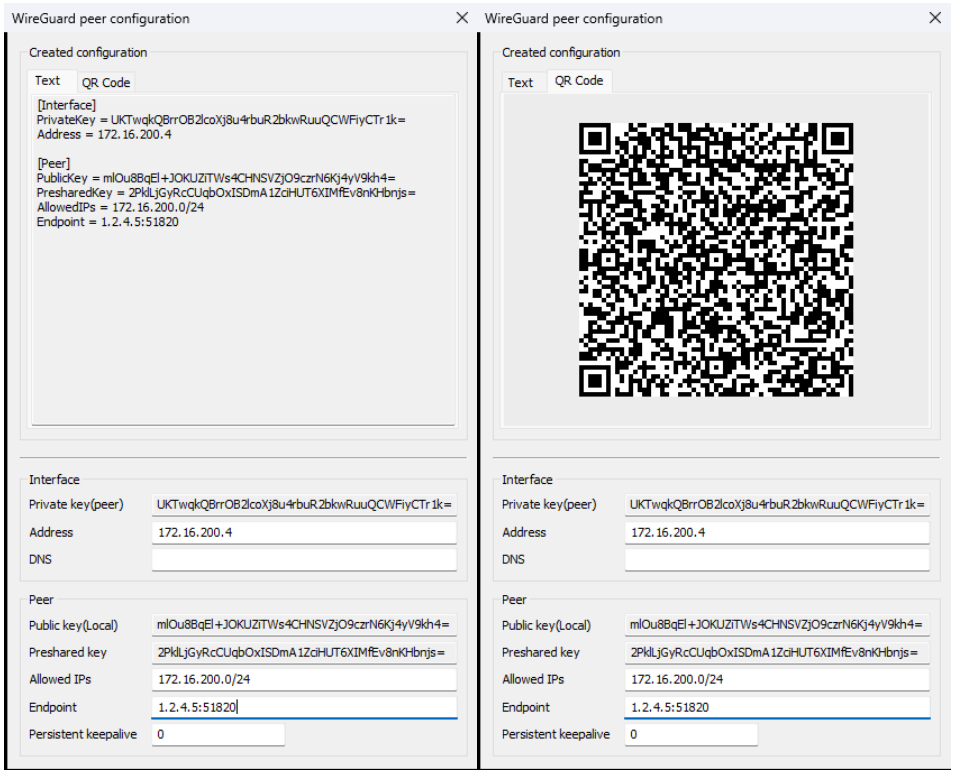
This function works similarly to a wizard, but with the advantage that the generated configuration can be recalled and displayed again at any time.

However, for this to work, the router or LANconfig must store the private key of the remote side — something that is typically undesirable when WireGuard peers belong to different administrative domains. Normally, each communication partner generates its own private/public key pair and shares only the public key with the remote side. The private key remains secret and is only known to the respective partner. This function is ideally suited for administrators who want to generate configurations for devices under their own control.

The parameters DNS and Pre-Shared Key are optional. All other parameters must be entered in order to generate a minimal configuration.

The parameters **Address**, **Allowed IPs**, and **Endpoint** are not stored by LANconfig and must be re-entered when the configuration is reopened.

To access this function in LANconfig for the respective WireGuard connection, go to **VPN** > **WireGuard** > **Connection list** > **Create peer config**.



Supported configuration parameters for the remote side:

Interface

Private key (peer)

Defines the client's private key.

Addresses

Local IP address of the WireGuard interface on the client side.

DNS

DNS server that the client should use for name resolution (optional).

Peer

From the perspective of the remote client, the LCOS device acts as the peer.

Public key (local)

Public key of the LCOS device.

Preshared key

Optional additional key used alongside the public/private key pair for the connection. The key must be configured identically on both communication partners.

Allowed IPs

IP addresses that the client should route into or allow through the WireGuard tunnel. The local networks of the router that the client should access must be specified here.

Endpoint

Public IP address including port in the format <IP address>:<Port> of the LCOS device to which the client should establish the connection.

Persistent Keepalive

Defines the time in seconds in which the remote device (peer) should send WireGuard keepalive packets. A value of 0 disables the sending of keepalive packets.

The "Persistent Keepalive" function in WireGuard ensures that the connection remains active even when no data is being transmitted. By regularly sending keepalive packets, the connection is kept alive across intermediate NAT gateways, for example, and this helps prevent unintentional connection drops.

QR Code

Using the displayed QR code, you can import the configuration into a WireGuard app. Open the WireGuard app and add a new peer via QR code. Additional parameters can then be modified or added if necessary.

5.1.4 Trace Commands

This parameter ...	... triggers the following display during tracing:
`WireGuard`	Enables the basic WireGuard traces of negotiation packets as well as status and debug information.
`WG-Packet`	Displays the WireGuard payload packets.

5.1.5 Show commands

- `wg-connection` – Displays information about WireGuard connections
- `wg-detail` – Displays detailed information about WireGuard connections
- `wg-peer` – Displays information about configured WireGuard peers

5.1.6 Additions to the Setup menu

5.1.6.1 WireGuard

WireGuard is a simple and lightweight VPN protocol. Unlike IKEv2/IPSec, WireGuard focuses on simplicity, speed, and ease of use. It is also a protocol with a very compact code base and functionality, making it ideal for use on IoT and embedded devices.

A WireGuard configuration in LCOS consists of at least two configuration elements, as well as additional optional elements:

1. An entry in the WireGuard tunnel configuration table.
2. An entry in the IPv4 and/or IPv6 routing table. This entry corresponds to the concept of "Allowed IP Addresses" in WireGuard on other platforms.
3. (Optional) Configure local IP addresses for the WireGuard peer via the IP Parameters table in LANconfig under **Communication** > **Protocols** > **IP Parameters**.
4. (Optional) Firewall configuration for granular control of network access rights.

SNMP ID:

2.19.70

Console path:

Setup > **VPN**

5.1.6.1.1 Operating

Enables or disables the WireGuard function on the device.

SNMP ID:

2.19.70.1

Console path:

Setup > **VPN** > **WireGuard**

Possible values:

No
Yes

Default:

No

5.1.6.1.2 Cookie-Challenge

The cookie challenge is a protection mechanism against CPU exhaustion attacks during the handshake process. The computation of the Diffie-Hellman (DH) function during the WireGuard handshake is inherently CPU-intensive. An attacker could attempt to overload the router by sending a large number of handshake requests to crash it or severely impact its performance (CPU exhaustion attack). This mechanism forces the attacker to perform an additional network round trip and respond to the cookie for each handshake attempt. This significantly increases the cost of the attack, making it much

less effective, while allowing the server to limit the number of DH computations it must perform, thus protecting its resources.

When the cookie challenge is enabled, the device always sends a cookie-reply message during the handshake.

SNMP ID:

2.19.70.2

Console path:

Setup > **VPN** > **WireGuard**

Possible values:

No
Yes

Default:

No

5.1.6.1.3 Peers

This table defines the WireGuard connections.

SNMP ID:

2.19.70.3

Console path:

Setup > **VPN** > **WireGuard**

Peer

Name of the WireGuard connection or WireGuard peer.

SNMP ID:

2.19.70.3.1

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Default:

empty

Active

Enables or disables this connection.

SNMP ID:

2.19.70.3.2

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

No
Yes

Default:

Yes

Local-Port

Defines the local (UDP) port on which this connection should be accepted by the device. The configured local private key must be identical for all connections using the same port. Multiple configured connections using the same local port but different private keys are not supported and will prevent connections from being established or the internal configuration from being created. If the value "0" is entered for the local port, a dynamic port is created.

For a WireGuard tunnel using IPv6 as a transport protocol, the incoming UDP ports for the tunnel must be manually configured or allowed in the IPv6 firewall's inbound table.

SNMP ID:

2.19.70.3.3

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 5 characters from `[0-9]`

Default:

51820

Special values:

0

A dynamic port is created.

Remote-Gateway

IPv4, IPv6, or DNS address of the remote gateway or client. If the IP address of the remote side is unknown or dynamic, the field can be left blank. In this case, the connection must be initiated from the remote side.

Allowed values: IPv4 address, IPv6 address, 0.0.0.0, ::, or empty. The values 0.0.0.0 and :: for IPv6 have the same effect as an empty entry.

SNMP ID:

2.19.70.3.4

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 64 characters from `[A-Z][a-z][0-9].-:%?`

Default:

empty

Remote-Port

Port number on the remote gateway side. If the remote port for incoming connections is dynamic or unknown, it can be left empty or set to 0. If an explicit port is configured, it must exactly match during connection setup; otherwise, the connection will be rejected or discarded.

Allowed values: Port, 0, or empty entry.

SNMP ID:

2.19.70.3.5

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 5 characters from `[0-9]`

Default:

51820

Rtg-Tag

Defines the routing tag through which the WireGuard connection is established.

SNMP ID:

2.19.70.3.6

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

0 … 65535

Default:

0

Local-Private-Key

Local private key for the WireGuard connection in Base64 format. Hex-formatted keys are not supported. The device automatically derives its public key from the local private key.

The configured local private key must be identical for all connections using the same local port. Multiple configured connections using the same port but different private keys are not supported and will prevent connections from being established or the internal configuration from being created.

The local private key is confidential and is generally not shared with the remote side—unless an administrator generates key pairs for managed devices. In this case, the administrator knows all device key pairs.

SNMP ID:

2.19.70.3.7

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 44 characters from `[A-Z][a-z][0-9]+/=`

Default:

empty

Peer-Private-Key

The peer private key is optional and only configured when LANconfig is used to generate a configuration or QR code for the remote side. It is not required for LCOS functionality and is only stored so that the configuration for the remote side can be displayed or regenerated later.

SNMP ID:

2.19.70.3.9

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 44 characters from `[A-Z][a-z][0-9]+/=`

Default:

empty

Peer-Public-Key

Public key of the remote gateway in Base64 format. Hex-formatted entries are not supported.

Each communication partner in the WireGuard connection must generate its own unique public/private key pair and share its public key with the remote side.

SNMP ID:

2.19.70.3.10

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 44 characters from `[A-Z][a-z][0-9]+/=`

Default:

empty

Shared-Key

An optional additional key used alongside the public/private key pair for the connection. The key must be configured identically on both communication partners.

SNMP ID:

2.19.70.3.11

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 44 characters from `[A-Z][a-z][0-9]+/=`

Default:

empty

IPv6

This entry defines the IPv6 WAN profile. An empty entry disables IPv6 for this interface.

SNMP ID:

2.19.70.3.13

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Default:

empty

Comment

Enter a comment for this entry.

SNMP ID:

2.19.70.3.14

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 64 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_.`

Default:

empty

Persistent-Keepalive

Defines the time in seconds in which the remote device (peer) should send WireGuard keepalive packets. A value of 0 disables the sending of keepalive packets.

The "Persistent Keepalive" function in WireGuard ensures that the connection remains active even when no data is being transmitted. By regularly sending keepalive packets, the connection is kept alive across intermediate NAT gateways, for example, and this helps prevent unintentional connection drops.

SNMP ID:

2.19.70.3.15

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

Max. 3 characters from `[0-9]`

Default:

0

Always-On

Defines whether the WireGuard tunnel should be established automatically—e.g., after the device starts or after the WAN connection has been established—or only when actual user data is being transmitted. This switch must be configured together with the "Persistent-Keepalive" option so that the WireGuard peer behaves like other peers that are intended to remain permanently active.

SNMP ID:

2.19.70.3.16

Console path:

Setup > **VPN** > **WireGuard** > **Peers**

Possible values:

no

The WireGuard connection is established only when user data traffic is present.

yes

The WireGuard connection is established permanently—regardless of whether user data is being transmitted.

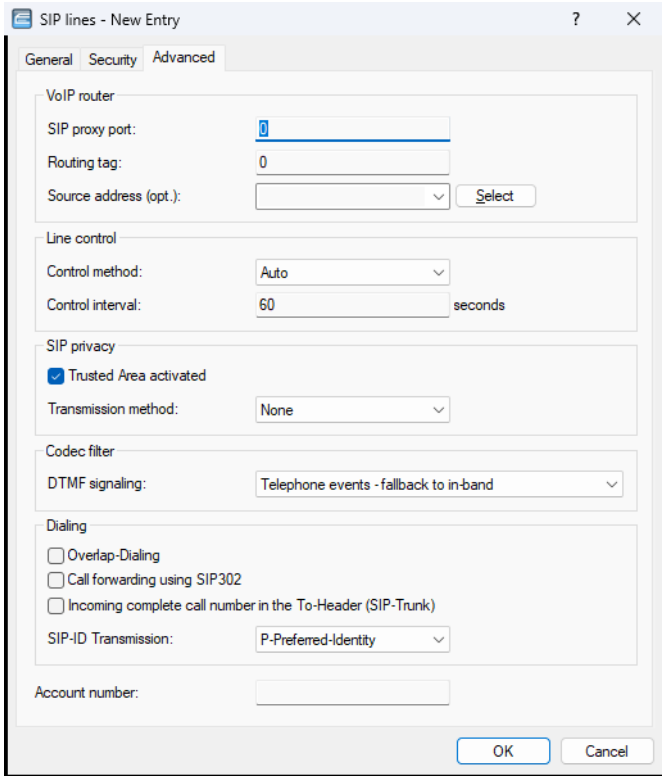
Default:

yes

6 Voice over IP – VoIP

6.1 Configuration of Lines: SIP Lines

As of LCOS 10.94, it is possible to enter a phone number in the **Account-Number** field of the SIP Lines table (**Voice-Call-Manager** > **Lines** > **SIP Lines** > **Advanced**) that belongs to this SIP connection.



Account number

Enter here a phone number that belongs to this SIP connection.

For SIP lines of the type “Flex”, this source number is transmitted in the PPI for account verification.

If the FROM number is modified by call routing or if the SIP phone sends a number that does not match the connection, this will not cause the call to be rejected by the provider.

This allows CLIP no screening calls to be made directly via the VCM, provided the feature is supported by the SIP provider.

6.1.1 Additions to the Setup menu

6.1.1.1 Account-Number

Enter here a phone number that belongs to this SIP connection.

For SIP lines of the type “Flex”, this source number is transmitted in the PPI for account verification.

If the FROM number is modified by call routing or if the SIP phone sends a number that does not match the connection, this will not cause the call to be rejected by the provider.

This allows CLIP no screening calls to be made directly via the VCM, provided the feature is supported by the SIP provider.

SNMP ID:

2.33.4.1.1.43

Console path:

Setup > **Voice-Call-Manager** > **Line** > **SIP-Provider** > **Line**

Possible values:

Max. 32 characters from `[A-Z][a-z][0-9]#@\{|}~!$%&'()*+-,/:;<=>?[\]^_. ``

Default:

empty

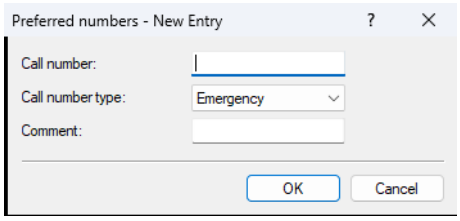
6.2 Preferred Numbers

As of LCOS 10.94, emergency phone numbers can be stored.

Enter emergency phone numbers in this table. If a call to an emergency number cannot be established due to an error message from the SIP provider, an existing call that is using this line (line type Trunk/Flex) or the associated line group (line type Single Account/Provider) will be terminated. This ensures that a voice channel is available for the emergency call.

A line group is defined in the "Dynamic SIP Lines" table. SIP lines with the same "Dynamic-Line-Name" belong to the same group. Typically, these are multiple individual numbers that together provide a certain number of voice channels.

You configure the entries in the table for preferred numbers in LANconfig under **Voice Call Manager** > **Call Router** by clicking the **Preferred numbers** button.



Call number

Enter your call number here.

Call number type

Enter the call number type here.

Emergency

This is an emergency call number.

Private

These call numbers suppress the overlap dialing wait time for this destination.

Comment

Enter a comment for the selected call number here.

6.2.1 Additions to the Setup menu

6.2.1.1 Preferred-Numbers

Enter emergency phone numbers in this table. If a call to an emergency number cannot be established due to an error message from the SIP provider, an existing call that is using this line (line type Trunk/Flex) or the associated line group (line type Single Account/Provider) will be terminated. This ensures that a voice channel is available for the emergency call.

A line group is defined in the "Dynamic SIP Lines" table. SIP lines with the same "Dynamic-Line-Name" belong to the same group. Typically, these are multiple individual numbers that together provide a certain number of voice channels.

SNMP ID:

2.33.12.1

Console path:

Setup > **Voice-Call-Manager** > **Call-Handling**

6.2.1.1.1 Called-Number

Enter your phone number here.

SNMP ID:

2.33.12.1.1

Console path:

Setup > **Voice-Call-Manager** > **Call-Handling** > **Preferred-Numbers**

Possible values:

Max. 19 characters from `[A-Z][0-9]#@{|}~!$%&'()+-,/:;<=>?[]^_.`

Default:

empty

6.2.1.1.2 Type

Enter the phone number type here.

SNMP ID:

2.33.12.1.2

Console path:

Setup > **Voice-Call-Manager** > **Call-Handling** > **Preferred-Numbers**

Possible values:

Emergency
This is an emergency number.

Private
This number disables the overlap dialing wait time for this destination.

6.2.1.1.3 Comment

Enter a comment for the selected phone number here.

SNMP ID:

2.33.12.1.4

Console path:

Setup > **Voice-Call-Manager** > **Call-Handling** > **Preferred-Numbers**

Possible values:

Max. 63 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[]^_. ``

Default:

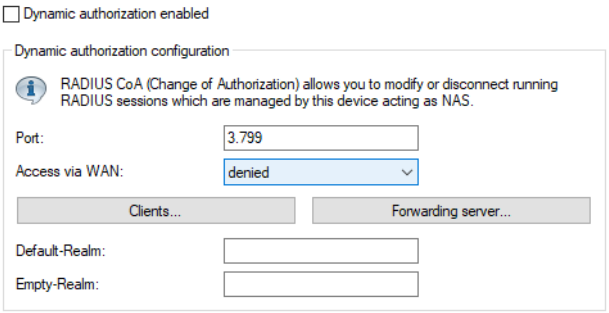
empty

7 RADIUS

7.1 RADIUS CoA for 802.1X Authenticator Ethernet Ports

The 802.1X Authenticator for Ethernet ports supports RADIUS Change of Authorization (CoA) and Disconnect Messages (DM) for 802.1X, as well as for authentication based on MAC addresses.

The shared configuration for Dynamic Authorization is used. In LANconfig under **RADIUS** > **Dyn. Authorization** and on the CLI under **Setup** > **RADIUS** > **Dyn-Auth.**. This configuration is also used by Public Spot or IKEv2.



The following CoA functions are supported:

- Disconnecting the session of a current user (Disconnect Message)
- Changing the current user session by modifying the VLAN via a CoA message

Examples:

1. The currently active sessions can be displayed via the status menu:

```
root@test-8021x-dm:/
> ls /Status/LAN/IEEE802.1x/Authenticator-Ifc-Status/

Ifc   Operating Mode        State         MAC-Auth.-Bypass MAC-Address  VLAN-ID Auth-Count Conflicting-MAC
===============-------------------------------------------------------------------------------------------
ETH-2 Yes       Single-Host authenticated No               e89c255b7b86 0       1          000000000000


Conflict-Age
-----------------
0
```

2. The status for CoA can be displayed with the show command “show ethernet-dynauth”:

```
> show ethernet-dynauth
MAC address e8:9c:25:5b:7b:86 on ETH-2: NAS-Identifier 'test-8021x-dm', User-Name 'test'
```

3. A user session can be disconnected using the CLI command “Radclient” under **Setup** > **RADIUS** > **Dyn-Auth.** in the LCOS, for example:

```
do Radclient 192.168.1.112 disconnect 12345678 "NAS-Identifier=test-8021x-dm;User-Name=test;"
```

   Where:

   - “192.168.1.112” is the IP address of the NAS, i.e., the router
   - “disconnect” is the disconnect message to be sent
   - “12345678” is the configured Dyn-Auth/CoA password
   - “NAS-Identifier” is the name of the router or the unique identifier of the NAS
   - “User-Name” is the 802.1X username used by the client during authentication

All of these parameters are required.

4. The VLAN of an active session for a MAC-authenticated user can be changed as follows:

```
do Radclient 192.168.1.112 coa 12345678 "NAS-Identifier=test-8021x-dm;User-Name=e89c255b7b86;
   Tunnel-Type:0=VLAN;Tunnel-Medium-Type:0=IEEE-802;Tunnel-Private-Group-Id:0=200;
```

Where:

- "192.168.1.112" is the IP address of the NAS, i.e., the router
- "coa" is the CoA message to be sent
- "12345678" is the configured Dyn-Auth/CoA password
- "NAS-Identifier" is the name of the router or the unique identifier of the NAS
- "Tunnel-Type:0=VLAN;Tunnel-Medium-Type:0=IEEE-802;Tunnel-Private-Group-Id:0=200" are the required RADIUS attributes to move the client into VLAN 200

All of these parameters are required.

For analyzing CoA functionality, the traces "DYN-AUTH-Client" and "DYN-AUTH-Server" are available.

7.2 Support for Rate-Limit RADIUS Attributes in the PPPoE Server

As of LCOS 10.94, the PPPoE server supports the vendor-specific RADIUS attributes LCS-TxRateLimit and LCS-RxRateLimit with the vendor ID 2356 (LANCOM Systems GmbH) in the RADIUS Access-Accept. This allows upload and download bandwidths of a PPPoE client to be limited at Layer 2. This function is only supported when the PPPoE client is connected via LAN interfaces. It is not supported when the PPPoE client is connected through Layer-2 tunnel interfaces such as Ethernet-over-GRE (EoGRE) or L2TPv3.

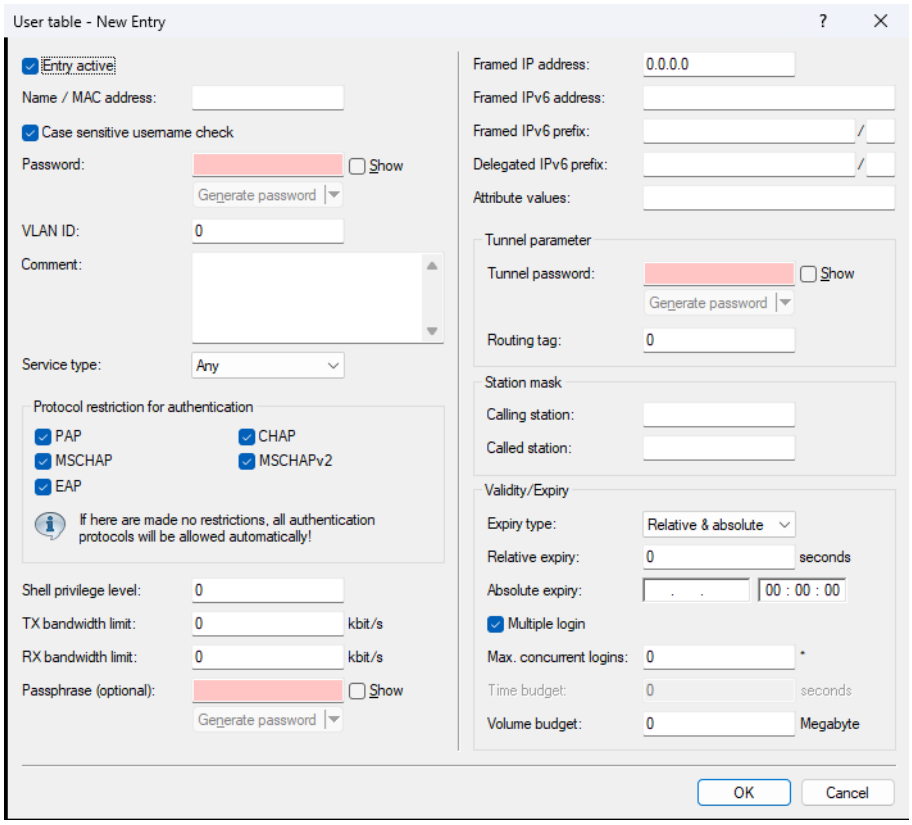
Table 1: Vendor-specific RADIUS Attributes in the Access-Request

ID:	Name	Meaning	Possible values in LCOS
8	LCS-TxRateLimit, Vendor 2356	Defines a maximum downstream rate in kbps on Layer 2 from the perspective of the PPPoE server (NAS) toward the PPPoE client.	
9	LCS-RxRateLimit, Vendor 2356	Defines a maximum upstream rate in kbps on Layer 2 from the perspective of the PPPoE server (NAS) coming from the PPPoE client.	

7.3 Additional parameters in the user table

As of LCOS 10.94 some parameters were added to the user table. This allows these attributes values to be entered more easily.

In LANconfig, you can find the new parameters under **RADIUS** > **Server** > **User database** > **User table**.



Framed IP Address

Defines the Framed IP Address attribute (according to *RFC 2865*, attribute type 8) for this RADIUS user.

Framed IPv6 Address

Defines the Framed IPv6 Address attribute (according to *RFC 6911*, attribute type 168) for this RADIUS user.

Framed IPv6 Prefix

Defines the Framed IPv6 Prefix attribute (according to *RFC 3162*, attribute type 97) for this RADIUS user.

Delegated IPv6 Prefix

Defines the Delegated IPv6 Prefix attribute (according to *RFC 4818*, attribute type 123) for this RADIUS user.

7.3.1 Additions to the Setup menu

7.3.1.1 Framed-IP-Address

Defines the Framed IP Address attribute (according to *RFC 2865*, attribute type 8) for this RADIUS user.

SNMP ID:

2.25.10.7.26

Console path:

Setup > **RADIUS** > **Server** > **Users**

Possible values:

Max. 15 characters from `[0-9].`

7.3.1.2 Framed-IPv6-Address

Defines the Framed IPv6 Address attribute (according to *RFC 6911*, attribute type 168) for this RADIUS user.

SNMP ID:

2.25.10.7.27

Console path:

Setup > **RADIUS** > **Server** > **Users**

Possible values:

Max. 39 characters from `[0-9][A-F][a-f]:.`

7.3.1.3 Framed-IPv6-Prefix

Defines the Framed IPv6 Prefix attribute (according to *RFC 3162*, attribute type 97) for this RADIUS user.

SNMP ID:

2.25.10.7.28

Console path:

Setup > **RADIUS** > **Server** > **Users**

Possible values:

Max. 43 characters from `[0-9][A-F][a-f]:./`

7.3.1.4 Delegated-IPv6-Prefix

Defines the Delegated IPv6 Prefix attribute (according to *RFC 4818*, attribute type 123) for this RADIUS user.

SNMP ID:

2.25.10.7.29

Console path:

Setup > **RADIUS** > **Server** > **Users**

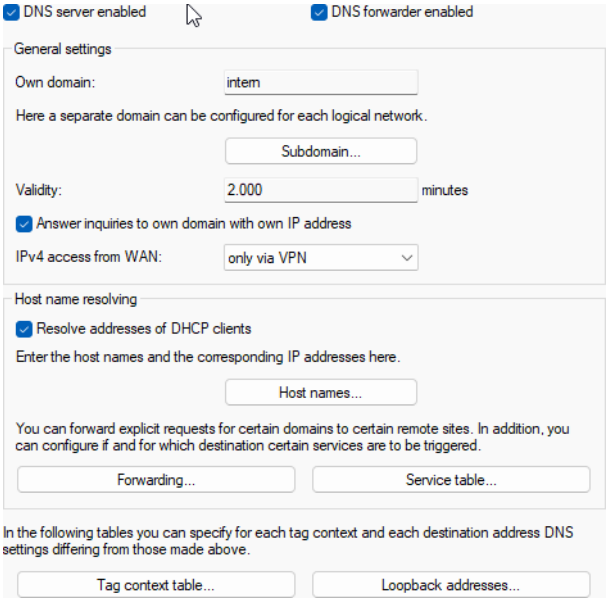
Possible values:

Max. 43 characters from `[0-9][A-F][a-f]:./`

8 Other services

8.1 IPv4 WAN Access in DNS

As of LCOS 10.94, you can configure IPv4 WAN access in DNS under **DNS** > **General**.



IPv4 access from WAN

Defines whether access from WAN interfaces to the DNS server or DNS forwarder via IPv4 is generally allowed. Access to these services via IPv6 is controlled exclusively through the IPv6 inbound firewall.

Access can be controlled globally for the corresponding interface types using this switch. For more granular control than this level, corresponding IPv4 firewall rules can be configured.

Access to the DNS service must be allowed via VPN if VPN clients are to use the router as a DNS server or DNS forwarder, for example, to resolve locally configured station names.

Access to the DNS service via WAN must be allowed if clients are to connect to the router using PPPoE, L2TP, or PPTP. In this case, it is recommended to configure granular control for the local DNS service via firewall rules.

VPN interfaces include IPSec VPN (IKEv1/IKEv2) and WireGuard. WAN interfaces include all WAN counterparts such as Internet connections and RAS dial-ins to the LANCOM router acting as a PPPoE, PPTP, or L2TP server.

8.1.1 Additions to the Setup menu

8.1.1.1 IPv4-WAN-Access

Defines whether access from WAN interfaces to the DNS server or DNS forwarder via IPv4 is generally allowed. Access to these services via IPv6 is controlled exclusively through the IPv6 inbound firewall.

Access can be controlled globally for the corresponding interface types using this switch. For more granular control than this level, corresponding IPv4 firewall rules can be configured.

Access to the DNS service must be allowed via VPN if VPN clients are to use the router as a DNS server or DNS forwarder, for example, to resolve locally configured station names.

Access to the DNS service via WAN must be allowed if clients are to connect to the router using PPPoE, L2TP, or PPTP. In this case, it is recommended to configure granular control for the local DNS service via firewall rules.

VPN interfaces include IPSec VPN (IKEv1/IKEv2) and WireGuard. WAN interfaces include all WAN counterparts such as Internet connections and RAS dial-ins to the LANCOM router acting as a PPPoE, PPTP, or L2TP server.

SNMP ID:

2.17.18

Console path:

Setup > **DNS**

Possible values:

No

Access to the DNS server and DNS forwarder via IPv4 from WAN and VPN interfaces is not allowed.

Yes

Access to the DNS server and DNS forwarder via IPv4 is generally allowed from all interfaces such as LAN, WAN, and VPN.

VPN

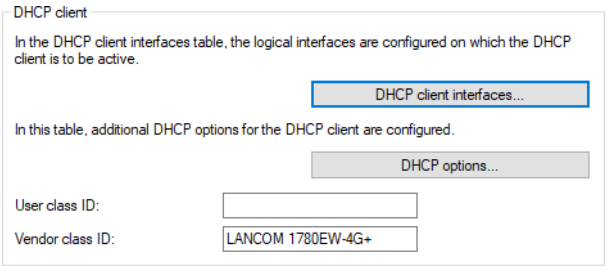
Access to the DNS server and DNS forwarder via IPv4 is allowed from LAN interfaces and via VPN (IPSec VPN and WireGuard). Access from WAN interfaces, such as Internet connections or RAS dial-ins to the LANCOM router acting as a PPPoE, PPTP, or L2TP server, is not allowed.

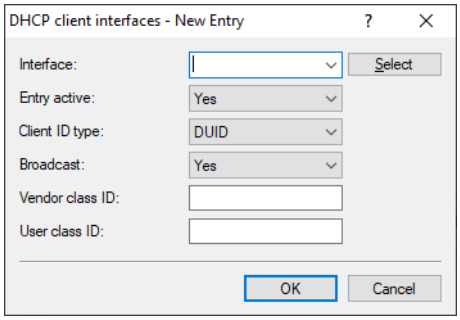
Default:

VPN

8.2 New DHCPv4 Client Configuration

As of LCOS 10.94, you can configure client interfaces of the DHCP client for IPv4 under **IPv4** > **DHCPv4** > **DHCP client** > **DHCP client interfaces**.





Interface

Name of the interface on which the client is active (LAN, physical WAN, or WWAN interface). Depending on the device, default entries for Zero Config exist after a system reset: "INTERNET-DHCPDEF", "INTERNET-DEFAULT", or "WWAN-DEFAULT".

Entry active

Switch to specify whether this entry is active.

Client ID type

Switch that specifies the type of client ID.

Broadcast

Switch that specifies the type of client ID.

Vendor class ID

String containing the vendor class identifier to be reported on this interface. If this value is empty, the (global) value under **IPv4** > **DHCPv4** > **DHCP client** > **Vendor class ID** will be used.

User class ID

String containing the user class identifier to be reported on this interface. If this value is empty, the (global) value under **IPv4** > **DHCPv4** > **DHCP client** > **User class ID** will be used.

Other changes

- Under **setup** > **dhcp** > **client** (SNMP ID 2.10.40), the menu items **LAN-Client-ID-Type** (SNMP ID 31) and **WAN-Client-ID-Type** (SNMP ID 32) have been removed, as the values can now be set per client.
- Under **setup** > **dhcp** > **network-list** (SNMP ID 2.10.20), the option "Client" was removed from the **Operating** switch.
- Under **setup** > **wan** > **layer** (SNMP ID 2.2.4), the values "DHCP" and "B-DHCP" were removed from the **Layer-3** column (SNMP ID 3).
- A configuration converter performs the following actions:
  - For all WAN connections using a layer with DHCP or B-DHCP, an entry is created in the **setup** > **dhcp** > **client** > **interfaces** table. This applies to DSL, xDSL, and WWAN connections.
  - For all LAN interfaces where the operating switch is set to "Client", an entry is created in the **setup** > **dhcp** > **client** > **interfaces** table. In addition, the corresponding entry is removed from **setup** > **dhcp** > **network-list**.

8.2.1 Additions to the Setup menu

8.2.1.1 Interfaces

Use this table to configure the IPv4 DHCP client interfaces.

SNMP ID:

2.10.40.1

Console path:

Setup > **DHCP** > **Client**

8.2.1.1.1 Interface

Name of the interface on which the client is active (LAN, physical WAN, or WWAN interface). Depending on the device, default entries for Zero Config exist after a system reset: "INTERNET-DHCPDEF", "INTERNET-DEFAULT", or "WWAN-DEFAULT".

SNMP ID:

2.10.40.1.1

Console path:

Setup > **DHCP** > **Client** > **Interfaces**

Possible values:

Max. 16 characters from `[A-Z][0-9]@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Default:

empty

8.2.1.1.2 Operating

Switch to specify whether this entry is active.

SNMP ID:

2.10.40.1.2

Console path:

Setup > **DHCP** > **Client** > **Interfaces**

Possible values:

No
Yes

Default:

Yes

8.2.1.1.3 Client-ID-Type

Switch that specifies the type of client ID.

SNMP ID:

2.10.40.1.3

Console path:

Setup > **DHCP** > **Client** > **Interfaces**

Possible values:

MAC
DUID

Default:

DUID

8.2.1.1.4 Broadcast

Switch that specifies whether the client sets the “Broadcast” flag. On a LAN interface, this value is always set to “Yes”.

SNMP ID:

2.10.40.1.4

Console path:

Setup > **DHCP** > **Client** > **Interfaces**

Possible values:

No
Yes

Default:

Yes

8.2.1.1.5 Vendor-Class-Identifer

String containing the vendor class identifier to be reported on this interface. If this value is empty, the (global) value under *2.10.40.3 Vendor class identifier* is used.

SNMP ID:

2.10.40.1.5

Console path:

Setup > **DHCP** > **Client** > **Interfaces**

Possible values:

Max. 64 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_.`

Default:

empty

8.2.1.1.6 User-Class-Identifer

String containing the user class identifier to be reported on this interface. If this value is empty, the (global) value under *2.10.40.2 User-Class-Identifier* is used.

SNMP ID:

2.10.40.1.6

Console path:

Setup > **DHCP** > **Client** > **Interfaces**

Possible values:

Max. 64 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_.`

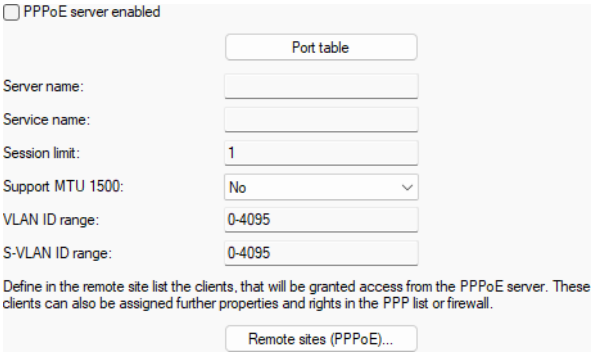
Default:

empty

8.3 Q-in-Q support for PPPoE servers

As of LCOS 10.94, the PPPoE server now supports Q-in-Q VLANs, i.e. double-tagged VLANs. For incoming PPPoE packets, the corresponding peers are automatically created in LCOS.

In LANconfig, you can find the new parameters under **Communication** > **General**.



VLAN ID range

The PPPoE server supports Q-in-Q VLANs, i.e. double-tagged VLANs. For incoming PPPoE packets, LCOS automatically creates the corresponding peers in LCOS.

A range for permitted VLANs can be specified here. A string of up to 64 characters consisting of the digits 0 to 9 and the character '-' for a range, as well as ',' for a list, can be specified.

The list is validated on input. A maximum tag of 4095 may be entered. Tag 0 means “untagged”. With the default “0-4095”, all tags are permitted.

Possible entries are individual values, ranges, as well as lists of values and ranges, e.g. “0,1,20-60,70,100-200,4095”. For ranges, the second value must always be greater than (or equal to) the first value, i.e. “123-123” is valid, whereas “123-122” is not.

If a packet is received with a tag that is not permitted, the PPP trace outputs this accordingly, e.g.

```
[PPP] 2025/03/19 18:19:16,051

Received PADI frame from peer b2:8d:ef:36:03:fd for session 0000 on LAN-1
 (VLAN-ID 8 not allowed) => Discard
```

Default: 0-4095

S-VLAN ID range

The PPPoE server supports Q-in-Q VLANs, i.e. double-tagged VLANs. For incoming PPPoE packets, LCOS automatically creates the corresponding peers in LCOS.

A range for permitted S-VLANs can be specified here. A string of up to 64 characters consisting of the digits 0 to 9 and the character '-' for a range, as well as ',' for a list, can be specified.

The list is validated on input. A maximum tag of 4095 may be entered. Tag 0 means “untagged”. With the default “0-4095”, all tags are permitted.

Possible entries are individual values, ranges, as well as lists of values and ranges, e.g. “0,1,20-60,70,100-200,4095”. For ranges, the second value must always be greater than (or equal to) the first value, i.e. “123-123” is valid, whereas “123-122” is not.

Default: 0-4095

8.3.1 Additions to the Setup menu

8.3.1.1 VLAN-ID-Range

The PPPoE server supports Q-in-Q VLANs, i.e. double-tagged VLANs. For incoming PPPoE packets, LCOS automatically creates the corresponding peers in LCOS.

A range for permitted VLANs can be specified here. A string of up to 64 characters consisting of the digits 0 to 9 and the character '-' for a range, as well as ',' for a list, can be specified.

The list is validated on input. A maximum tag of 4095 may be entered. Tag 0 means “untagged”. With the default “0-4095”, all tags are permitted.

Possible entries are individual values, ranges, as well as lists of values and ranges, e.g. “0,1,20-60,70,100-200,4095”. For ranges, the second value must always be greater than (or equal to) the first value, i.e. “123-123” is valid, whereas “123-122” is not.

The VLAN or S-VLAN type (e.g. 8100 or 88a8) can be configured under **Setup** > **VLAN**.

If a packet is received with a tag that is not permitted, the PPP trace outputs this accordingly, e.g.

```
[PPP] 2025/03/19 18:19:16,051

Received PADI frame from peer b2:8d:ef:36:03:fd for session 0000 on LAN-1
 (VLAN-ID 8 not allowed) => Discard
```

SNMP ID:

2.31.9

Console path:

Setup > **PPPoE-Server**

Possible values:

Max. 64 characters from `[0-9]-,`

Default:

0-4095

8.3.1.2 S-VLAN-ID-Range

The PPPoE server supports Q-in-Q VLANs, i.e. double-tagged VLANs. For incoming PPPoE packets, LCOS automatically creates the corresponding peers in LCOS.

A range for permitted S-VLANs can be specified here. A string of up to 64 characters consisting of the digits 0 to 9 and the character '-' for a range, as well as ',' for a list, can be specified.

The list is validated on input. A maximum tag of 4095 may be entered. Tag 0 means “untagged”. With the default “0-4095”, all tags are permitted.

Possible entries are individual values, ranges, as well as lists of values and ranges, e.g. “0,1,20-60,70,100-200,4095”. For ranges, the second value must always be greater than (or equal to) the first value, i.e. “123-123” is valid, whereas “123-122” is not.

The VLAN or S-VLAN type (e.g. 8100 or 88a8) can be configured under **Setup** > **VLAN**.

SNMP ID:

2.31.9

Console path:

Setup > **PPPoE-Server**

Possible values:

Max. 64 characters from `[0-9]-,`

Default:

0-4095

9 Enhancements in the menu system

9.1 Additions to the Setup menu

9.1.1 Parameter-Format

As of LCOS version 10.94, the new parameter lineid is supported.

Format of the parameter string contained in the PAP-ACK message for this provider. Possible placeholders are:

- {txrate} – Upstream-Rate
- {rxrate} – Downstream-Rate
- {lineid} – Line ID of the connection. This is displayed for information purposes only or to identify the line.

Example: The provider sends the string "SRU=39983#SRD=249973#" in their PAP-ACK message. The corresponding parameter string is then "SRU={txrate}#SRD={rxrate}#".

SNMP ID:

2.2.62.2

Console path:

Setup > **WAN** > **Provider-Specifics**

Possible values:

Max. 250 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()+-,/:;<=>?[\]^_.`

Default:

empty

9.1.2 Key-Exchange-Algorithms

As of LCOS version 10.94, SSH supports mlkem768x25519-sha256 algorithm.

The MAC key exchange algorithms are used to negotiate the key algorithm. Select one or more of the available algorithms.

SNMP ID:

2.11.28.3

Console path:

Setup > **Config** > **SSH**

Possible values:

diffie-hellman-group1-sha1
diffie-hellman-group14-sha1
diffie-hellman-group-exchange-sha1
diffie-hellman-group-exchange-sha256
ecdh-sha2
curve25519-sha256
curve448-sha512
sntrup761x25519-sha512
diffie-hellman-group14-sha256
diffie-hellman-group15-sha512
diffie-hellman-group16-sha512
diffie-hellman-group17-sha512
diffie-hellman-group18-sha512
sntrup4591761x25519-sha512
mlkem768x25519-sha256

Hybrid post-quantum algorithm mlkem768x25519. In this case, the post-quantum algorithm ML-KEM (Module-Lattice-Based Key-Encapsulation Mechanism) is combined with the well-known classical method Curve25519.

Default:

diffie-hellman-group-exchange-sha256

ecdh-sha2

curve25519-sha256

curve448-sha512

sntrup761x25519-sha512

diffie-hellman-group14-sha256

diffie-hellman-group15-sha512

diffie-hellman-group16-sha512

mlkem768x25519-sha256

9.1.3 Elliptic curves

As of LCOS version 10.94, the hybrid post-quantum algorithm X25519MLKEM768 is supported for TLS.

Here you specify which elliptic curves are to be used for encryption.

SNMP ID:

2.21.40.9

Console path:

Setup > **HTTP** > **SSL**

Possible values:

secp256r1

secp256r1 is used for encryption.

secp384r1

secp384r1 is used for encryption.

secp521r1

secp521r1 is used for encryption.

x25519

x25519 is used for encryption.

x448

x448 is used for encryption.

X25519MLKEM768

X25519MLKEM768 is used for encryption. The X25519MLKEM768 algorithm combines the post-quantum algorithm ML-KEM (Module-Lattice-Based Key-Encapsulation Mechanism) with the well-known classical algorithm Curve25519. Post-quantum algorithm key agreement is only supported for TLS 1.3. For TLS 1.2, this new algorithm cannot be used, as it is not defined in the standard by the IETF.

Default:

secp256r1

secp384r1

secp521r1

x25519

x448

X25519MLKEM768

9.1.4 Password

As of LCOS 10.94, the maximum input length for the BGP password has been extended to 254 characters.

The device and the BGP neighbor authenticate themselves by exchanging this password in the form of an MD5 signature in the TCP packets.

Authentication is not used if no password is set.

SNMP ID:

2.93.1.2.8

Console path:

Setup > **Routing-Protocols** > **BGP** > **Neighbors**

Possible values:

Max. 254 characters from `[A-Z][a-z][0-9]#@{|}~!$%&'()*+-,/:;<=>?[\]^_.`

Default:

empty

10 Discontinued Features

As of LCOS 10.94, the following features have been discontinued:

- AutoWDS (2.37.1.15, 2.37.1.16, 2.59.4)
- LANCOM Battery Pack (2.97)
- The value “Exclusive” was removed from **Communication** > **RADIUS** > **Authentication via RADIUS for PPP** > **RADIUS server** (LANconfig) and from **Setup** > **WAN** > **RADIUS** > **Active** (CLI). Existing configurations were changed to “Yes”, so RADIUS remains active.