EC954-FQ38 User's Munual_V2.0

Edge Computer EC954-FQ38

Series User's Manual

(Compatible with Debian 11, IEOS V2.0.0 and above versions)

Version 2.0, January 2024

www.inhandnetworks.com.cn

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1 Introduction

This user manual is applicable to the Edge Computer EC954 series based on Arm architecture, and covers a complete set of instructions applicable to all supported models. Before referring to these chapters, please confirm if the hardware specifications of your computer model support the features/settings covered.

2 Hardware installation instructions

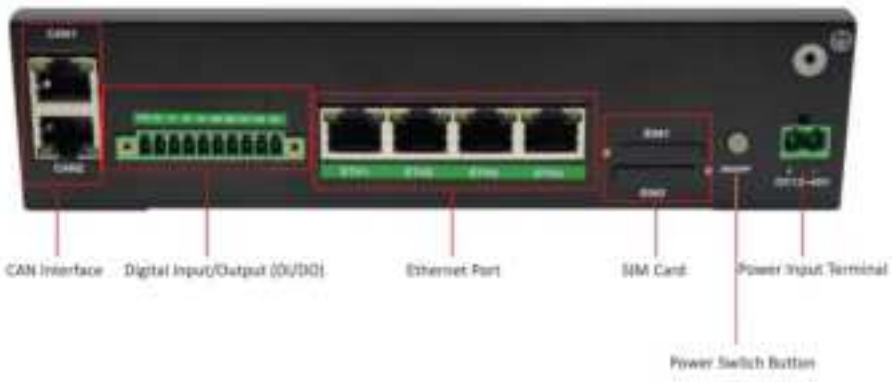
In this chapter, we will introduce the hardware installation instructions of the edge computer EC954 series based on Arm structure.

2.1 Introduction

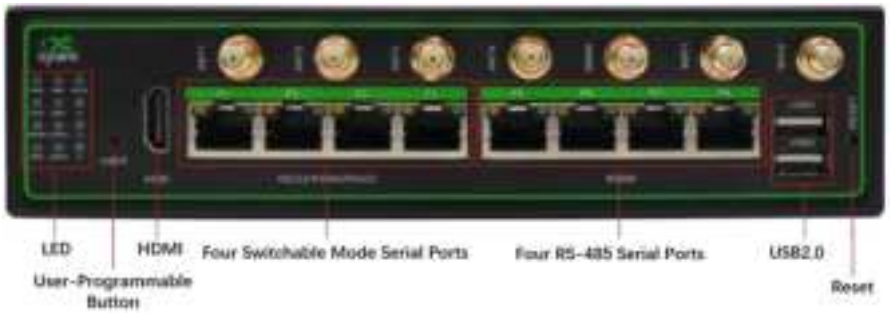
The following chapter takes the EC954 series as an example to describe the application of external connectors and pin assignments in the EC954 series.

2.2 EC954-FQ38 Panel

Top panel



Front panel



2.3 EC954-FQ38 External Connector

2.3.1 Ethernet

These are four RJ45 connectors for Ethernet connection

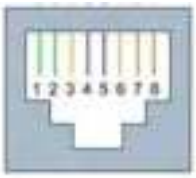
EC954-FQ38 has four RJ45 Ethernet ports and supports 10M/100M/1000M adaptive rates.

Green light: The LINK indicator light is on for a long time when the peer device has a 1000M interface, and off for a long time when the peer device has a 10/100M interface.

Yellow light: ACT light, flashing when there is data

2.3.2 Serial port

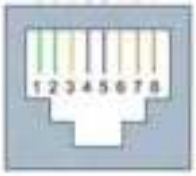
EC954-FQ38 supports 8 serial ports, with the first 4 channels supporting RS-232, RS-485, or RS-422 communication. The software is configurable, and the last 4 channels are fixed to RS-485



RJ45 pin number	RS-232	RS-422	RS-485
one	DSR	-	-
two	RTS	TxD+	-
three	GND	GND	GND
four	TxD	TxD-	-
five	RxD	RxD+	Data+
six	DCD	RxD-	Data-
seven	CTS	-	
eight	DTR	-	

2.3.3 CAN

EC954-FQ38 has a 2-way CAN bus interface and supports the CAN 2.0A/B standard. CAN2 is compatible with CAN FD and can reach a maximum speed of 5Mbps.



RJ45 pin number	RS-232	RS-422	RS-485
one	DSR	-	-
two	RTS	TxD+	-
three	GND	GND	GND
four	TxD	TxD-	-
five	RxD	RxD+	Data+
six	DCD	RxD-	Data-
seven	CTS	-	
eight	DTR	-	

2.3.4 Digital Input Interface

Interface identification	Function	Describe
COM	DI Common Port	4-way digital input DI, Dry contact status "1": Closed dry contact status "0": Open Isolation 3000VDC
DI0	Digital input interface 0	
DI1	Digital input interface No.1	
DI2	Digital input interface No.2	
DI3	Digital input interface No.3	

2.3.5 Digital Output Interface

Interface identification	function	describe

GND	DO grounding terminal	4-channel digital output DO, Isolation 3000VDC
DO0	Digital output interface 0	
DO1	Digital output interface No.1	
DO2	Digital output interface No.2	
DO3	Digital output interface No.3	

2.3.6 USB

EC954-FQ38 provides two USB 2.0 Host interfaces.

2.3.7 LED

EC954-FQ38 has 12 LED lights that respectively indicate the power supply and system operation status.

Identification	Name	Definition
PWR	Power indicator light	Always on when powered on
STAT	System operation status indicator light	When the system starts up normally, the STATUS flashes. If there is an abnormality during the system startup phase that causes the system to fail to start; When the factory operation is not yet completed, the STATUS will be turned off for a long time.

WARN	Warning indicator light	When a warning exception occurs in the system and the system upgrade or factory restoration is not yet completed, the WARN light flashes.
ERR	Error indicator light	When a serious error occurs in the system and the system upgrade or factory recovery is not yet completed, the Error light flashes.
SIM1	SIM1 card indicator light,	When selecting SIM card 1 for dialing, it always lights up. When selecting SIM card 2 for dialing or turning off dialing, it stays off.
SIM2	SIM1 card indicator light, if selected, it remains on	When selecting SIM card 2 for dialing, it always lights up. When selecting SIM card 1 for dialing or turning off dialing, it stays off.
USER1	User programmable indicator light 1	Default off, can be programmed and controlled by the user
USER2	User programmable indicator light 2	Default off, can be programmed and controlled by the user
4G	Cellular network connection status indicator light	Always on after successful dialing
L1	Cellular network signal strength	See instructions for cellular network signal strength indicator lights
L2	Cellular network signal strength	
L3	Cellular network signal strength	

Cellular network signal strength indicator light

LED	No signal	Weak signal (RSSI<-90)	Signal medium (-90<=RSSI<-70)	Signal strength (RSSI>=-70)
L1	Extinction	bright	bright	bright

L2	Extinction	Extinction	bright	bright
L3	Extinction	Extinction	Extinction	bright

In addition to the combination of L1, L2, and L3 signal lights to indicate cellular signal strength, there is also a set of LED combinations to indicate the process of factory restoration.

LED	state
WARN	flicker
Error	flicker
STATUS	Extinguish

After restoring the factory settings, the system will undergo a restart. After the restart is completed, the factory reset is not complete. At this time, the WARN light and ERROR flash, and the STATUS goes out. In this state, the device cannot be powered off, otherwise it may cause some files to be lost and affect system functions. This state will last for 30 seconds. After the factory is restored, WARN and ERROR will turn off, and STATUS will flash.

2.3.8 User programmable buttons

EC954-FQ38 provides an API interface, which users can call to detect the status of programmable buttons and then implement their own button logic.

2.3.9 DC Input

EC954-FQ38 supports 12-48V DC input

2.3.10 SIM card slot

EC954-FQ38 supports 2 SIM card slots. SIM cards need to be installed in a power-off state. Simply press and insert the SIM card into the slot.

2.3.11 MicroSD card slot

EC954-FQ38 has a MircoSD card slot, and SD does not support hot swapping. It needs to be plugged and unplugged in the event of a power outage. After inserting the SD card and powering on the device, the system will automatically mount all partitions.

2.3.12 Factory Reset Button

There is a reset button for restoring the system to factory settings. Refer to "Restore Factory Settings" for operation.

2.3.13 On/Off button

EC954-FQ38 is equipped with an on/off button for power on/off.

2.3.14 Antenna interface

EC954-FQ38 has a total of 7 antenna interfaces, and the number of antennas standard for different models varies. The antennas are screwed into the corresponding antenna interfaces to complete antenna installation.

Identification	Name
ANT1	4G LTE main antenna
ANT2	4G LTE diversity receiving antenna
GNSS	GNSS antenna
WiFi1	WiFi antenna
WiFi2	WiFi antenna

Note: The device operating in the 5150-5250 MHz band, under RSS-247, The device is for indoor use only

2.3.15 mSATA hard drive interface

EC954-FQ38 supports mSata hard drives, which are not included by default at the factory. If users have high-capacity storage needs and need to purchase their own mSata hard drives, they can also consult InHand to purchase mSATA.

3 Introduction

In this chapter, we will introduce the basic configuration of the Edge Computer EC900 based on the Arm structure.

3.1 Connecting to EC900

You need a computer to connect to EC900 and log in to the command line interface. It can be connected through an Ethernet cable.

Factory default username and password:

Username: edge

Password: security@edge

EC900 devices default to creating root at the factory, but login is disabled. If you need to use the root user, please manually modify the system configuration and enter sudo - s to switch to the root user. The user edge is in the sudo group, so you can use sudo to execute system level commands under the edge user. For other details, please refer to the sudo mechanism section in Chapter 5.

Prompt

When the **command not found** appears, enter sudo - s to switch to the root user or use the sudo command to operate.

Take care

For security reasons, we recommend that you disable the default user account and create your own user account.

3.1.1 Connecting through SSH Console

EC900 supports SSH connection through Ethernet. Connect to EC900 using the following default IP address.

Port	Default IP
ETH 1	192.168.1.100
ETH 2	192.168.1.100
ETH 3	192.168.5.100

ETH 4	192.168.6.100

3.1.1.1 Linux users

Prompt

These steps apply to connecting to EC900 on a Linux PC. Please do not apply these steps to the EC900 device itself. Before running the ssh command, make sure to configure the Ethernet port IP address of the PC within a specific range. ETH1: 192.168.1.0/24, ETH2: 192.168.4.0/24, ETH3: 192.168.5.0/24, ETH4: 192.168.6.0/24.

Use the ssh command on a Linux PC to access the ETH1 port of EC900.

```
user@PC:~$ ssh edge@192.168.3.100
```

Enter **yes** to continue connecting.

```
The authenticity of host '192.168.3.100 (192.168.3.100)' can't be established.
ECDSA key fingerprint is SHA256:jqiLREbTX6Ut2whNFdpLvCcQfM3KUnl3Ta7/dWppBCU.
Are you sure you want to continue connecting (yes/no)? yes
```

When the interface displays the terminal prompt `edge@edge-computer:~$`, indicating that shell commands can be entered, the connection is successful.

3.1.1.2 Windows users

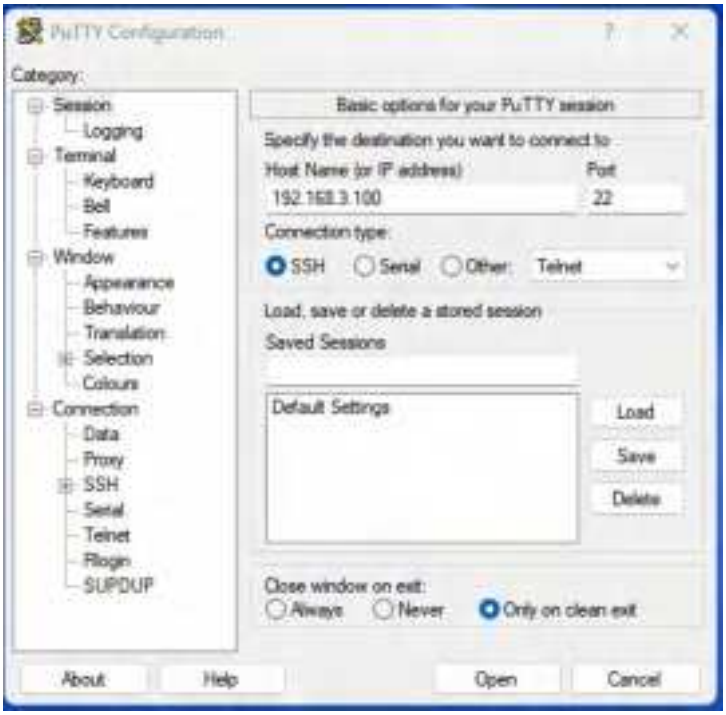
Prompt

These steps apply to connecting EC900 on a Windows PC. Please do not apply these steps to the EC900 device itself.

Please take the following steps on your Windows PC

Click on the link http://www.chiark.greenend.org.uk/ ~Sgtatham/putty/download.html, download PuTTY (free software), and establish the connection with the edge computer

EC900 in the way of SSH command in the Windows environment. The following figure is an example of using SSH connection:



3.2 User Account Management

3.2.1 Switch to root user

You can use the command sudo - s to switch to the root user. For security reasons, do not operate all commands under root privileges.

Prompt

Click on the link to get more information about the **sudo** command.

https://wiki.debian.org/sudo

Take care

You may receive a permission denied prompt when using certain pipes or redirection behaviors without root privileges. In this case, you must use 'sudo su - c' instead of commands such as'>','<','>>','<<',' etc ', and include single quotes for the complete command.

3.2.2 Creating and deleting user accounts

You can use the **useradd** and **userdel** commands to create and delete user accounts. Please make sure to use these commands on the main interface to set the relevant access permissions for this account. Here is an example of how to create test1 in the sudo group (the default login environment for test1 users is bash, and their home directory is/home/test1)

```
edge@edge-computer:~$ sudo useradd -m -G sudo -s /bin/bash test1
```

Change the password for test1, use the passwd command, enter the new password, and then

repeat the process to confirm the change

```
edge@edge-computer:~$ sudo passwd test1
New password:
Retype new password:
passwd: password updated successfully
```

If you want to delete user test1, use the command userdel

```
edge@edge-computer:~$ sudo userdel test1
```

3.2.3 Disable default user accounts

Take care

Before disabling the default account, you should first create a user account

Use the passwd command to lock the default user account and prevent edge users from logging in

```
edge@edge-computer:~$ sudo passwd -l edge
passwd: password expiry information changed.
```

Unlocking edge users

```
edge@edge-computer:~$ sudo passwd -u edge
passwd: password expiry information changed.
```

3.3 Network and System Management

EC954-FQ38 is based on the Debian 11 system, so it can use native Linux commands for network and system management; In order to facilitate user configuration, InHand has developed an IEOS system program that provides a web interface, allowing users to easily manage networks and systems through the web. However, it should be noted that when the IEOS function is enabled, IEOS will take over network and system management. At this time, using Linux native commands for network and system management may become ineffective; IEOS is enabled by default at the factory of the device. If users need to perform network and system management based on Linux native command lines, they need to first disable IEOS.

3.3.1 Web management based on IEOS

IEOS is a network management and system management program developed by InHand that runs on Linux systems. IEOS provides a web interface, allowing users to configure Ethernet IP addresses, cellular dialing, Wi Fi Station, DHCP Client/Server, static routing, firewalls, and other network configurations through the web; You can also perform operations on system time, time zone, firmware upgrades, and system restarts; In addition, IEOS also supports integration with InHand's device management platform DeviceLive, allowing users to remotely monitor and manage EC954 devices through the DeviceLive platform.

IEOS adopts a design scheme that separates state and configuration, divided into three functional modules: network management, system management, and state. Only network and system related configurations can be performed under the network management menu and system management menu, and status information needs to be viewed uniformly on the status page.

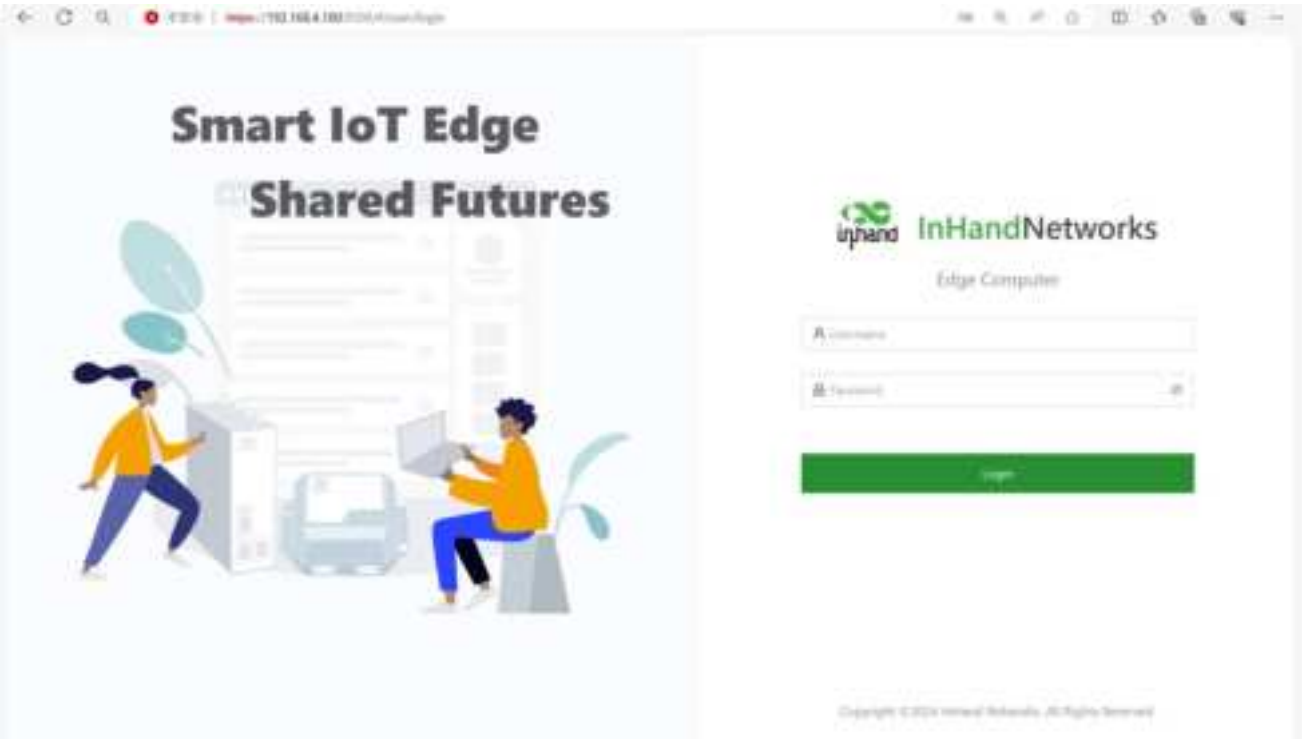
Important note: When using the IEOS program to manage network and system configurations, if Linux native commands are used at the same time, the two may affect each other, leading to abnormal running states. It is recommended that the configurations

supported by IEOS be managed through the IEOS web. For configurations not supported by IEOS, such as VPN, the configuration goals can be achieved by combining native Linux commands.

3.3.1.1 Logging into the web

Considering that the user's program may require the use of HTTP/HTTPS standard port number 80/443, IEOS uses port number 9100 as the port for HTTPS connection and does not support access through HTTP; When users access the web using HTTP, they will automatically redirect to using HTTPS. This document takes the default address 192.168.4100 through eth2 as an example for explanation. After entering 192.168.4100:9100 in the browser, the user will be redirected to the login page

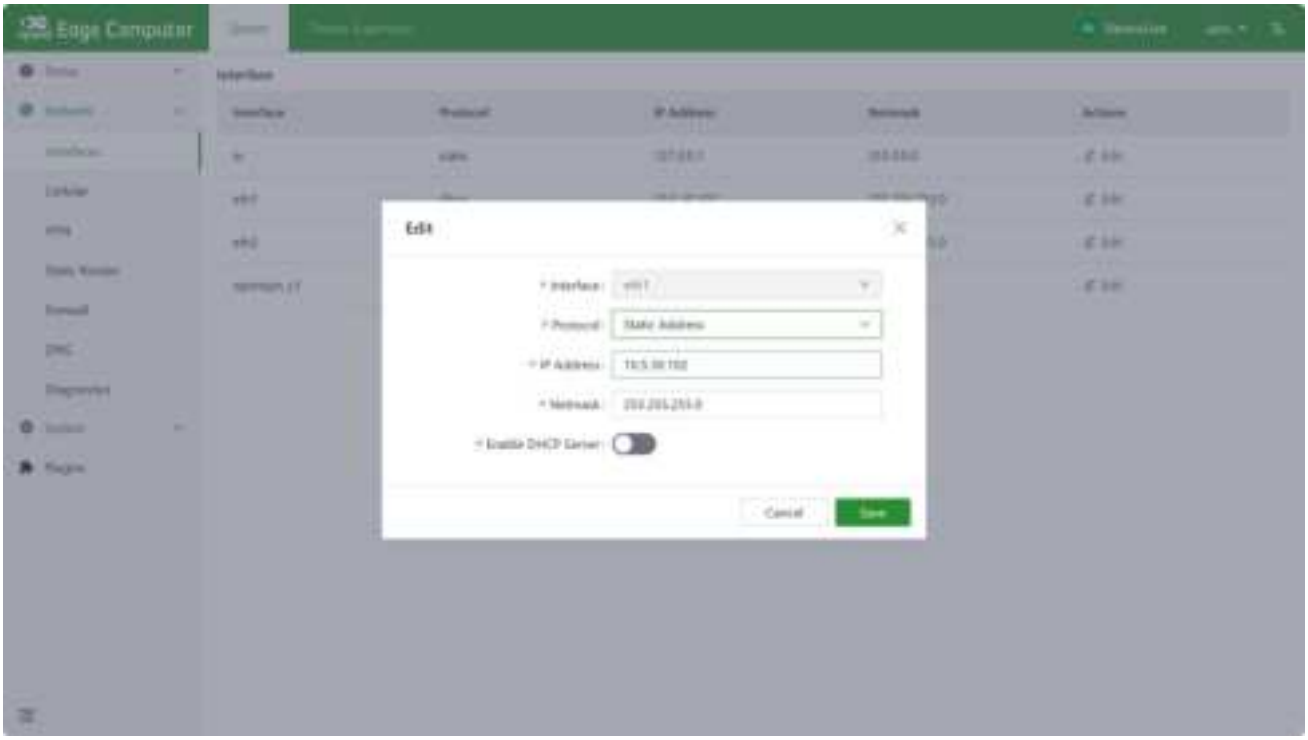
Important note: When the IEOS program is enabled, some port numbers will be reserved for internal communication, with a reserved port number range of 9100 to 9200. After enabling IEOS, customer programs should avoid using these port numbers, otherwise conflicts may occur and functional abnormalities may occur.



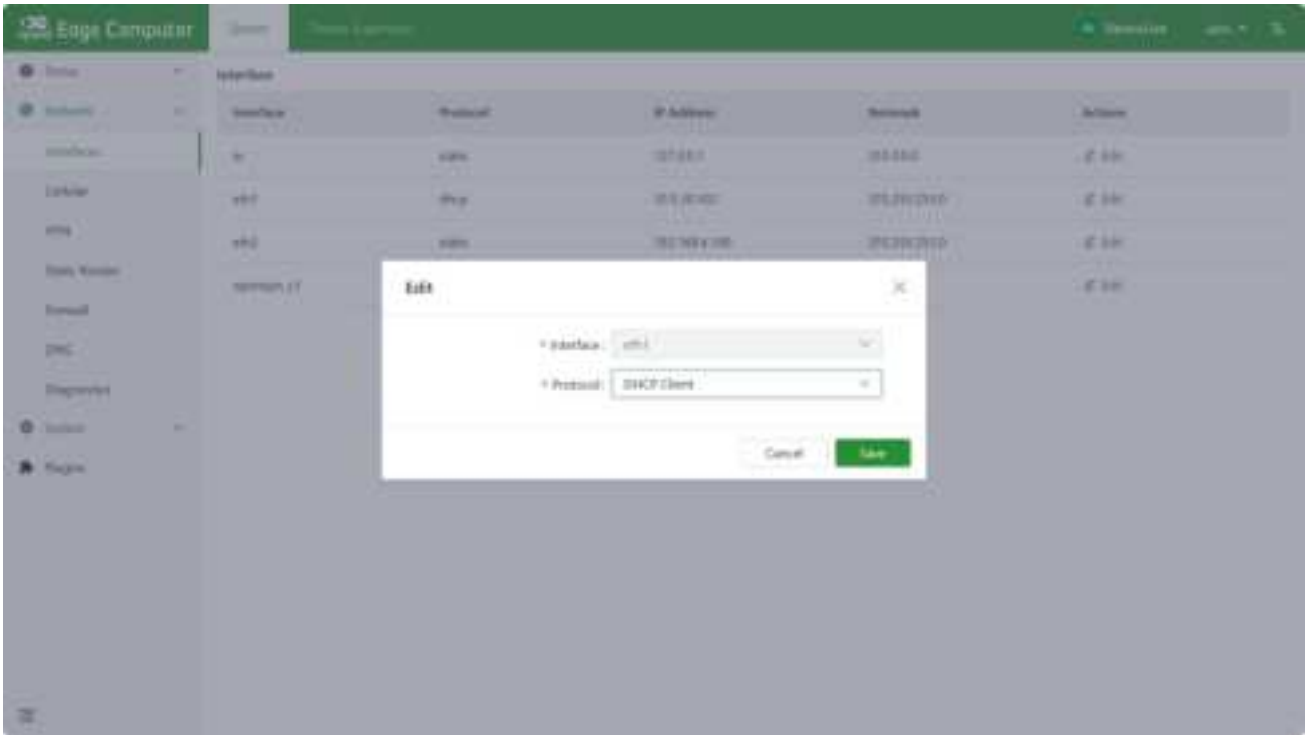
3.3.1.2 Network Management

3.3.1.2.1 Configure Ethernet interface

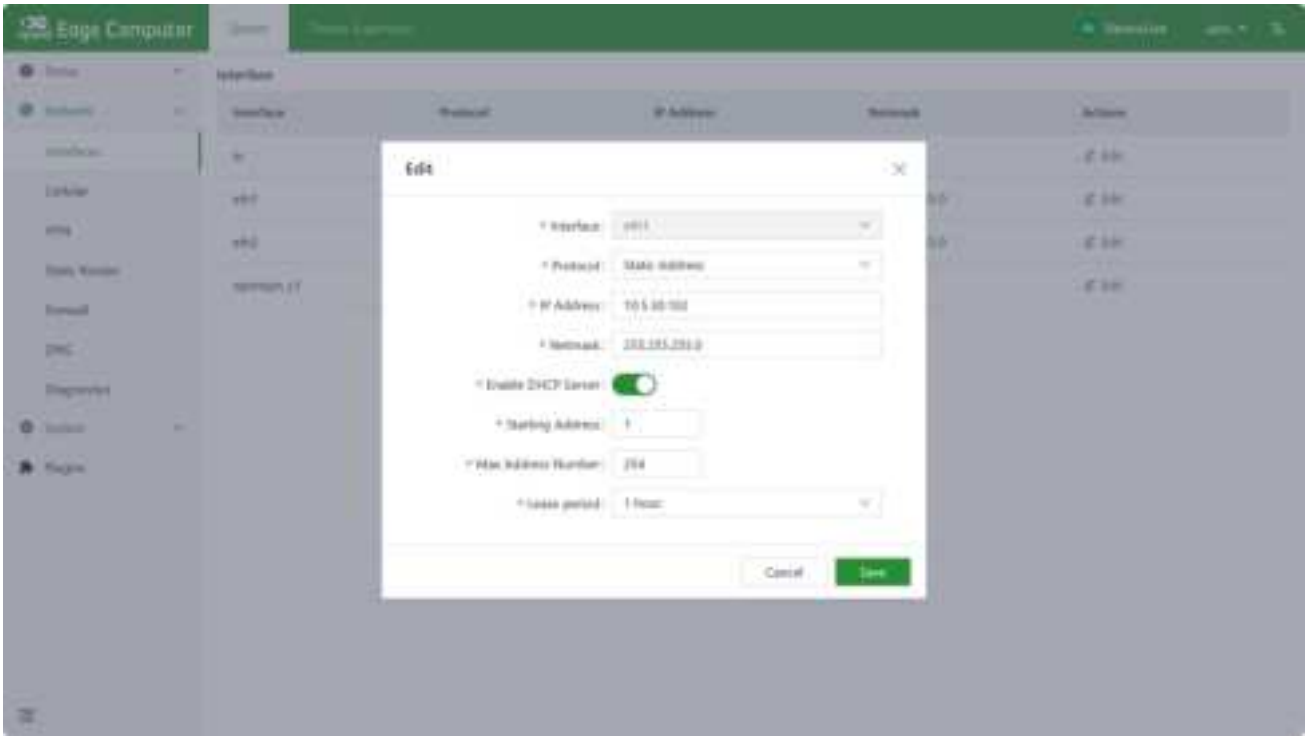
Configure static IP addresses for the eth1 interface



Configure DHCP Client for eth1 interface



Start the dhcp server function on the eth1 interface and assign addresses to the underlying devices of eth1



DHCP Server configuration parameter description:

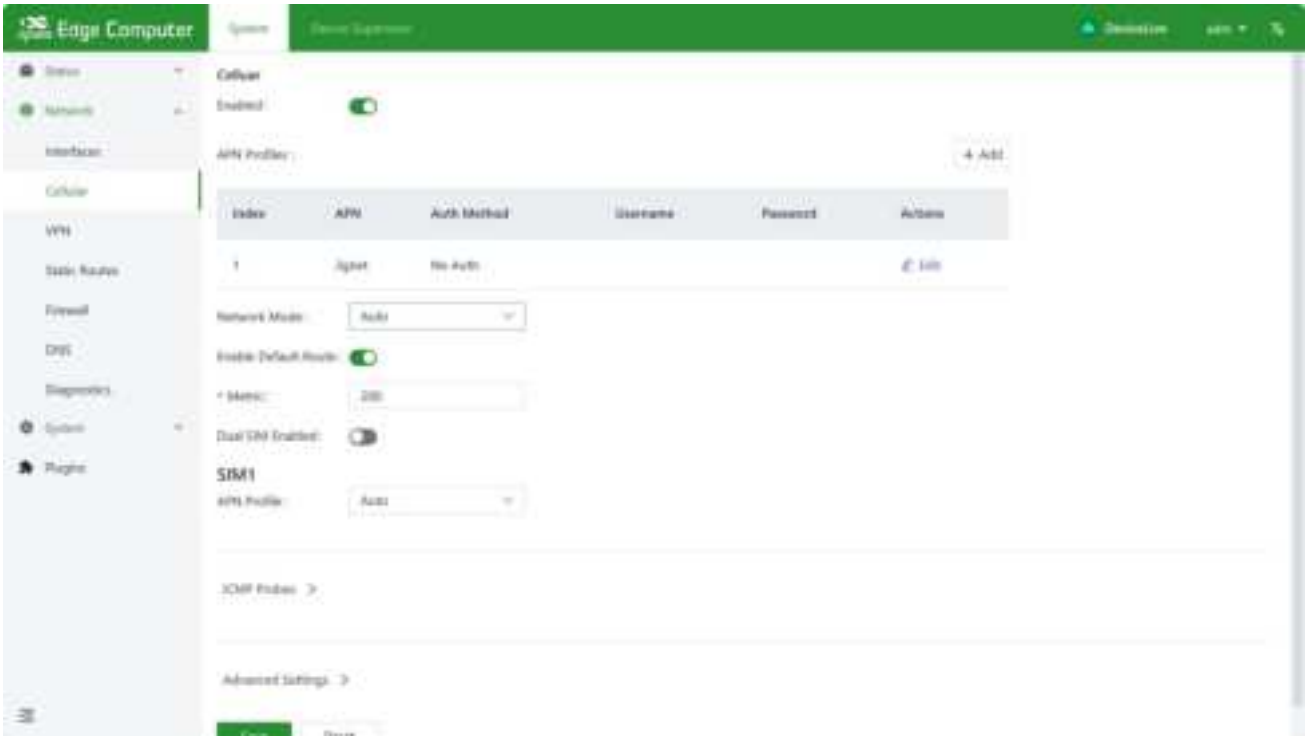
Enable DHCP Server: Switch for DHCP Server functionality

Starting Address: The starting base address of the DHCP Server address pool, where network segment+starting address=the starting IP address of the address pool. In the screenshot, the network segment of eth1 is 192.168.1.0/24, and the base address is 1, so the starting address of the address pool is 192.168.1.1/24

Max Address Number: The maximum number of addresses in the address pool

Lease period: Lease period

3.3.1.2.2 Configure cellular dialing



Cellular network parameter description:

Enable: switch for cellular function; The default is the enabled state.

APN Profiles: A set of dialing parameters used to configure APN, username, password, and authentication method information when dialing with a dedicated network card. If it is not a dedicated network card, there is usually no need to modify the configuration here. The dialing parameter set can add up to 10 records.

Network Mode: The cellular network format, which can choose from 3G, 4G and other related network formats, such as LTE, WCDMA, etc. If it is unclear which network standard to choose, choose automatic; The program will automatically select the most suitable network format. The default value is automatic.

Enable Default Route: Enable the add default route function. When enabled, a default route for the cellular port will be added after successful dialing. It is enabled by default.

Metric: The metric value of the default routing for cellular ports. When default routing is configured for cellular, Wi Fi, and Ethernet ports, the metric with the smallest value takes effect.

Dual SIM enabled: enables the dual SIM feature. EC954 supports dual card single dial to improve network reliability. Two SIM cards need to be inserted into the device. After enabling this function, if the SIM card 1 fails to dial due to arrears, it will automatically switch to the SIM card 2 for dialing. The default is off.

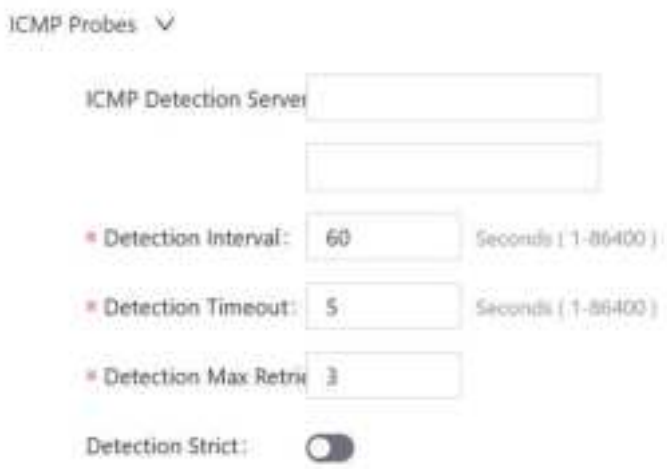
Main SIM: The main SIM card will prioritize the selected SIM card for dialing. When dialing

fails a certain number of times, it will switch to another SIM card for dialing. By default, sim1 will be used for dialing first.

Max Number of Dials: After enabling the dual SIM single dial function, if the current SIM card reaches the specified number of dials, switch to another SIM card for dialing.

APN Profile: The dialing parameter set selected by the SIM card, with the default value being automatic. Usually, a dedicated network card needs to configure a dial-up parameter set and select the Index of the dial-up parameter set here.

PIN Code: The PIN code of the SIM card.



Wireless cellular networks are quite complex, and sometimes there may be false dial-up connections, where the dial-up status is successful but the target address cannot be pinged; When these situations occur, dialing again can restore normal operation. IEOS cellular dialing supports ICMP detection to detect fake connections. It is recommended that customers using cellular networking enable ICMP detection, so that when false connections occur, they can quickly recover.

ICMP detection parameters:

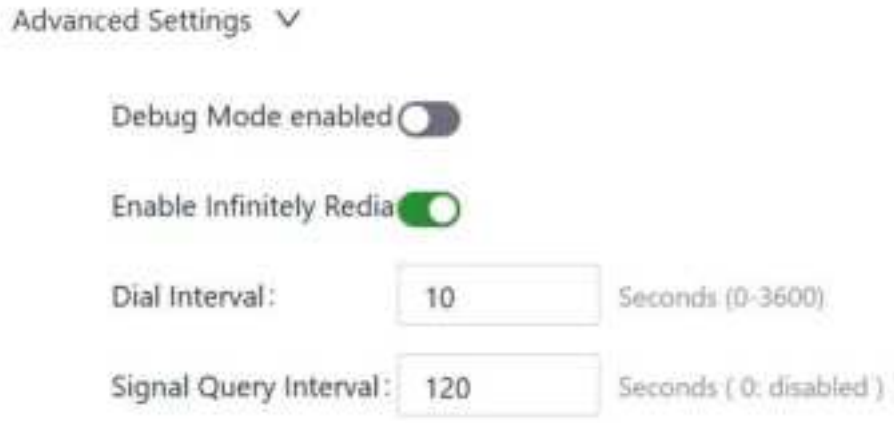
ICMP Detection Server Probes: ICMP detection address; Two detection addresses can be configured, and as long as one address is successfully detected, it indicates that there is no false connection in the cell. When both addresses are not configured, the ICMP detection function is turned off.

Detection Interval: How often should ICMP detection be conducted.

Detection Timeout: The ICMP detection timeout period. If no detection response message is received after waiting for a long time, it is considered that the detection has failed

Detection Max Retries: Maximum number of detections; When the detection fails and reaches this value, trigger a redial. Value range [1,5]

Detection Strict: Whether strict detection is enabled. When strict detection is turned off, the detection program will detect whether the messages received by the cellular interface have changed during each detection cycle. If there are changes, it indicates that the cellular network is connected, and ICMP messages will not be sent for detection, which can save some traffic; If detection is enabled, ICMP detection messages will be periodically sent regardless of whether the number of messages received by the cellular interface has changed. The default is off.



In advanced configuration, there are some uncommon setting options.

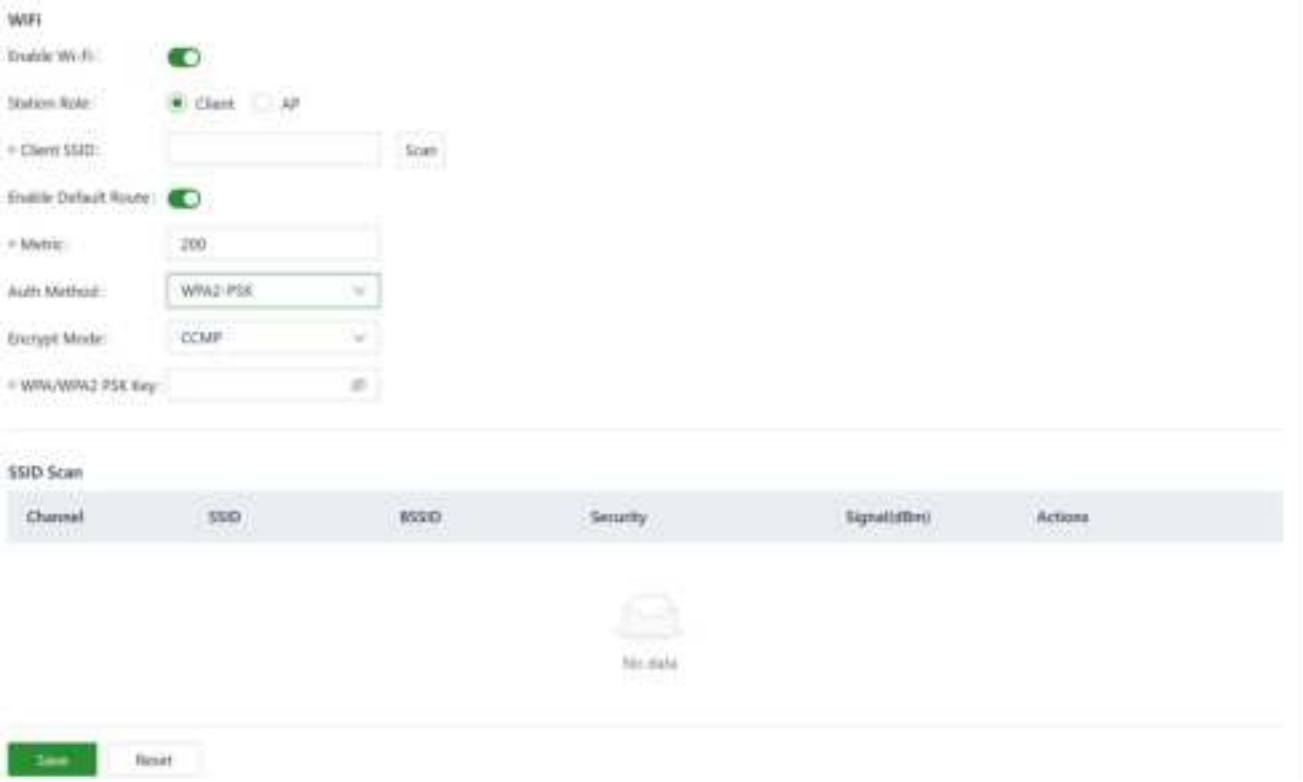
Debug Mode enabled: Whether to enable the debug function. After enabling it, some dial-up related debugging information will be added to the log, which is disabled by default.

Enable Infinitely Redial: Enable infinite redial. In some cases, dialing may be in an abnormal state and can be restored to normal by restarting the system; The default infinite redial is turned off. After a certain number of failed dials, the system will restart to try to recover. Due to dialing being enabled by default, some customers may fail to dial without inserting a SIM card, and the system may restart. In this case, unlimited redial can be enabled; This way, no matter how many times the dialing fails, the system will not restart.

Dial Interval: Dialing interval; But the time to wait before proceeding to the next dial when a dial fails.

Signal Query Interval: Signal query interval. When the signal is poor, false connections may occur; At this point, there is a certain probability that redialing can solve the problem of fake connections. The dial-up program will regularly check the signal strength, and the signal detection cycle is configured here.

3.3.1.2.3 Configure Wi Fi Station



Enable Wi Fi: enable switch; Default Off

Client SSID: The ssid that needs to be connected, which can be manually entered; You can also obtain nearby accessible ssids by scanning the button

Enable Default Route: Whether to enable the add default route function. When enabled, a default route for the WLAN port will be added after a successful WiFi connection. It is enabled by default.

Metric: The metric value of the default routing for WiFi ports. When default routing is configured for cellular, Wi Fi, and Ethernet ports, the metric with the smallest value takes effect.

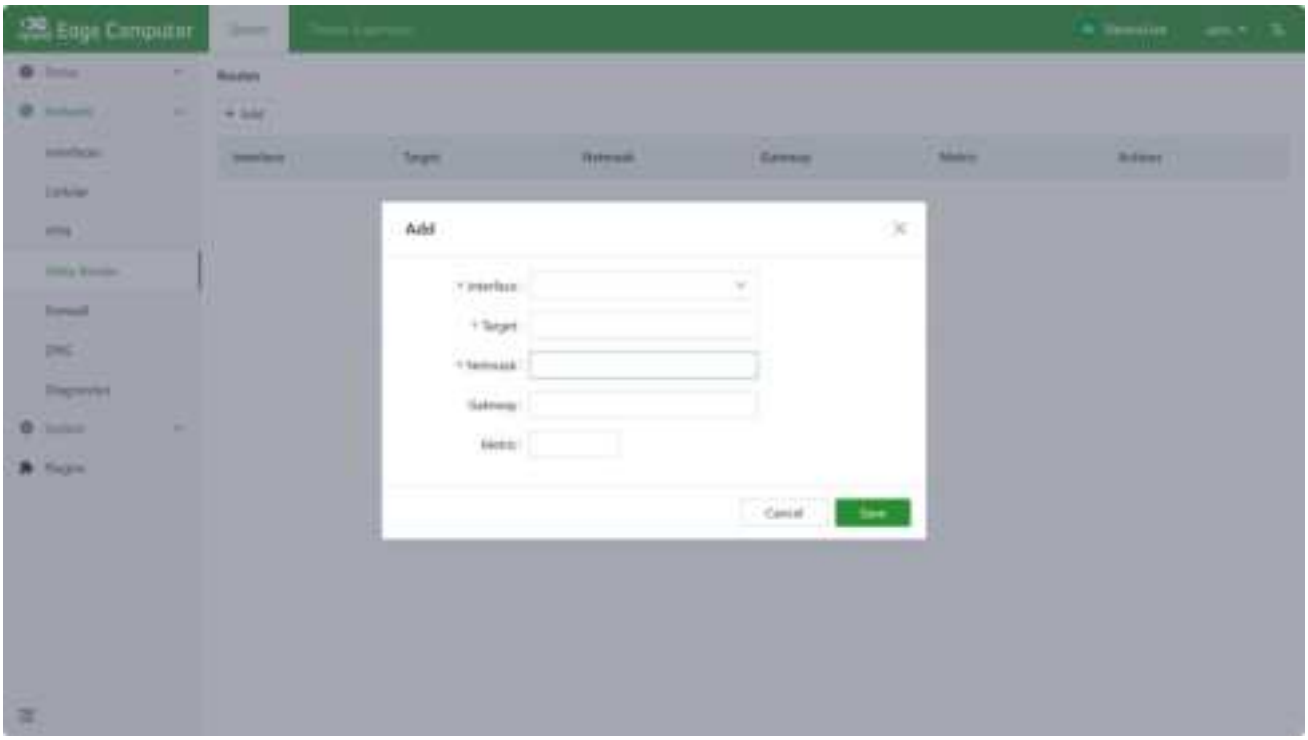
Auth Method: Authentication method, supports no authentication, WPA-PSK, WPA2-PSK, WPA-PSK/WPA2-PSK Mixed

Encrypt Mode: encryption method; Supports CCMP, TKIP, TKIP, and CCMP

WPA/WPA2 PSK Key: Key information

3.3.1.2.4 Configure static routing

The configuration here is for static routing of Ethernet. When default routing of Ethernet, cellular, and WiFi is configured simultaneously, the default routing with the lowest metric value takes effect. It is necessary to ensure that the metric value of the default route is different.



Static routing configuration parameters:

Interface: The outbound interface for static routing

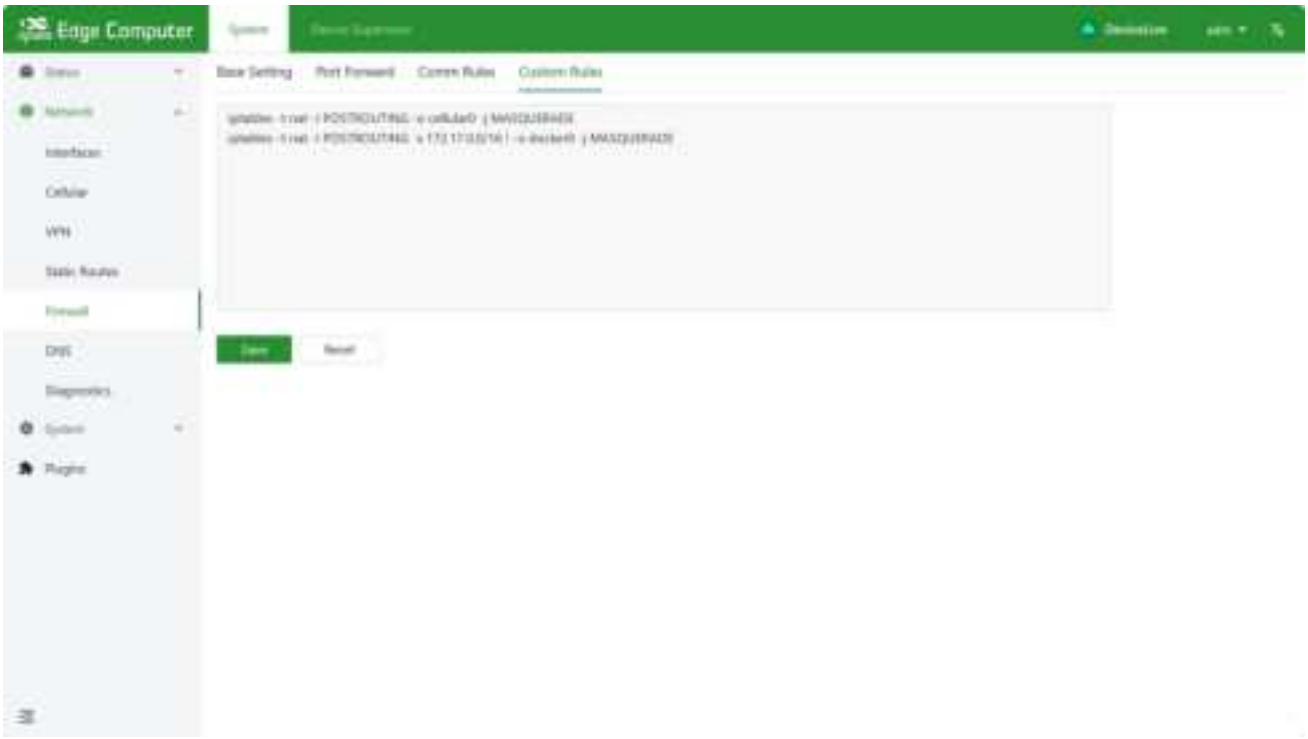
Target: Target network

Netmask: Target Netmask

Gateway: Next hop address

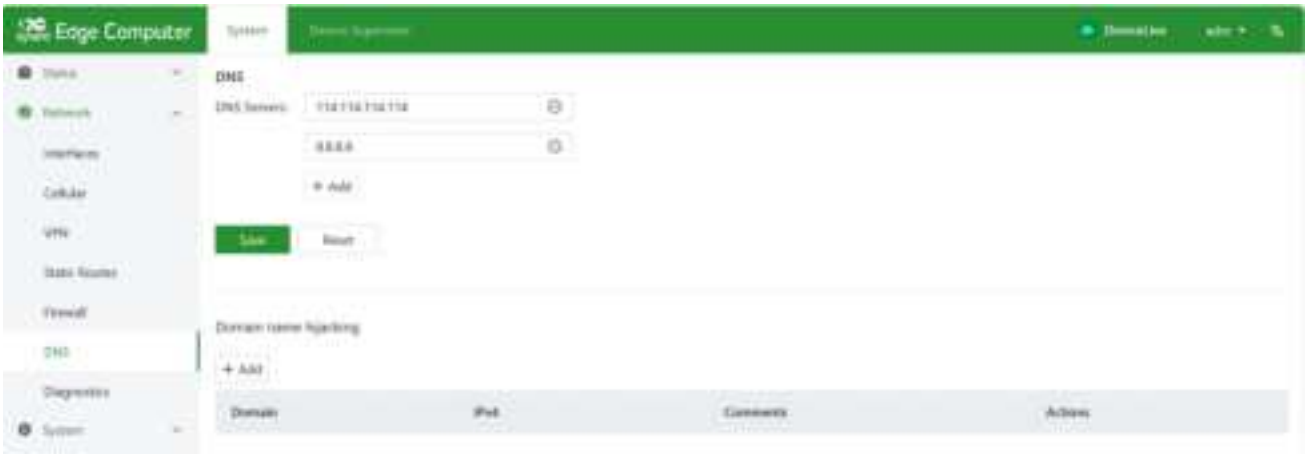
Metric: The metric value of static routing

3.3.1.2.5 Configure firewall



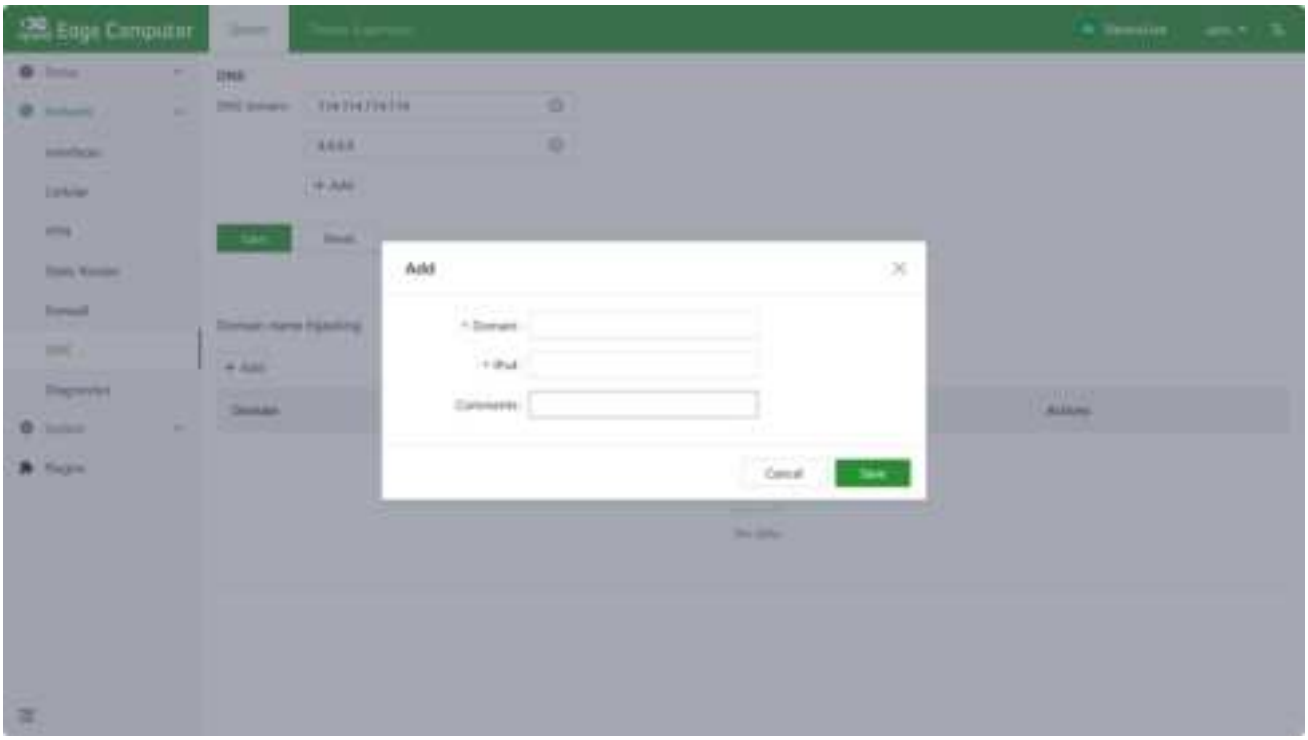
Currently, only the iptables command is supported for configuration.

3.3.1.2.6 Configure DNS



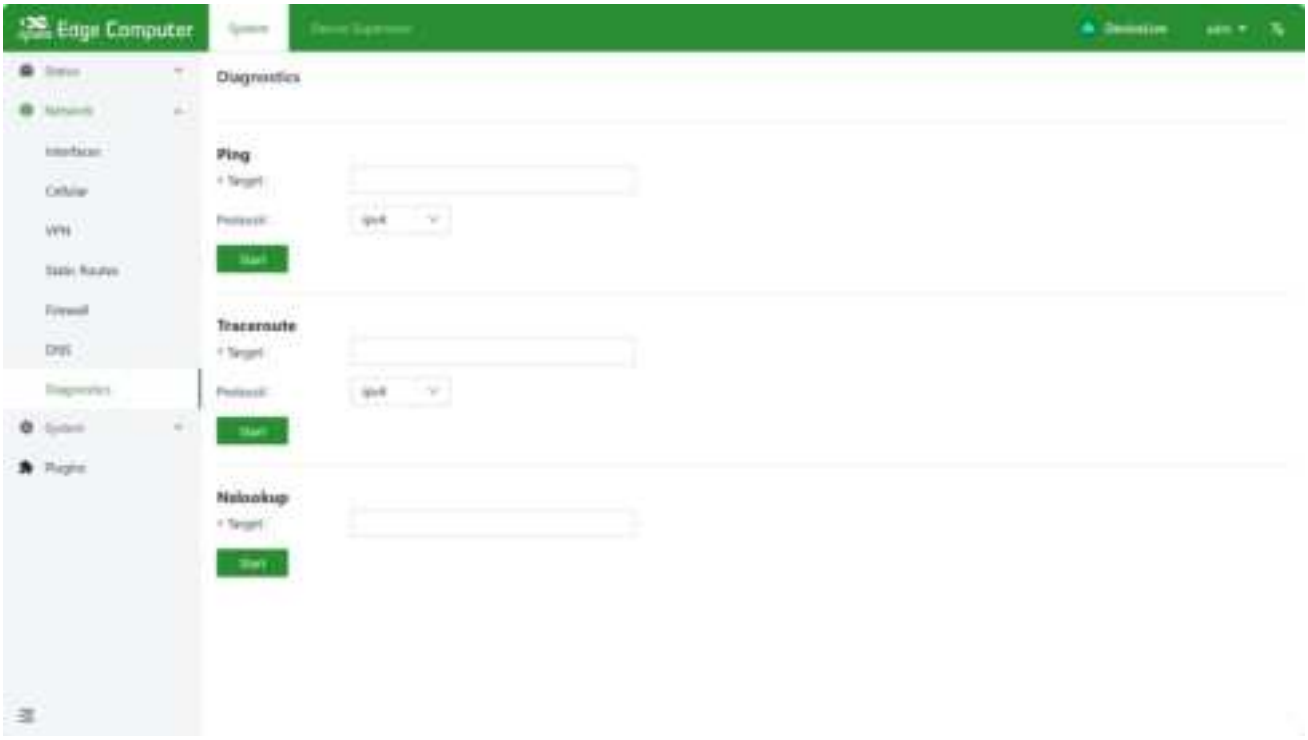
DNS servers: DNS server addresses, supporting up to 4 configurations

Domain name hijacking: Domain name hijacking function, which can achieve binding between IP addresses and domain names.



3.3.1.2.7 Network Diagnostics

Network diagnosis supports ping, traceroute, and nslookup functions.



3.3.1.3 System Management

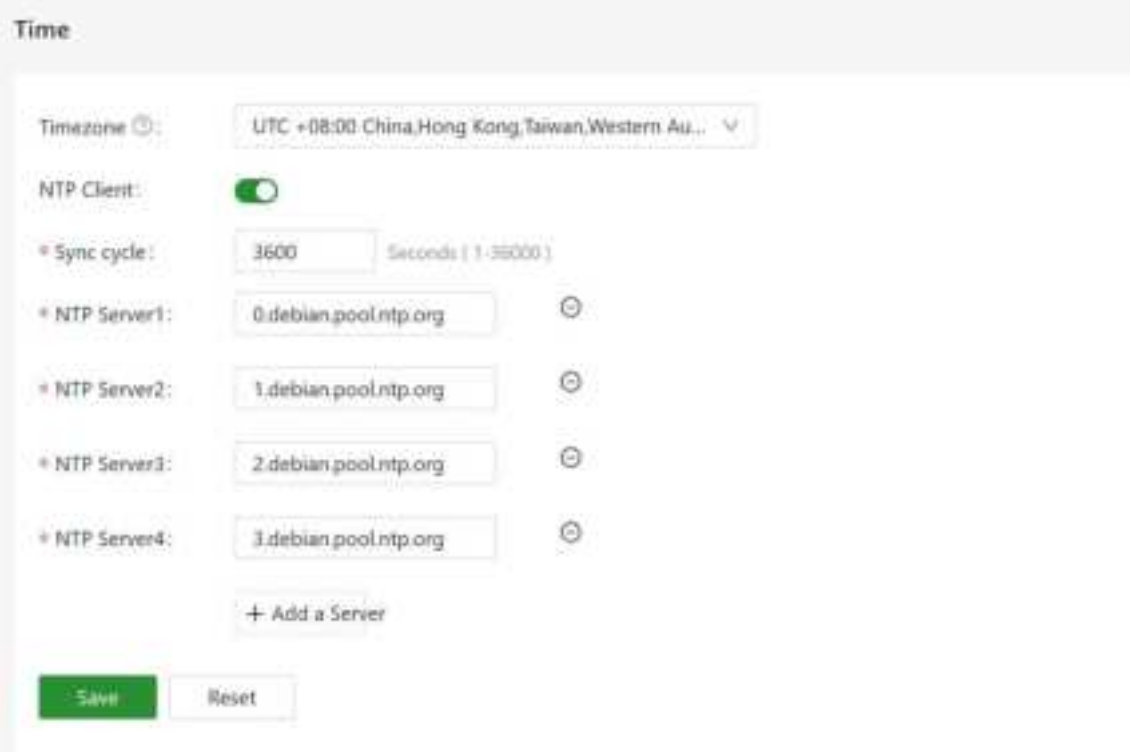
3.3.1.3.1 Basic Configuration

Cloud management

Enabled: an enable switch for docking with the DeviceLive platform; DeviceLive is a remote monitoring and management platform for InHand devices;

Cloud Server: DeviceLive platform has 2 addresses; One is the address of the domestic platform, and the other is the address of the overseas platform; Choose which platform to connect to here.

Time zone and NTP client

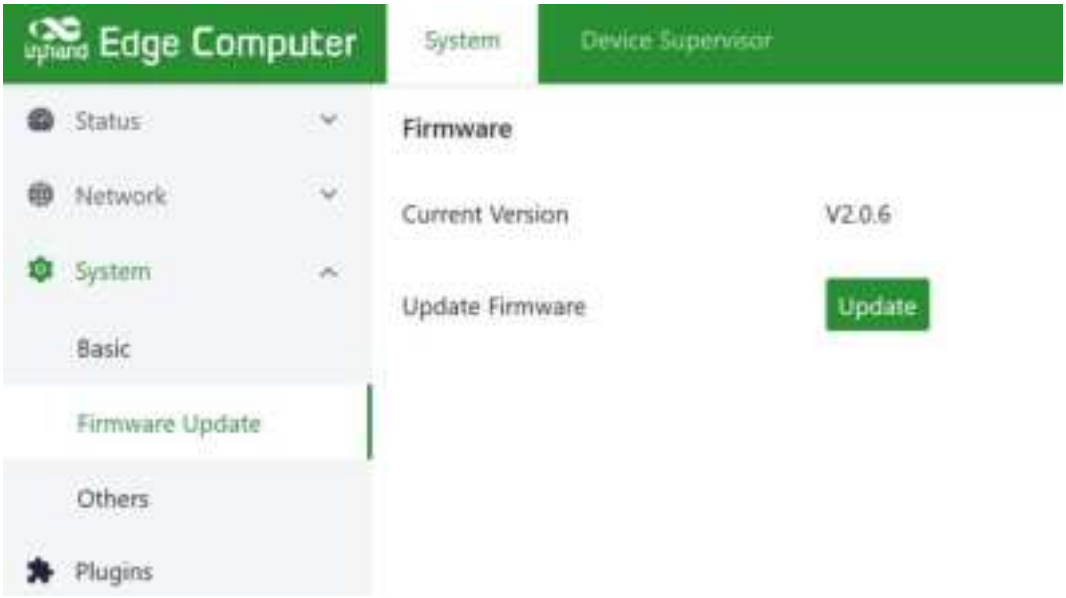


Up to 10 NTP server addresses can be configured, and the program periodically sends synchronization requests to each server address in sequence. After successful synchronization, the system time is written to the RTC and synchronization requests are no longer sent to subsequent NTP servers.

In addition to using NTP to synchronize time, there is a synchronization button on the Device Info status page that allows for manual synchronization of time. However, this synchronization button is only displayed when the device time and local time (the time of accessing the computer used by the device) differ by more than 3 seconds.

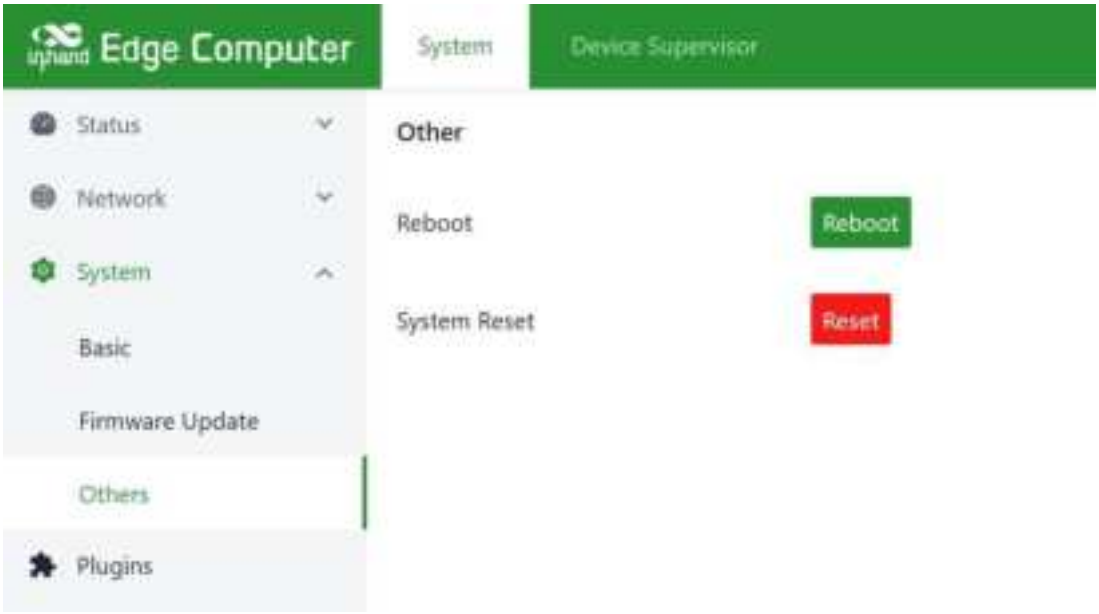
Here, configuration import, export, and factory recovery are supported.

3.3.1.3.2 Firmware Upgrade



The automatic restart option is disabled by default. After upgrading the firmware, the system needs to be manually restarted to take effect; After enabling the automatic restart option, the system will automatically restart after a successful firmware upgrade.

3.3.1.3.3 Others

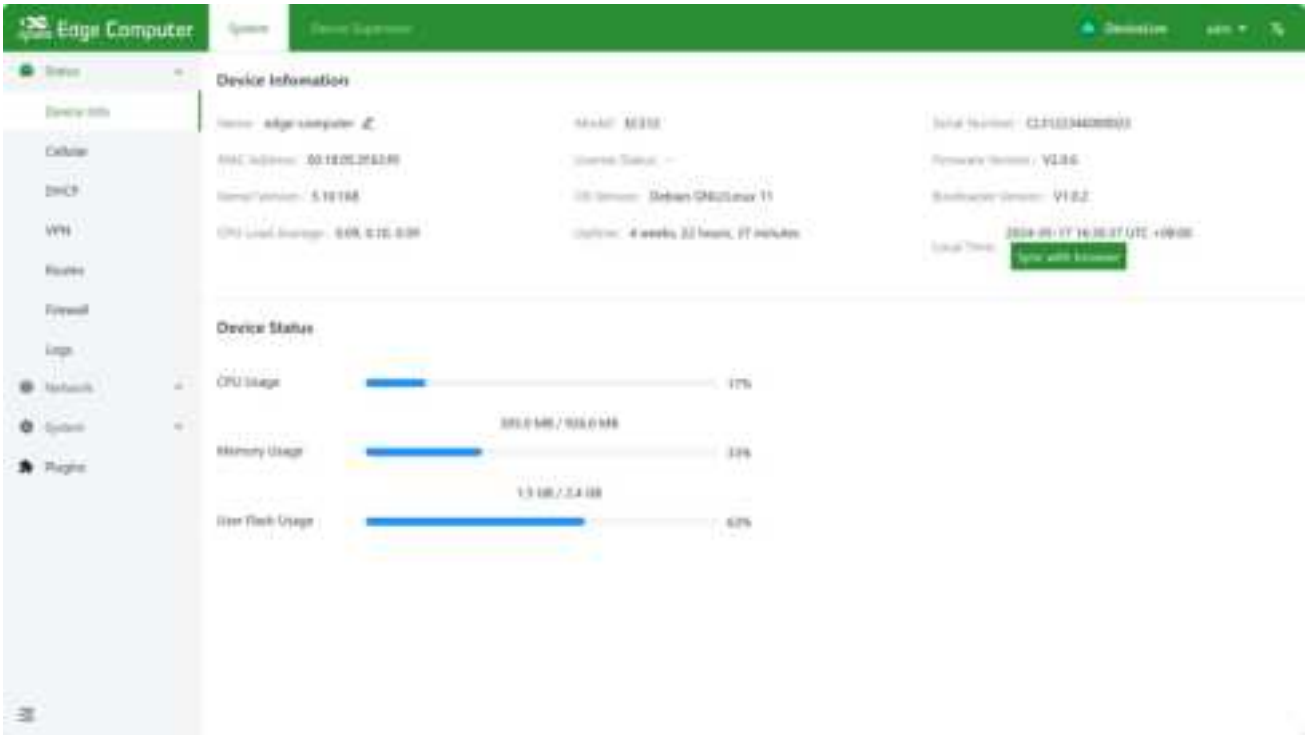


This page has two functions: system restart and system reset. Resetting the system requires careful use. Resetting the system function will restore the configuration and file system status of the system to be consistent with the factory settings, which means that the software installed by the user will also be cleared.

3.3.1.4 Status

3.3.1.4.1 Equipment information

The device information status page displays the host name, device model, serial number, firmware version, kernel version, file system version, as well as an overview of CPU, memory, and disk space usage.



3.3.1.4.2 Cellular dialing status information

The cellular dialing status page displays the SIM card, IMEI, IMSI, ICCID, signal strength, as well as the IP address, DNS, and other information obtained during dialing.

3.3.1.4.3 Wi-Fi Station Status Information

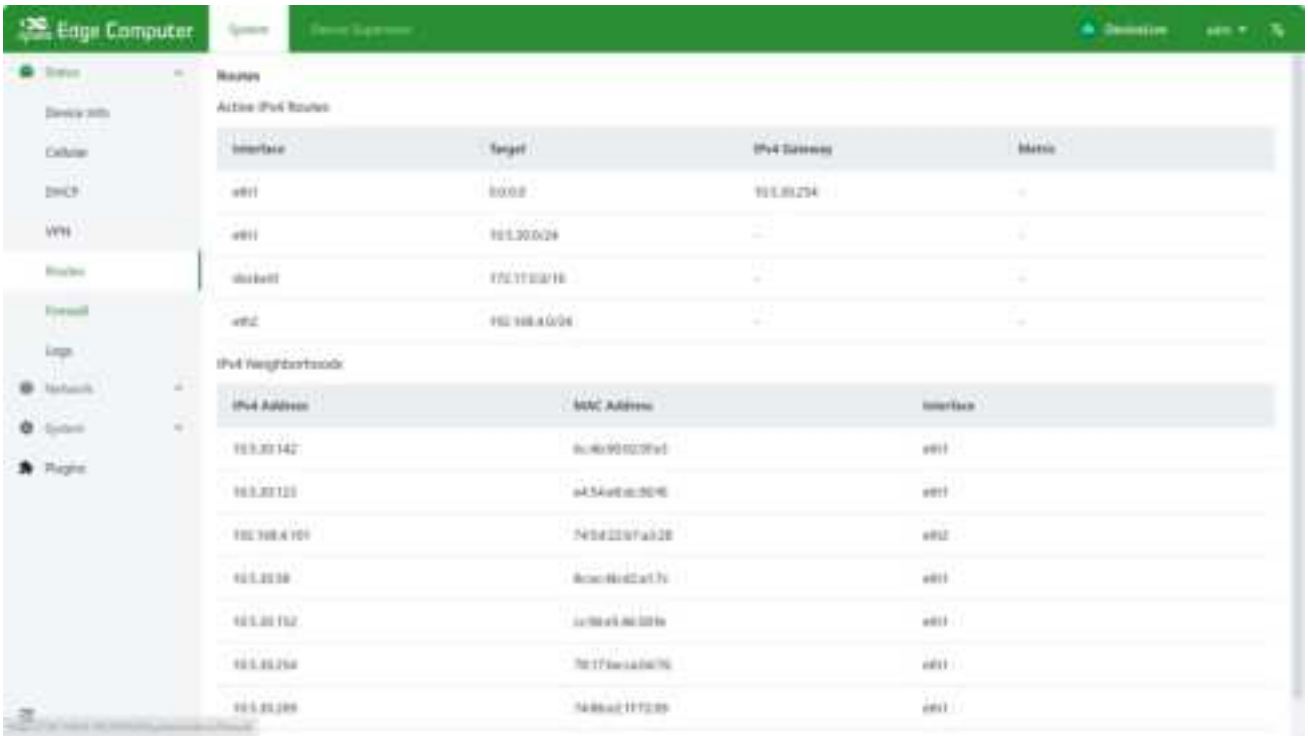
The Wi-Fi status page displays the IP address, gateway, and DNS information obtained after a successful Wi Fi connection.

3.3.1.4.4 DHCP Server status information

The DHCP Server status page displays the IP address, client host name, client host MAC, and expiration time assigned to the device as a DHCP Server.

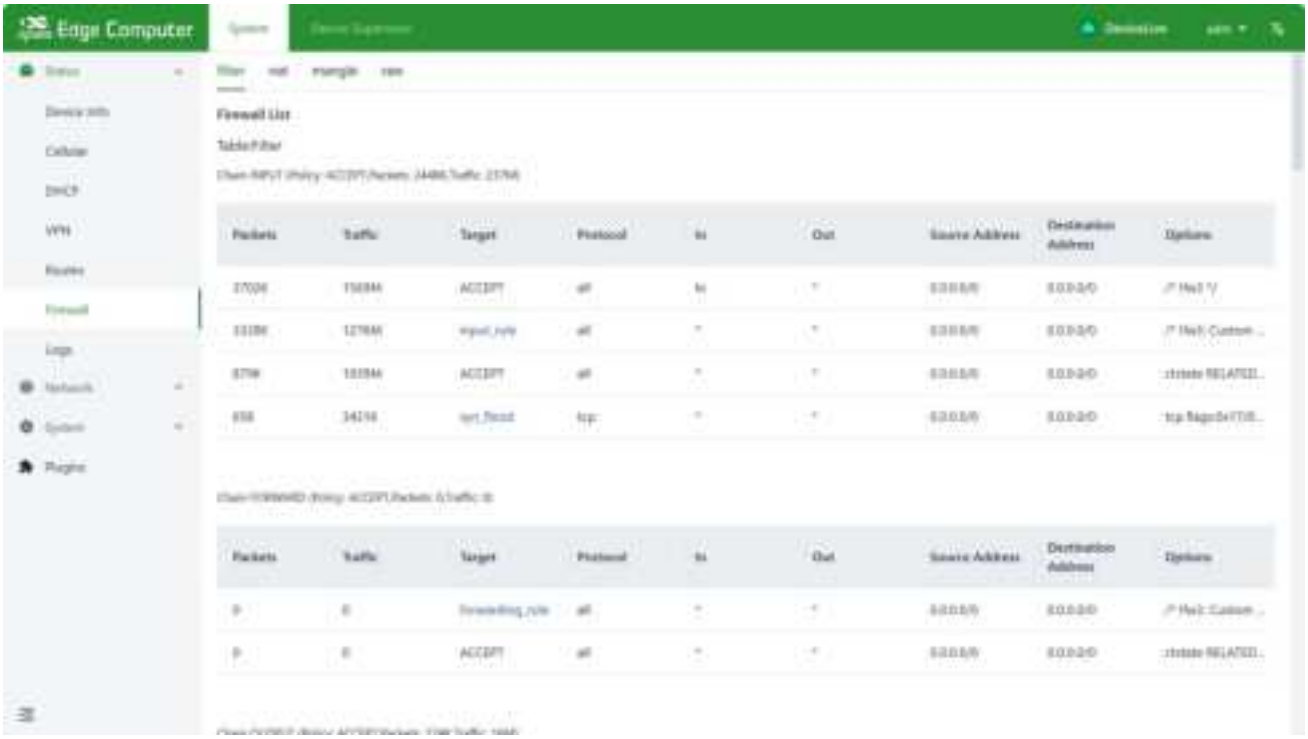
3.3.1.4.5 Routing status information

The routing status page displays information such as IPv4 direct routing, static routing, and routing neighbors.



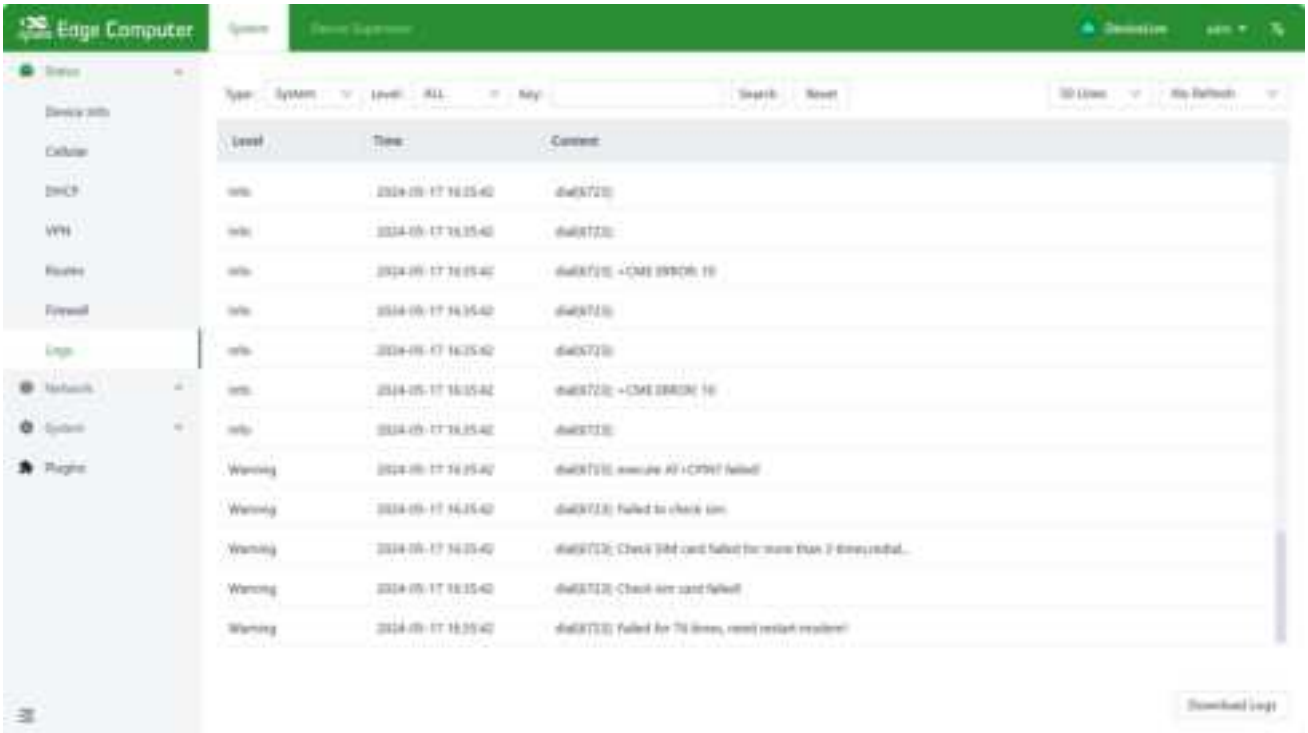
3.3.1.4.6 Firewall status information

The firewall status information displays filtering rules, IP address mapping rules, and other information.



3.3.1.4.7 Log information

The log page can view system logs, user logs, and set the level of logs to be viewed, including Error, Info, Debug, and other levels. Logs can also be downloaded locally.



3.3.2 Linux based command line management

When using the Linux command line for network and system configuration, the first step is to close the IEOS program. IEOS is managed through system ctl,

The way to close IEOS is as follows:

```
Systemctl stop ieos_daemon
```

This shutdown only takes effect for this startup. Even after the system restarts, the IEOS program will still start. The way to prevent the IEOS program from starting up is as follows:

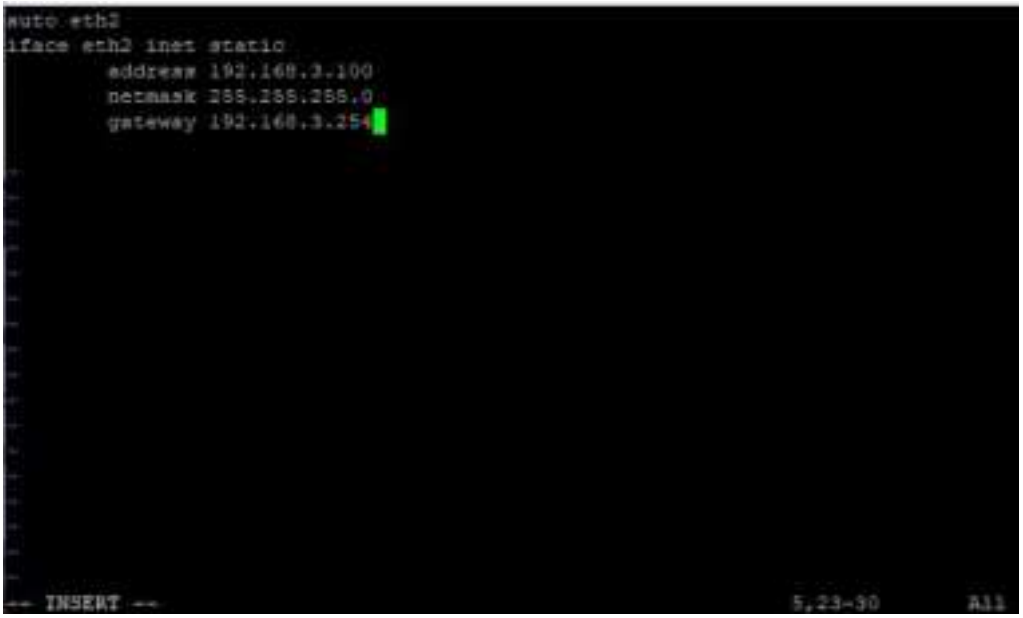
```
Systemctl disable ieos_daemon
```

Important note: After disabling IEOS, wireless networking functions such as dial-up and Wi Fi require users to implement them based on native Linux commands, and it is also impossible to remotely manage devices through the DeviceLive platform.

3.3.2.1 Network Management

3.3.2.1.1 Set a static IP address

If you want to set a static IP address for EC954-FQ38, modify the corresponding network configuration file by using the commands vim/etc/network/interfaces. d/eth1 or vim/etc/ network/interfaces. d/eth2 to set the default gateway, address, network, and subnet mask for the Ethernet interface. Here is an example of setting a static IP for the eth2 port:



After modifying the interface IP configuration, execute/etc/init.d/networking restart to restart the network service and make the configuration effective.

3.3.2.1.2 Set a dynamic IP address

If you want to set a dynamic IP address for EC954-FQ38, modify the corresponding network configuration file by using the command vim/etc/network/interfaces. d/eth1 or vim/etc/ network/interfaces. d/eth2, and set it to DHCP after inet to automatically obtain the IP address.

Here is an example of setting a dynamic IP for the eth1 port.

After modifying the interface IP configuration, execute/etc/init.d/networking restart to restart the network service and make the configuration effective.

3.3.2.2 System management

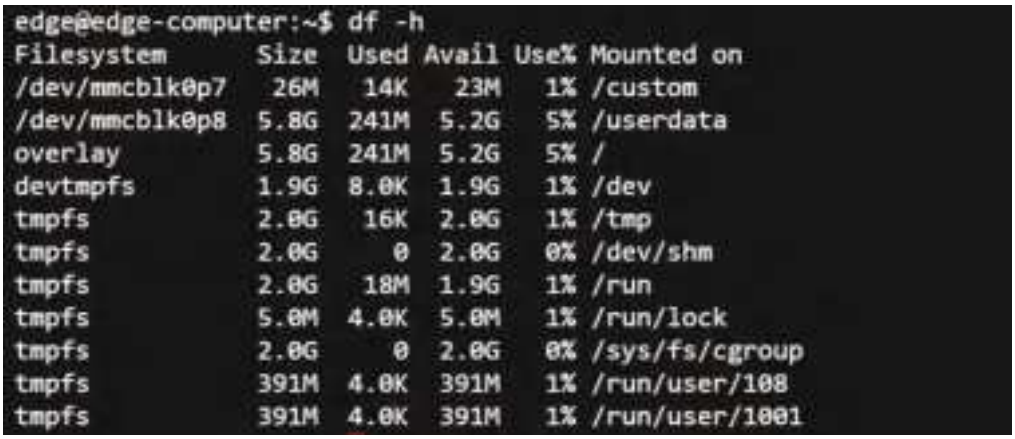
3.3.2.2.1 Querying Firmware Version

To check the computer firmware version of EC954-FQ38, please type:

By adding the - a option, you can see the complete version information:

3.3.2.2.2 Viewing available disk space

To determine the amount of available drive space, use the df command with the - h option. The system will return the amount of drive space decomposed by the file system. The available disk partition for users in EC954-FQ38 product is/dev/mmcblk0p8. Here is an example:



3.3.2.2.3 Query product model information

The devinfo tool can view product model information

```
edge@edge-computer:~$ sudo devinfo
model=EC942
alias=
serialnumber=CL9422343000019
partnumber=LQA8-W-G
```

3.3.2.2.4 Adjusting Time

EC954-FQ38 has two time settings. One is the system time, and the other is the RTC (Real Time Clock) time maintained by the hardware of EC954-FQ38. Use the date command to query the current system time or set a new system time. Use the hwclock command to query the current RTC time or set a new RTC time.

Use the command date MMDDhhmmYYYY to set the system time:

MM: Month

DD: Day

Hh: hour

Mm: minutes

YYYY: Year

```
edge@edge-computer:~$ sudo date 030115052023
Wed Mar  1 15:05:00 CST 2023
```

The following command can be used to set the RTC time to system time

```
edge@edge-computer:~$ sudo hwclock
2023-03-01 15:05:55.102061+08:00
```

Click on the following link to obtain more detailed information about dates and times:

https://www.debian.org/doc/manuals/system-administrator/ch-sysadmin-time.html

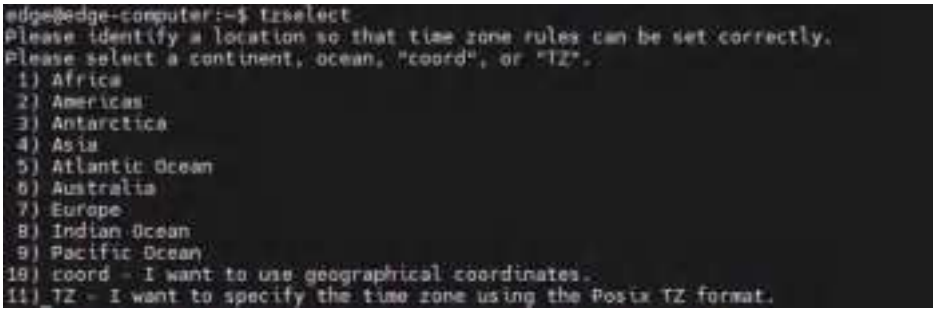
https://wiki.debian.org/DateTime

3.3.2.2.5 Setting Time Zone

There are two methods to configure the time zone of EC954-FQ38. One is to use the command tzselect. Another option is to use the/etc/localtime file.

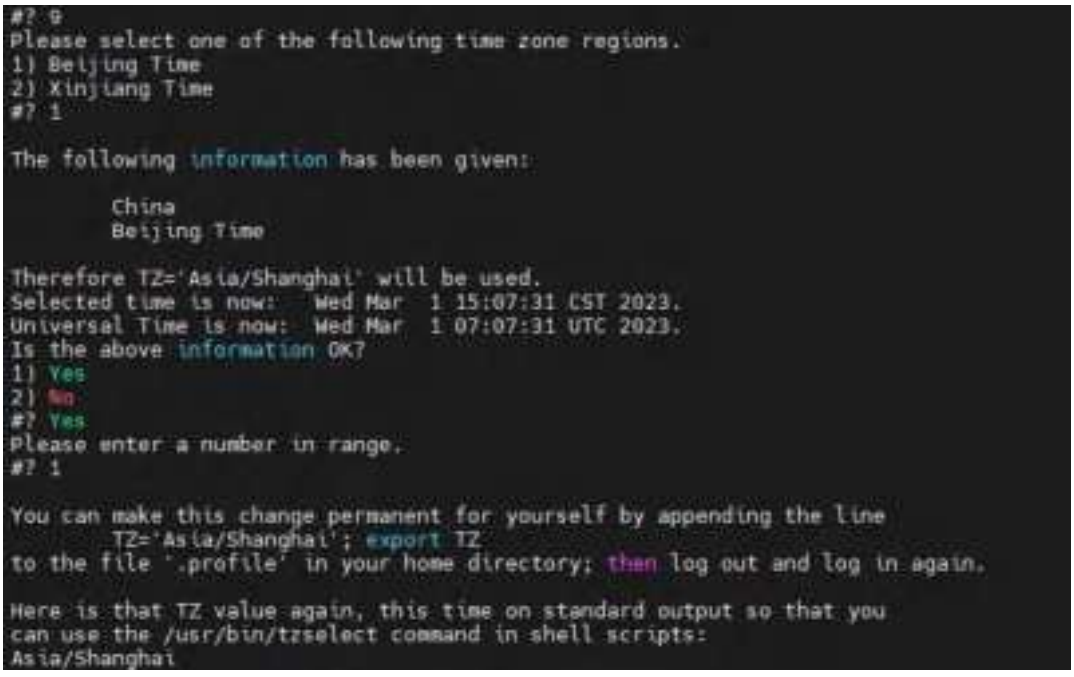
3.3.2.2.6 Using the tzselect command

After typing the tzselect command, you will enter the region selection interface. First, select the approximate region (divided by continent or ocean) and enter the number in front of the continent or ocean



Choose another country under that continent or ocean

Follow the above steps to obtain the Chinese time zone keyword Asia/Shanghai, and execute the following command to set the time zone



3.3.2.2.7 Using Localtime Files

The local time zone is stored in/etc/localtime, and if no value is set for the TZ environment variable, it is used by the GNU library for C (glibc). This file is either a copy of/usr/share/zoneinfo/file, or a symbolic link pointing to it. If EC954-FQ38 cannot find the/usr/share/zoneinfo/file, please download the time zone information file you need from the website (https:// www.iana.org/time-zones) And re link to the local time file in EC900.

Take care

After successfully downloading the required time zone information file, decompress it, and then use the zic command to compile and generate the corresponding binary file. The generated time zone file is "/usr/share/zoneinfo/custom time zone file name".

4 Advanced configuration of 4 peripheral interfaces

In this chapter, we will introduce the advanced configuration of the peripheral interface of the edge computer EC900 based on the Arm structure.

4.1 Serial port

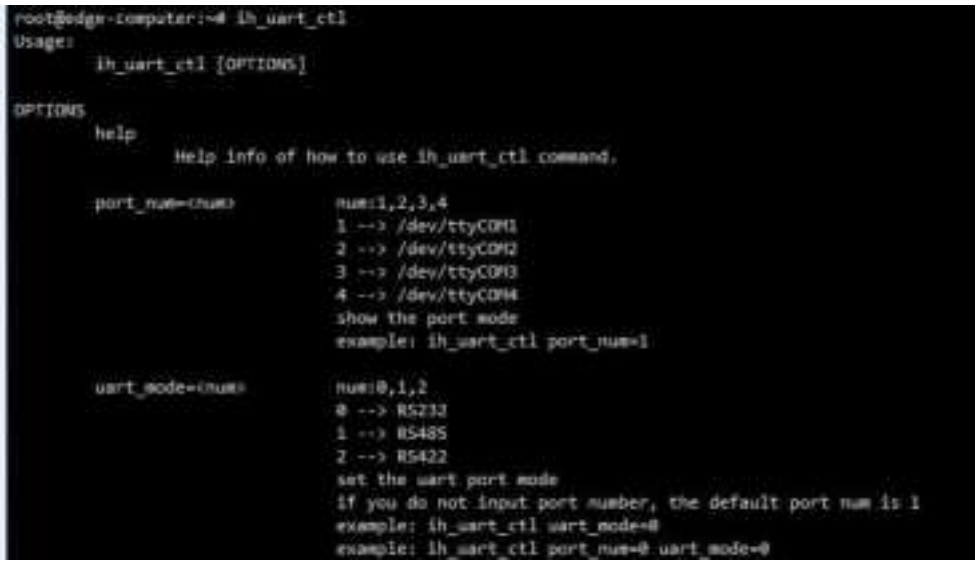
EC954-FQ38 has 8 serial ports, and the first 4 ports support multiple serial port modes including RS-232, RS-422, and RS-485. The default mode is RS-485, and the ih_uard_ctl command can be used to switch the serial port mode. The last four serial ports are fixed in RS-485 mode.

The device node corresponding to P1 is/dev/ttyCOM1

The device node corresponding to P2 is/dev/ttyCOM2

The device node corresponding to P3 is/dev/ttyCOM3

The device node corresponding to P4 is/dev/ttyCOM4



4.1.1 Changing Serial Port Settings

Viewing and Setting Serial Ports with the STTY Command

View detailed command content by typing sudo stty -- help:

```
edge@edge-computer:~$ sudo stty --help
Usage: stty [-F DEVICE | --file=DEVICE] [SETTING]...
  or:  stty [-F DEVICE | --file=DEVICE] [-a|--all]
  or:  stty [-F DEVICE | --file=DEVICE] [-g|--save]
Print or change terminal characteristics.

Mandatory arguments to long options are mandatory for short options too.
  -a, --all          print all current settings in human-readable form
  -g, --save         print all current settings in a stty-readable form
  -F, --file=DEVICE  open and use the specified DEVICE instead of stdin
      --help     display this help and exit
      --version  output version information and exit

Optional - before SETTING indicates negation.  An * marks non-POSIX
settings.  The underlying system defines which settings are available.

Special characters:
 * discard CHAR  CHAR will toggle discarding of output
   eof CHAR      CHAR will send an end of file (terminate the input)
   eol CHAR      CHAR will end the line
 * eol2 CHAR     alternate CHAR for ending the line
   erase CHAR    CHAR will erase the last character typed
   intr CHAR     CHAR will send an interrupt signal
   kill CHAR     CHAR will erase the current line
 * lnext CHAR    CHAR will enter the next character quoted
   quit CHAR     CHAR will send a quit signal
 * rprnt CHAR    CHAR will redraw the current line
   start CHAR    CHAR will restart the output after stopping it
   stop CHAR     CHAR will stop the output
   susp CHAR     CHAR will send a terminal stop signal
 * swtch CHAR    CHAR will switch to a different shell layer
 * werase CHAR   CHAR will erase the last word typed

Special settings:
   N             set the input and output speeds to N bauds
 * cols N        tell the kernel that the terminal has N columns
 * columns N     same as cols N
 * [-]drain      wait for transmission before applying settings (on by default)
   ispeed N      set the input speed to N
 * line N        use line discipline N
   min N         with -icanon, set N characters minimum for a completed read
   ospeed N      set the output speed to N
 * rows N        tell the kernel that the terminal has N rows
 * size          print the number of rows and columns according to the kernel
   speed         print the terminal speed
   time N        with -icanon, set read timeout of N tenths of a second

Control settings:
   [-]clocal     disable modem control signals
   [-]cread      allow input to be received
 * [-]crtscts    enable RTS/CTS handshaking
   csN           set character size to N bits, N in [5..8]
   [-]cstopb     use two stop bits per character (one with '-')
   [-]hup        send a hangup signal when the last process closes the tty
   [-]hupcl      same as [-]hup
```

```
   [-]parenb     generate parity bit in output and expect parity bit in input
   [-]parodd     set odd parity (or even parity with '-')
 * [-]cmspar     use "stick" (mark/space) parity
```

```
Input settings:
   [-]brkint     breaks cause an interrupt signal
   [-]icrnl      translate carriage return to newline
   [-]ignbrk     ignore break characters
   [-]igncr      ignore carriage return
   [-]ignpar     ignore characters with parity errors
 * [-]imaxbel    beep and do not flush a full input buffer on a character
   [-]inlcr      translate newline to carriage return
   [-]inpck      enable input parity checking
   [-]istrip     clear high (8th) bit of input characters
 * [-]iutf8      assume input characters are UTF-8 encoded
 * [-]iuclc      translate uppercase characters to lowercase
 * [-]ixany      let any character restart output, not only start character
   [-]ixoff      enable sending of start/stop characters
   [-]ixon       enable XON/XOFF flow control
   [-]parmrk     mark parity errors (with a 255-0-character sequence)
   [-]tandem     same as [-]ixoff

Output settings:
 * bsN           backspace delay style, N in [0..1]
 * crN           carriage return delay style, N in [0..1]
 * ffN           form feed delay style, N in [0..1]
 * nlN           newline delay style, N in [0..1]
 * [-]ocrnl      translate carriage return to newline
 * [-]ofdel      use delete characters for fill instead of NUL characters
 * [-]ofill      use fill (padding) characters instead of timing for delays
 * [-]olcuc      translate lowercase characters to uppercase
 * [-]onlcr      translate newline to carriage return-newline
 * [-]onlret     newline performs a carriage return
 * [-]onocr      do not print carriage returns in the first column
   [-]opost      postprocess output
 * tabN          horizontal tab delay style, N in [0..3]
 * tabs          same as tab0
 * -tabs         same as tab3
 * vtN           vertical tab delay style, N in [0..1]

Local settings:
   [-]crterase   echo erase characters as backspace-space-backspace
 * crtkill       kill all line by obeying the echoprt and echoe settings
 * -crtkill      kill all line by obeying the echoctl and echok settings
 * [-]ctlecho    echo control characters in hat notation ('^c')
   [-]echo       echo input characters
 * [-]echoctl    same as [-]ctlecho
   [-]echoe      same as [-]crterase
   [-]echok      echo a newline after a kill character
 * [-]echoke     same as [-]crtkill
   [-]echonl     echo newline even if not echoing other characters
 * [-]echoprt    echo erased characters backward, between '\' and '/'
 * [-]extproc    enable "LINEMODE"; useful with high latency links
 * [-]flusho     discard output
   [-]icanon     enable special characters: erase, kill, werase, rprnt
   [-]iexten     enable non-POSIX special characters
   [-]isig       enable interrupt, quit, and suspend special characters
```

```
   [-]noflsh     disable flushing after interrupt and quit special characters
 * [-]prterase   same as [-]echoprt
 * [-]tostop     stop background jobs that try to write to the terminal
 * [-]xcase      with icanon, escape with '\' for uppercase characters
```

```
Combination settings:
 * [-]LCASE       same as [-]lcase
   cbreak         same as -icanon
   -cbreak        same as icanon
   cooked         same as brkint ignpar istrip icrnl ixon opost isig
                  icanon, eof and eol characters to their default values
   -cooked        same as raw
   crt            same as echoe echoctl echoke
   dec            same as echoe echoctl echoke -ixany intr ^c erase 0177
                  kill ^u
 * [-]decctlq     same as [-]ixany
   ek             erase and kill characters to their default values
   evenp          same as parenb -parodd cs7
   -evenp         same as -parenb cs8
 * [-]lcase       same as xcase iuclc olcuc
   litout         same as -parenb -istrip -opost cs8
   -litout        same as parenb istrip opost cs7
   nl             same as -icrnl -onlcr
   -nl            same as icrnl -inlcr -igncr onlcr -ocrnl -onlret
   oddp           same as parenb parodd cs7
   -oddp          same as -parenb cs8
   [-]parity      same as [-]evenp
   pass8          same as -parenb -istrip cs8
   -pass8         same as parenb istrip cs7
   raw            same as -ignbrk -brkint -ignpar -parmrk -inpck -istrip
                  -inlcr -igncr -icrnl -ixon -ixoff -icanon -opost
                  -isig -iuclc -ixany -imaxbel -xcase min 1 time 0
   -raw           same as cooked
   sane           same as cread -ignbrk brkint -inlcr -igncr icrnl
                  icanon iexten echo echoe echok -echonl -noflsh
                  -ixoff -iutf8 -iuclc -ixany imaxbel -xcase -olcuc -ocrnl
                  opost -ofill onlcr -onocr -onlret nl0 cr0 tab0 bs0 vt0 ff0
                  isig -tostop -ofdel -echoprt echoctl echoke -extproc -flusho,
                  all special characters to their default values

Handle the tty line connected to standard input.  Without arguments,
prints baud rate, line discipline, and deviations from stty sane.  In
settings, CHAR is taken literally, or coded as in ^c, 0x37, 0177 or
127; special values ^- or undef used to disable special characters.

GNU coreutils online help: <https://www.gnu.org/software/coreutils/>
Report stty translation bugs to <https://translationproject.org/team/>
Full documentation at: <https://www.gnu.org/software/coreutils/stty>
or available locally via: info '(coreutils) stty invocation'
```

4.1.2 Viewing Serial Port Information:

```
edge@edge-computer:~$ sudo stty -a -F /dev/ttyCOM1
speed 9600 baud; rows 0; columns 0; line = 0;
intr = ^C; quit = ^\; erase = ^?; kill = ^U; eof = ^D; eol = <undef>; eol2 = <undef>; swtch = <undef>; start = ^Q; stop = ^S;
susp = ^Z; rprnt = ^R; werase = ^W; lnext = ^V; discard = ^O; min = 1; time = 0;
-parenb -parodd -cmspar cs8 hupcl -cstopb cread clocal -crtscts
-ignbrk -brkint -ignpar -parmrk -inpck -istrip -inlcr -igncr icrnl ixon -ixoff -iuclc -ixany -imaxbel -iutf8
opost -olcuc -ocrnl onlcr -onocr -onlret -ofill -ofdel nl0 cr0 tab0 bs0 vt0 ff0
isig icanon iexten echo echoe echok -echonl -noflsh -xcase -tostop -echoprt echoctl echoke -flusho -extproc
edge@edge-computer:~$
```

4.1.3 Set the baud rate of the COM1 serial port:

Sudo stty - F /dev/ttyCOM1 ispeed 9600 ospeed 9600 cs8

4.1.4 Setting the Baud Rate of COM2 Serial Port

Sudo stty - F /dev/ttyCOM1 ispeed 9600 ospeed 9600 cs8

4.1.5 Setting the Baud Rate of COM3 Serial Port

Sudo stty - F /dev/ttyCOM3 ispeed 9600 ospeed 9600 cs8

4.1.6 Setting the Baud Rate of COM4 Serial Port

Sudo stty - F /dev/ttyCOM4 ispeed 9600 ospeed 9600 cs8

Take care

Detailed information about the stty command can be found at the following link

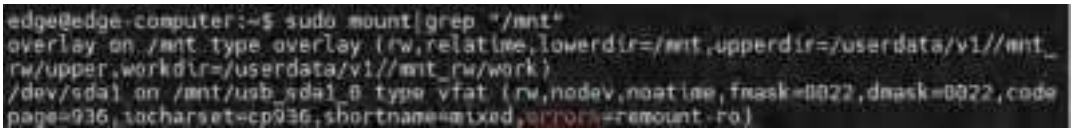
http://www.gnu.org/software/coreutils/manual/coreutils.html

4.2 USB interface

EC954-FQ38 provides two USB 2.0 Host interfaces, mainly used for expanding storage devices, connecting mice and keyboards

4.2.1 USB automatic mounting

EC954-FQ38 supports hot swapping of USB storage devices. It will automatically mount all partitions. EC954-FQ38 will partition all USB storage devices and mount them to the/mnt/path. The naming format for the mounting folder is usb1<node>_<num>. Among them,<node>is the device node name of the partition, and<num>can be a number from 0 to 9.

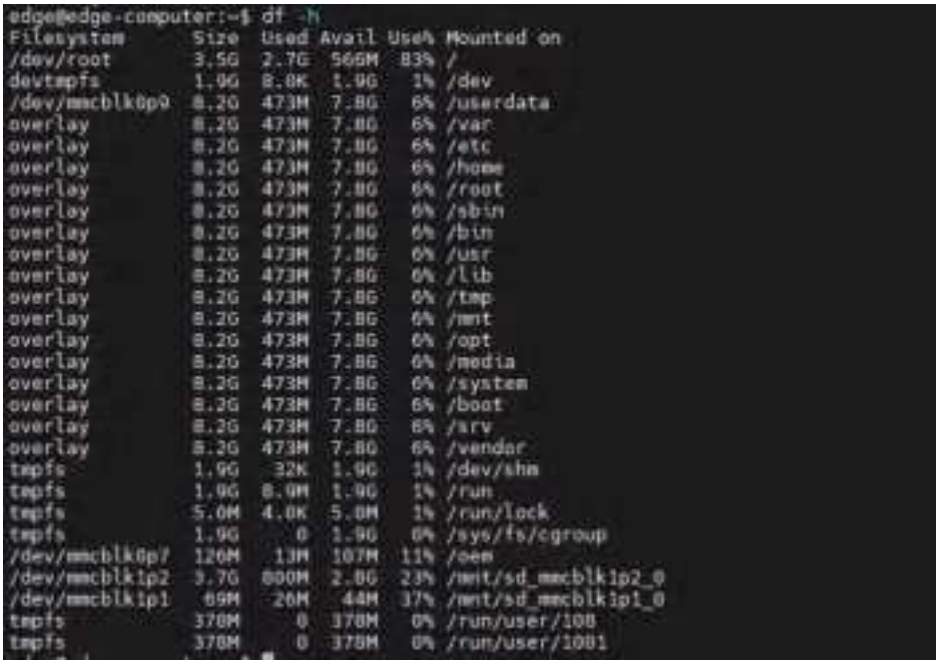


Take care

Before disconnecting a USB mass storage device, remember to enter the sync synchronization command to prevent data loss. When you disconnect the storage device, please exit from the/media/* directory. If you stay in/media/USB *, the automatic uninstallation process will fail. If this situation occurs, please type umount/media/USB * to manually uninstall the device

4.2.2 Automatic mounting of micro SD card

EC954-FQ38 supports micro SD storage cards but does not support hot swapping. It will automatically mount all partitions. EC954-FQ38 will partition all micro SD storage cards and mount them to the/mnt/path. The naming format for the mounting folder is sd_<node>_<num>. Among them,<node>is the device node name of the partition, and<num>is a number from 0 to 9.



4.2.3 mSATA hard drive automatic mounting

(1) Log in to the system, execute sudo fdisk - l, and locate your hard disk partition, as shown in the following image:/dev/sda1

```
edge@edge-computer:~$ sudo fdisk -l
Disk /dev/ram0: 4 MiB, 4194304 bytes, 8192 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 4096 bytes
I/O size (minimum/optimal): 4096 bytes / 4096 bytes


Disk /dev/sda: 119.2 GiB, 128035676160 bytes, 250069680 sectors
Disk model: Lenovo SSD SL700
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: dos
Disk identifier: 0x1a63708d

Device     Boot Start       End   Sectors   Size Id Type
/dev/sda1        2048 250069679 250067632 119.2G 83 Linux


Disk /dev/mmcblk0: 14.6 GiB, 15634268160 bytes, 30535680 sectors
Units: sectors of 1 * 512 = 512 bytes
Sector size (logical/physical): 512 bytes / 512 bytes
I/O size (minimum/optimal): 512 bytes / 512 bytes
Disklabel type: gpt
Disk identifier: 902C0000-0000-4864-8000-6B9300002304

Device           Start      End  Sectors  Size Type
/dev/mmcblk0p1   16384    24575     8192    4M unknown
/dev/mmcblk0p2   24576    32767     8192    4M unknown
/dev/mmcblk0p3   32768    98303    65536   32M unknown
/dev/mmcblk0p4   98304   163839    65536   32M unknown
/dev/mmcblk0p5  163840   229375    65536   32M unknown
/dev/mmcblk0p6  229376 10715135 10485760    5G unknown
/dev/mmcblk0p7 10715136 10977279   262144  128M unknown
/dev/mmcblk0p8 10977280 13074431  2097152    1G unknown
/dev/mmcblk0p9 13074432 30535615 17461184  8.3G unknown
```

(2) Format the partition to the desired file system, such as ext4

```
edge@edge-computer:~$ sudo mkfs.ext4 /dev/sda1
mke2fs 1.44.5 (15-Dec-2018)
Discarding device blocks: done
Creating filesystem with 31258454 4k blocks and 7815168 inodes
Filesystem UUID: 59e1a7cf-0044-4453-9886-518aee27fc2a
Superblock backups stored on blocks:
        32768, 98304, 163840, 229376, 294912, 819200, 884736, 1605632, 2654208,
        4096000, 7962624, 11239424, 20480000, 23887872

Allocating group tables: done
Writing inode tables: done
Creating journal (131072 blocks): done
Writing superblocks and filesystem accounting information: done
```

(3) Create a mount point, such as/mnt/sda1

(4) Edit the vi/etc/fstab file,
Add/dev/sda1/mnt/sda1 ext4 defaults, nofail, x-system. device timeout=1s 0 0 at the end of

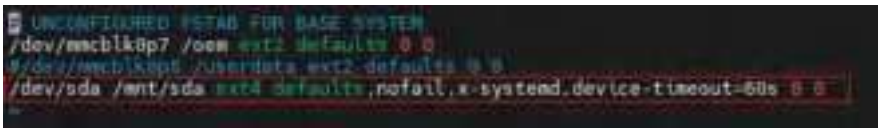
the line, as shown in the following figure:

/Dev/sda1: Device partition, user needs to configure according to actual situation

/Mnt/sda1: Mount point, user needs to configure according to actual situation

The file system format of the etx4 hard disk partition needs to be configured by the user according to the actual situation

Default, nofail, x-system. device timeout=1s 0 0 fixed configuration. It is recommended to use this configuration, and users can also modify it according to their needs.



4.3 CAN bus interface

The CAN port of EC954-FQ38 supports two CAN buses, with CAN1 corresponding to device can0 and CAN2 corresponding to device can1

4.3.1 Configure Connection CAN1 Interface

By default, the CAN port will be initialized. If any other configuration is required, please use the IP link command to check the CAN device. To check the status of the CAN device, use the IP link command:

To configure CAN devices, please use IP link set can0 down to first shut down the device

Sudo IP link set can0 down

Then configure the bit rate (the following is an example of a 125k bit rate):

Sudo IP link set can0 type can bitrate 125000

Finally, restart the device

Sudo IP link set can0 up

4.3.2 Configure Connection CAN2 Interface

By default, the CAN port will be initialized. If any other configuration is required, please use the IP link command to check the CAN device. To check the status of the CAN device, use the IP link command:

To configure CAN devices, please use IP link set can1 down to first shut down the device

Sudo IP link set can1 down

Then configure the bit rate (the following is an example of a 125k bit rate):

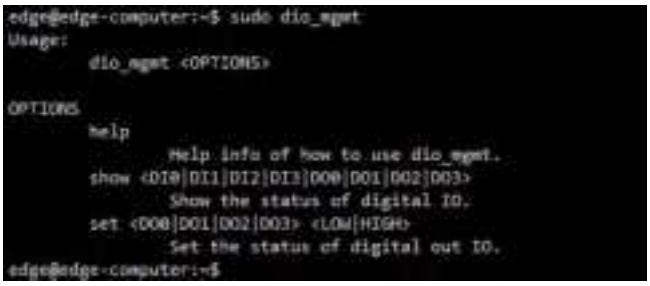
IP link set can1 type can bitrate 125000 dbitrate 1250000 fd on

Finally, restart the device

Sudo IP link set can1 up

4.4 IO debugging

EC954-FQ38 supports 4-way DI and 4-way DO. When you want to use the IO port, please type the dio_mgmt command to control the input and output of IO. Usage of dio_mgmt:



When you need to set a certain IO port to high or low, you can type the command dio_mgmt set D<I/O><number><HIGH/LOW>

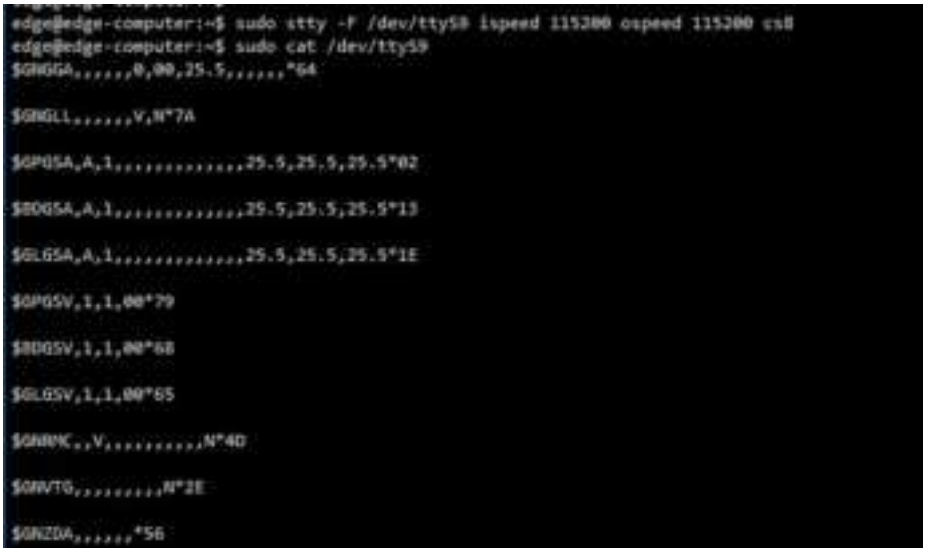
Print the level information of the corresponding IO port by typing dio_mgmt show D<I/O><number>.

4.5 GPS

Some EC900 models integrate GPS modules internally, and the data serial port nodes are/dev/ttyS9.

If you want to view detailed GPS information, there are two ways to view it:

1. Set up serial port nodes using STTY, type CAT to directly output source data



2. Type the gnss command to directly output parsed information such as time, longitude, and latitude

```
edge@edge-computer:~$ sudo gnss
```

4.6 Power on/off button

4.6.1 Shutdown of equipment

1. Press and hold the power button for 8 seconds to turn off the device

2. You can use Linux commands to shut down all software running on the device and stop the system. However, after running this command, major components such as CPU, RAM, and storage devices will power down.

```
edge@edge-computer:~$ sudo shutdown -h now
```

4.6.2 Starting the equipment

Short press the power on button, and the system will perform the power on operation.

5 Security

In this chapter, we will introduce the security mechanism of the edge computer EC900 based on ARM architecture.

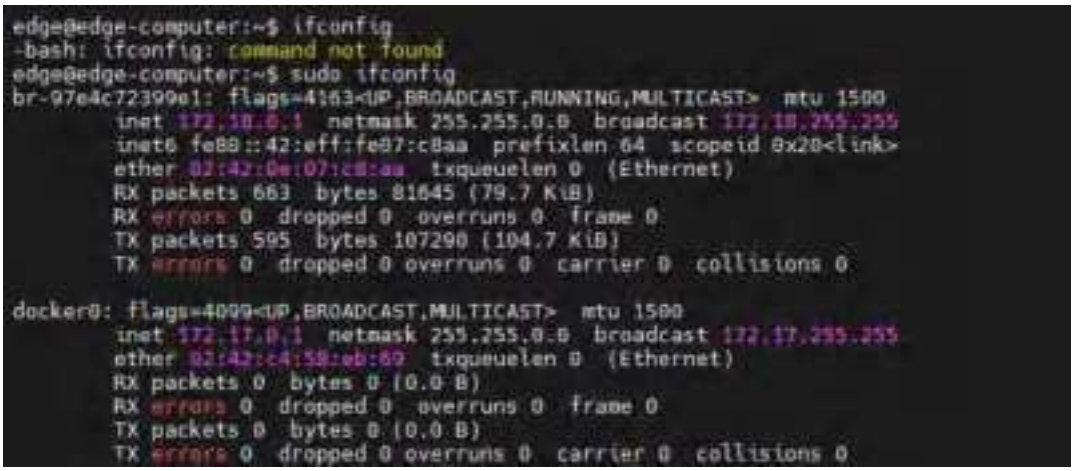
5.1 Sudo mechanism

In EC900, for better security, root users are prohibited from using it. Sudo is a program that allows system administrators to allow approved users to execute commands as root or other users. The most basic principle is to give as little privilege as possible to complete the work. Using sudo is safer than opening a session with root identity for many reasons, including:

- No need to know the root password (sudo will prompt the current user's password), ordinary user privileges can be granted

- It is easy to run commands that require privileges through sudo, and for the rest of the time, work as an unprivileged user to reduce the potential damage caused by incorrect operations.

- Some system level commands cannot be directly used by users, as shown in the following example output:



5.2 Firewall

Netfileter/iptables (hereinafter referred to as iptables) is an excellent and completely free packet filtering firewall tool that comes with the Nuix/Linux system. Its functions are very powerful, and it is very flexible to use. It can finely control the inflow, outflow, and flow of data packets through the server.

5.3 TPM2.0

TPM stands for Trusted Platform Module, which is a hardware security module designed to provide security and encryption capabilities for computer systems. It is a security microcontroller that can be embedded in computer systems or sold as a standalone hardware device. It includes an encryption coprocessor for storing encryption keys, digital certificates, and other secure data, as well as supporting multiple encryption algorithms and security protocols. On EC954-FQ38, the standard TPM2.0 protocol stack and TPM2.0 tools have been integrated for users to use.

6. System restoration to factory settings and updates

In this chapter, we will introduce how to restore the factory settings and update the edge computer EC900 based on the Arm structure.

6.1 Restoring Factory Settings

There are two methods to restore factory settings:
1. By typing a command, the system will automatically restart and restore factory settings.

2. Restore factory settings through buttons:

- Press and hold the factory reset button for 10-20 seconds, and you will see that the warning light is on for a long time.
- After the warning light stays on, release the factory reset button.
- After releasing the factory reset button, the error light flashes a few times before the system starts to restart and perform factory reset
- After the system restarts, the warning and error lights flash and the status goes out; After about 30 seconds, when both the warn and error lights stop flashing and the status starts flashing, the system will complete the factory reset.

6.2 System Upgrade

Prepare a USB flash drive (micro SD card). If the USB drive (SD card) has multiple partitions, please use the first partition. It is recommended not to create multiple partitions. The partition of the USB drive (SD card) needs to be in FAT32 format. This document takes upgrading EC954-V2.0.0.img as an example for explanation.

- Create an empty ec900_img directory in the root directory of the USB drive (SD card), and place the EC954-V2.0.0.img file and md5.txt file published by inhand in the ec900_img directory.
- Confirm that there is only the MD5 hash value in the EC954-V2.0.0.img line in the md5.txt file. EC954 does not support OTA upgrades for multiple IMG images.
- Exit the USB drive (SD card) normally on the computer. Be careful not to directly remove the USB drive, and choose the "Exit" or "Eject" operation on the desktop.
- Insert the USB flash drive (SD card) into the target EC900 device. The target device will automatically verify the EC954-V2.0.0.img file and perform an OTA upgrade. During the upgrade process, the WARN and ERROR lights will be displayed accordingly. After WARN and ERROR return to normal, the upgrade operation will be completed. Due to the large size of the img file and the long upgrade time, please be patient and wait.
- After the upgrade is completed, EC900 will write the key information during the upgrade to the log file in the ec900_img directory. Please review the relevant documents.

7 Programming Guide

EC900 provides a JSON format device information description file. Customers who need to operate peripherals such as IO, LED, serial port, etc. can obtain the device node information of these peripherals by querying the device description information file.

Device description information file path:/tmp/ieos/etc/systeminfo.json, the content is as follows:

```
{
   "device_info":{
```

```
"model_info":{
    "model":"EC954",
    "pn":"IO-FQ58",
    "sn":"EC9540000011111",
    "oem":"inhand",
    "features":";io;cell-FQ58;wlan;ble;gps;"
},
"software_info":{
    "boot_loader":"1.0.2",
    "kernel":"5.10.160-00001-g406d1811beab-dirty",
    "version":"V2.0.0-beta.1",
    "OS":"Debian GNU/Linux 11 (bullseye)"
},
"hardware_info":{
    "arch":"arm64",
    "soc":"rk3568",
    "interface":{
        "eth":[
            {
                "iface_name":"eth1",
                "iface_mac":"00:33:44:11:00:01"
            },
            {
                "iface_name":"eth2",
                "iface_mac":"00:33:44:11:00:02"
            },
            {
                "iface_name":"eth3",
                "iface_mac":"00:33:44:11:00:03"
            },
            {
                "iface_name":"eth4",
                "iface_mac":"00:33:44:11:00:04"
            }
        ],
        "wlan":[
            {
                "iface_name":"wlan0",
                "iface_mac":"94:A4:08:8A:30:CD"
            },
            {
                "iface_name":"wlan1",
                "iface_mac":"96:A4:08:8A:30:CD"
            }
        ],
        "ble":[
        ]
    },
    "gpio":[
        {
            "gpio_name":"cellular_power",
            "dev_node":"/sys/class/gpio/gpio0"
        },
```

```
    {
        "gpio_name":"sim_switch",
        "dev_node":"/sys/class/gpio/gpio19"
    },
    {
        "gpio_name":"msata_power",
        "dev_node":"/sys/class/gpio/gpio20"
    },
    {
        "gpio_name":"gnss_power",
        "dev_node":"/sys/class/gpio/gpio110"
    },
    {
        "gpio_name":"ble_power",
        "dev_node":"/sys/class/gpio/gpio220"
    }
],
"user_key":[
    {
        "user_key_name":"USER",
        "dev_node":"/sys/class/gpio/gpio95"
    }
],
"uart":[
    {
        "uart_name":"P1",
        "dev_node":"/dev/ttyO1"
    },
    {
        "uart_name":"P2",
        "dev_node":"/dev/ttyO2"
    },
    {
        "uart_name":"P3",
        "dev_node":"/dev/ttyO3"
    },
    {
        "uart_name":"P4",
        "dev_node":"/dev/ttyO4"
    },
    {
        "uart_name":"P5",
        "dev_node":"/dev/ttyO5"
    },
    {
        "uart_name":"P6",
        "dev_node":"/dev/ttyO6"
    },
    {
        "uart_name":"P7",
        "dev_node":"/dev/ttyO7"
    },
    {
```

```
        "uart_name":"P7",
        "dev_node":"/dev/ttyO8"
    }
],
"io":{
    "di":[
        {
            "di_name":"DI1",
            "dev_node":"/sys/class/gpio/gpio487"
        },
        {
            "di_name":"DI2",
            "dev_node":"/sys/class/gpio/gpio488"
        },
        {
            "di_name":"DI3",
            "dev_node":"/sys/class/gpio/gpio489"
        },
        {
            "di_name":"DI4",
            "dev_node":"/sys/class/gpio/gpio490"
        }
    ],
    "do":[
        {
            "di_name":"DO1",
            "dev_node":"/sys/class/gpio/gpio491"
        },
        {
            "di_name":"DO2",
            "dev_node":"/sys/class/gpio/gpio492"
        },
        {
            "di_name":"DO3",
            "dev_node":"/sys/class/gpio/gpio493"
        },
        {
            "di_name":"DO4",
            "dev_node":"/sys/class/gpio/gpio494"
        }
    ]
},
"led":[
    {
        "led_name":"USER1",
        "dev_node":"/sys/class/leds/user1"
    },
    {
        "led_name":"USER2",
        "dev_node":"/sys/class/leds/user2"
    },
    {
        "led_name":"4G/5G",
```

```
            "dev_node":"/sys/class/leds/cell"
        },
        {
            "led_name":"SIM1",
            "dev_node":"/sys/class/leds/sim1"
        },
        {
            "led_name":"SIM2",
            "dev_node":"/sys/class/leds/sim2"
        },
        {
            "led_name":"WARN",
            "dev_node":"/sys/class/leds/warn"
        },
        {
            "led_name":"ERROR",
            "dev_node":"/sys/class/leds/error"
        },
        {
            "led_name":"STATUS",
            "dev_node":"/sys/class/leds/status"
        },
        {
            "led_name":"L1",
            "dev_node":"/sys/class/leds/level1"
        },
        {
            "led_name":"L2",
            "dev_node":"/sys/class/leds/level2"
        },
        {
            "led_name":"L3",
            "dev_node":"/sys/class/leds/level3"
        }
      ]
    }
  }
}
```


7.1 IO Programming Guide

At present, there are a total of 8 IO interfaces on the device: for example, DI0~DI3 on the device panel have 4 input pins; DO0~DO3 have 4 output pins.

According to the device description information file/tmp/ieos/etc/systeminfo.json, the IO device nodes can be obtained as follows:

DI0~DI3-- **sys/class/gpio/gpio487~sys/class/gpio/gpio490**

DO0~DO3-- **sys/class/gpio/gpio491~sys/class/gpio/gpio494**

When you need to program IO interfaces, simply operate on the value value value under the backend device node (**sys/class/gpio/gpioxxx/value**)

Case:

When DO0 needs to output high voltage, it can directly **write 1** to **sys/class/gpio/gpio491/value**

Echo 1>/sys/class/gpio/gpio491/value

When you need to check the level of DI0, you can also directly check the value of **sys/class/gpio/gpio487/value**

Cat/sys/class/gpio/gpio487/value

Complete shell script:

```
#!/bin/bash

gpio491="/sys/class/gpio/gpio491/value"
gpio492="/sys/class/gpio/gpio492/value"
gpio493="/sys/class/gpio/gpio493/value"
gpio492="/sys/class/gpio/gpio494/value"
# To output a high level on DO0, you can directly write a '1' to sys/class/gpio/gpio491/value.
if [ -f "$gpio491" ]; then
    echo 1 > /sys/class/gpio/gpio491/value
else
    echo "no file exit "$gpio491
fi

# To output a low level on DO1, you should write '0' to sys/class/gpio/gpio491/value.
if [ -f "$gpio492" ]; then
    echo 0 > $gpio492
else
    echo "no file exit "$gpio492
fi

gpio487="/sys/class/gpio/gpio487/value"
gpio488="/sys/class/gpio/gpio488/value"
gpio489="/sys/class/gpio/gpio489/value"
gpio490="/sys/class/gpio/gpio490/value"
# To check the level of DI0, you can also directly view the value of `sys/class/gpio/gpio487/value`.
if [ -f "$gpio487" ]; then
    cat $gpio487
else
    echo "no file exit "$gpio487
fi
```

7.2 Led Programming Guide

On the device, users can use two lights, USER1 and USER2, for status prompts. Please check the light label to confirm the positions of USER1 and USER2 lights.

According to the device description information file/tmp/ieos/etc/systeminfo.json, it can be obtained that the USER1 and USER2 device nodes are:

User1:/sys/class/LEDs/user1

User2:/sys/class/LEDs/user2

There are some control files in the sys/class/leds/user1 directory used to control the properties and status of LEDs:

/Sys/class/leds/user1/brightness: This file is used to control whether the USER1 light is on or off. Writing 1 means it is always on, and writing 0 means it is always off.

/Sys/class/leds/user1/trigger: The trigger for the LED light, which can be written as timer to indicate the timer is triggered, and written as none to indicate the cancellation of the trigger.

/Sys/class/leds/user1/delay_on: This file represents the time when the LED light is on, in milliseconds.

/Sys/class/leds/user1/delayed off: This file represents the time when the LED light went out, in milliseconds.

If the trigger is configured for timed triggering, the value in brightness will no longer take effect and will automatically become 0.

Replacing user1 with user2 in the file path controls the operation of the USER2 light.

case:

When the USER1 light needs to stay on, write 1 to the brightness file

Echo 1>/sys/class/LEDs/user1/brightness

When the USER1 light needs to flash, write the timer to the trigger file and control the on and off times through delay_on and delay_off

```
# Start Timer
echo timer > /sys/class/leds/user1/trigger

# Light for 1 second
echo 1000 > /sys/class/leds/user1/delay_on

# Off for 1 second
echo 1000 > /sys/class/leds/user1/delay_off
```

Complete shell script:

```
#!/bin/bash

USER1_BRIGTHNESS="/sys/class/leds/user1/brightness"
USER1_TRIGGER="/sys/class/leds/user1/trigger"
USER1_DELAY_ON="/sys/class/leds/user1/delay_on"
USER1_DELAY_OFF="/sys/class/leds/user1/delay_off"

USER2_BRIGTHNESS="/sys/class/leds/user2/brightness"
USER2_TRIGGER="/sys/class/leds/user2/trigger"
```

```
USER2_DELAY_ON="/sys/class/leds/user2/delay_on"
USER2_DELAY_OFF="/sys/class/leds/user2/delay_off"


# Light Up USER1 LED
if [ -f "$USER1_BRIGTHNESS" ]; then
    echo 1 > $USER1_BRIGTHNESS
else
    echo "no file exit "$USER1_BRIGTHNESS
fi

# Light Up USER2 LED
if [ -f "$USER2_BRIGTHNESS" ]; then
    echo 1 > $USER2_BRIGTHNESS
else
    echo "no file exit "$USER2_BRIGTHNESS
fi

# Set USER1 LED to Blink
if [ -f "$USER1_TRIGGER" ]; then
    echo timer > $USER1_TRIGGER
else
    echo "no file exit "$USER1_TRIGGER
fi

# Set USER2 LED to Blink
if [ -f "$USER2_TRIGGER" ]; then
    echo timer > $USER2_TRIGGER
else
    echo "no file exit "$USER2_TRIGGER
fi

# Set USER1 LED to Illuminate for 1000ms
if [ -f "$USER1_DELAY_ON" ]; then
    echo 1000 > $USER1_DELAY_ON
else
    echo "no file exit "$USER1_DELAY_ON
fi

# Set USER1 LED to Turn Off for 1000ms
if [ -f "$USER1_DELAY_OFF" ]; then
    echo 1000 > $USER1_DELAY_OFF
else
    echo "no file exit "$USER1_DELAY_OFF
```

```
fi

# Set USER2 LED to Illuminate for 1000ms
if [ -f "$USER2_DELAY_ON" ]; then
    echo 1000 > $USER2_DELAY_ON
else
    echo "no file exit "$USER2_DELAY_ON
fi

# Set USER2 LED to Turn Off for 1000ms
if [ -f "$USER2_DELAY_OFF" ]; then
    echo 1000 > $USER2_DELAY_OFF
else
    echo "no file exit "$USER2_DELAY_OFF
fi

# Disable USER1 LED Blinking
if [ -f "$USER1_TRIGGER" ]; then
    echo none > $USER1_TRIGGER
else
    echo "no file exit "$USER1_TRIGGER
fi

# 关Disable USER2 LED Blinking
if [ -f "$USER2_TRIGGER" ]; then
    echo none > $USER2_TRIGGER
else
    echo "no file exit "$USER2_TRIGGER
fi
```

7.3 Cross compilation

The user's own C/C++program can be cross compiled using a cross compilation toolchain on the development machine, and then the target file can be uploaded to the EC954 device for execution.

Cross compilation tool compressed package: gcc-linaro-6.3.1-2017.05-x86_64-arch64 Linux gnu.tar.gz

Method for configuring environment variables for cross compilation toolchain:

- Unzip gcc-linaro 6.3.1-2017.05-x86_64-arch64 Linux gnu. tar. gz to/opt path on the development machine (you can also unzip to other paths, make corresponding adjustments when setting the PATH environment variable in step 2)
- Edit the~/. bashrc file and add a line at the end of the file with PATH=$PATH:/opt/gcc

linaro 6.3.1-2017.05-x86_64-arch64 Linux gnu/bin

- Execute source~/. bashrc to make the environment variables effective on the current terminal; The newly opened terminal will automatically take effect.

Using the classic Hello World program as an example, create the following directory and files

```
mkdir ~/example
touch ~/example/hello.c
touch ~/example/Makefile
```

~/The content of the example/hello. c file is as follows:

```
#include <stdio.h>

int main(void)
{
	printf("hello, world!\n");
	return 0;
}
```

~/The content of the example/Makefile file is as follows:

```
# Define Target Filename and Source Filename
TARGET  := hellworld
DIRS    := $(shell find . -maxdepth 3 -type d)
SRCS    := $(foreach dir,$(DIRS),$(wildcard $(dir)/*.c))
OBJS    := $(SRCS:.c=.o)


CC=aarch64-linux-gnu-gcc

# Define Compiler and Compilation Options
CFLAGS  := -Wall -Wextra -g -Wno-unused-parameter

# Specify Default Target
all: $(TARGET)

# Declare Dependencies of Target Files and Compilation Commands
$(TARGET): $(OBJS)
	$(CC) $(CFLAGS) $(LIBS) $^ -o $@

# Formulate the Command to Compile Source Files into Target Files
%.o: %.c
	$(CC) $(CFLAGS) $(LIBS) -c $< -o $@

# Establish the Command to Remove Temporary Files
clean:
	rm -f $(TARGET) $(OBJS)

# Declare Pseudo-Target ".PHONY"
.PHONY: all clean
```

FCC STATEMENT

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two

conditions:

(1) This device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause

undesired operation.

NOTE 1: This equipment has been tested and found to comply with the limits for a Class B

digital device , pursuant to part 15 of the FCC Rules. These limits are designed to provide

reasonable protection against harmful interference in a residential installation. This equipment

generates, uses and can radiate radio frequency energy and, if not installed and used in

accordance with the instructions, installed and used in accordance with the instructions, may

cause harmful interference to radio communications. However, there is no guarantee that

interference will not occur in a particular installation. If this equipment does cause harmful

interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.

- Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/TV technician for help.

NOTE 2: Any changes or modifications to this unit not expressly approved by the party

responsible for compliance could void the user's authority to operate the equipment.

RF Exposure

The equipment complies with FCC radiation exposure limits set forth for an uncontrolled

environment. This device should be installed and operated with minimum distance 20cm

between the radiator & your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or

transmitter. The availability of some specific channels and/or operational frequency bands is

country dependent and firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

IC STATEMENT

This device complies with Industry Canada license-exempt RSS standard(s): Operation is

subject to the following Two conditions:

(1) this device may not cause interference, and

(2) This device must accept any interference, including interference that may cause

undesired operation

of the device.

Le present appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio

exempts de licence. L'exploitation est autorisée aux deux conditions suivantes :

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareildoit accepter tout brouillage radioélectrique subi, même si le

brouillage est susceptible d'en compromettre le fonctionnement.

CAN ICES-3 (B)

Avis d’Industrie Canada

Le présent appareil est conforme aux CNR d'industrie Canada applicables aux appareils radio

exem pts de licence L'exploitation est autorisée aux deux conditions suivantes:

1) l'appareil ne doit pas produire de brouillage; et

2) l'utillsateur de l'appareil doit accepterbrouillage radioélectrique subi meme si le brouillage

est susceptible d'encompromettre le fonctionnement. mauvais fonctionnement de l'appareil.

Cet appareil numériquie de la classe B est conforme à la norme NMB-003 du Canada.

CAN NMB-3 (B)

Radiation Exposure Statement:

This equipment complies with IC radiation exposure limits set forth for an uncontrolled

environment. This equipment should be installed and operated with minimum distance 20cm

between the radiator & your body.

Déclaration d'exposition aux radiations:

Cet équipement est conforme aux limites d'exposition aux rayonnements IC établies pour un

environnement non contrôlé. Cet équipement doit être installé et utilisé avec un minimum de

20cm de distance entre la source de rayonnement et votre corps.