PUSR

Linux Development Manual

Internet of Things (IoT) Controller

SH800

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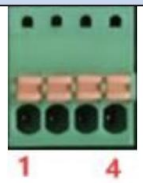
Content

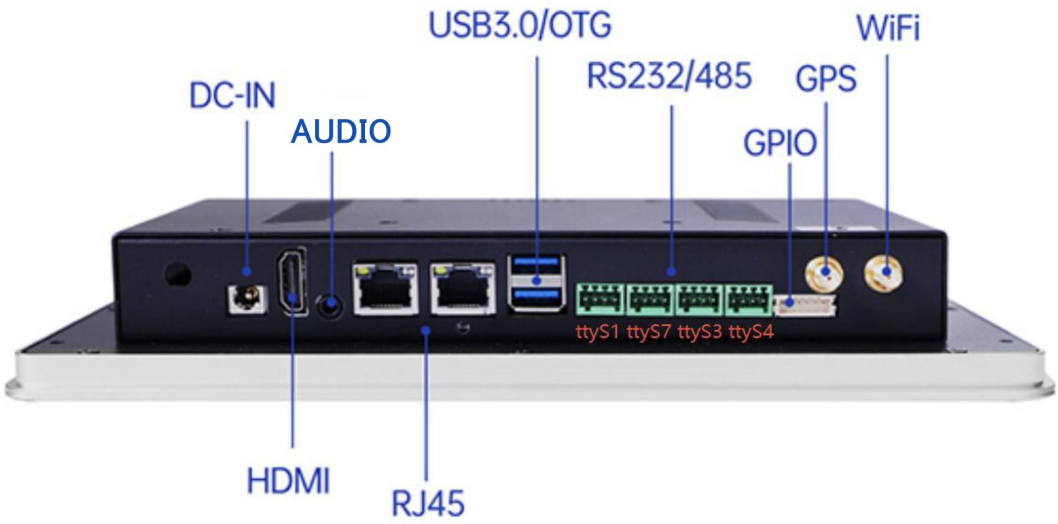
1. SH800 Hardware Interfaces

Description of serial port driver identification:

Interface	Driver Identifier
RS485-1	ttyS1
RS485-2	ttyS7
RS232-1	ttyS3
RS232-2	ttyS4

Details of the RS485/RS232 connector: the interface pin spacing is 2.0MM

NO.	Definition	Attribute	Description	
1	3.3V	Output	3.3V voltage output	
2	TX/A	Output	Transmit（TX/A）	
3	RX/B	Input	Receive（RX/B）	
4	GND	Ground	Ground	



A demo for serial port transmission and reception is provided under the USR-EG828 directory: EG828_Uart_Rev.c. and EG828_Uart_Send.c.

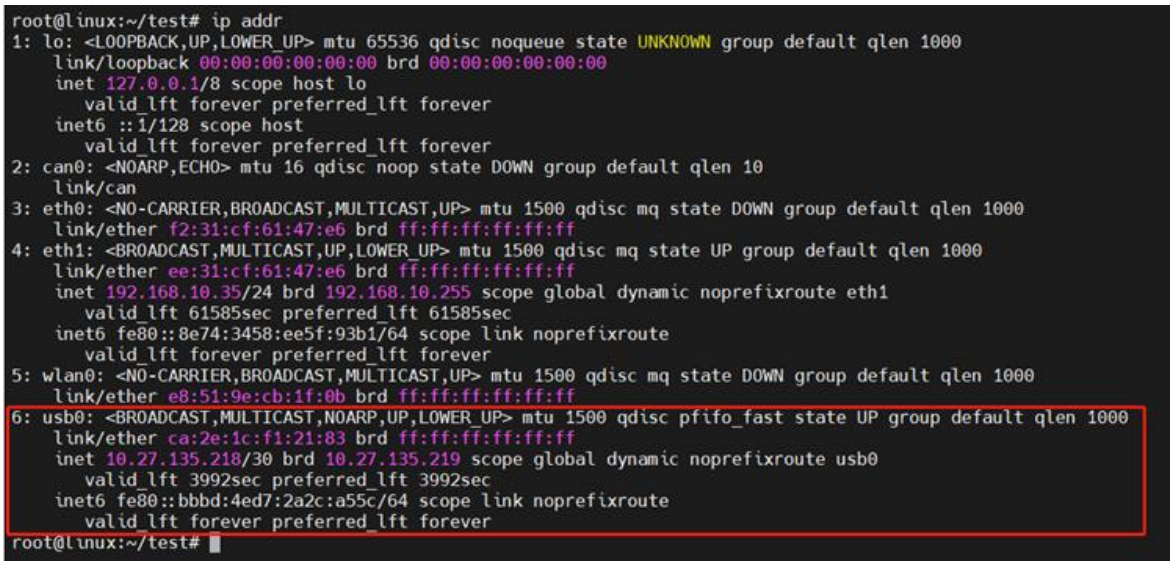
2. General Interfaces

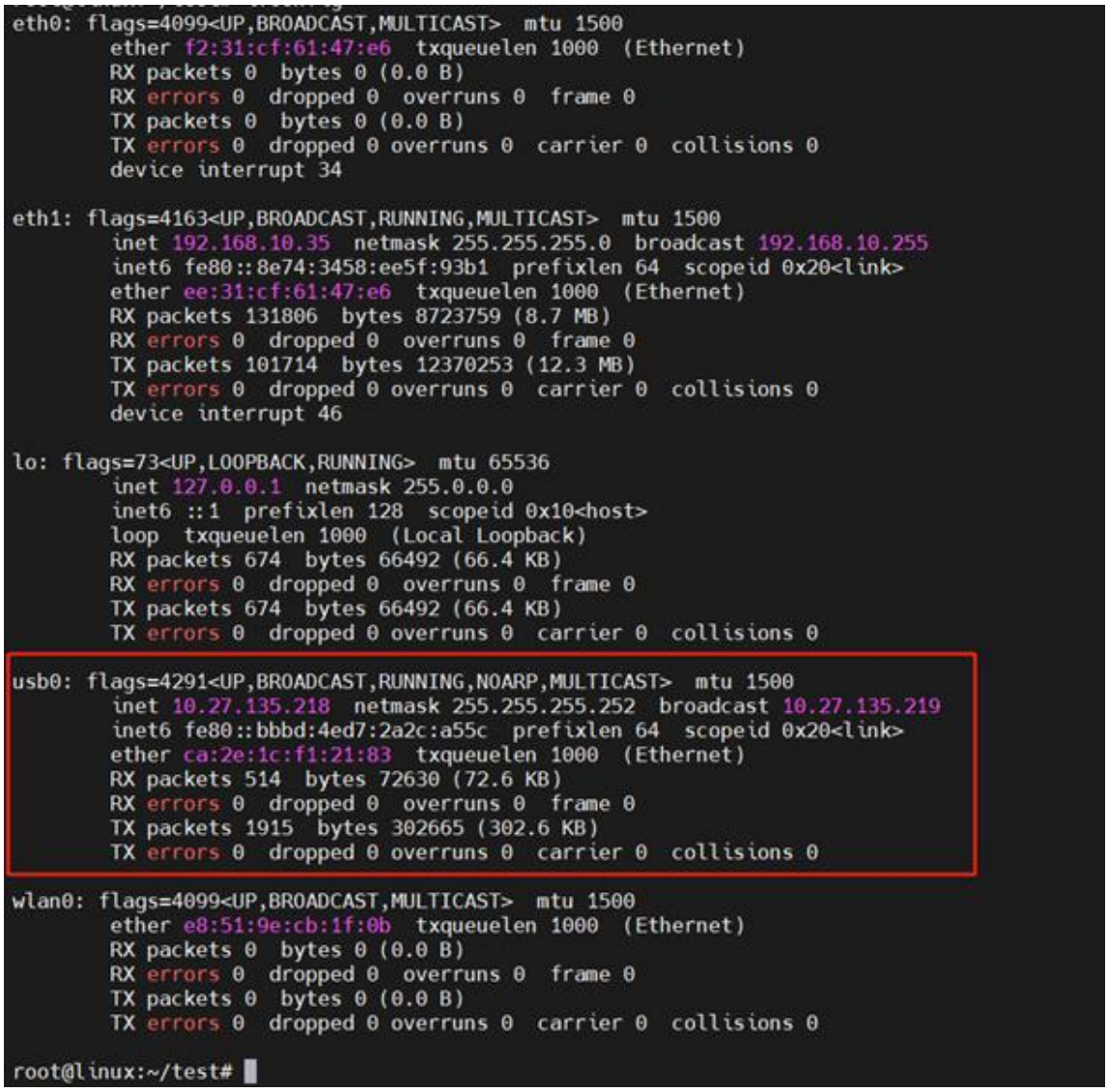
2.1. Cellular Network (USR-SH800-EW version don’t support)

Cellular networks include 4G and 5G. After connecting to the carrier network, data is transmitted via the carrier’s public or private network. Cellular networks connect automatically by default. Use the following commands for verification:

Note: If using a carrier-specific SIM card (private network), configure APN parameters manually.

Command	Interface
ifconfig	Wwan OR usb0
ip addr	Wwan OR usb0





2.2. SIM card ICCID Query

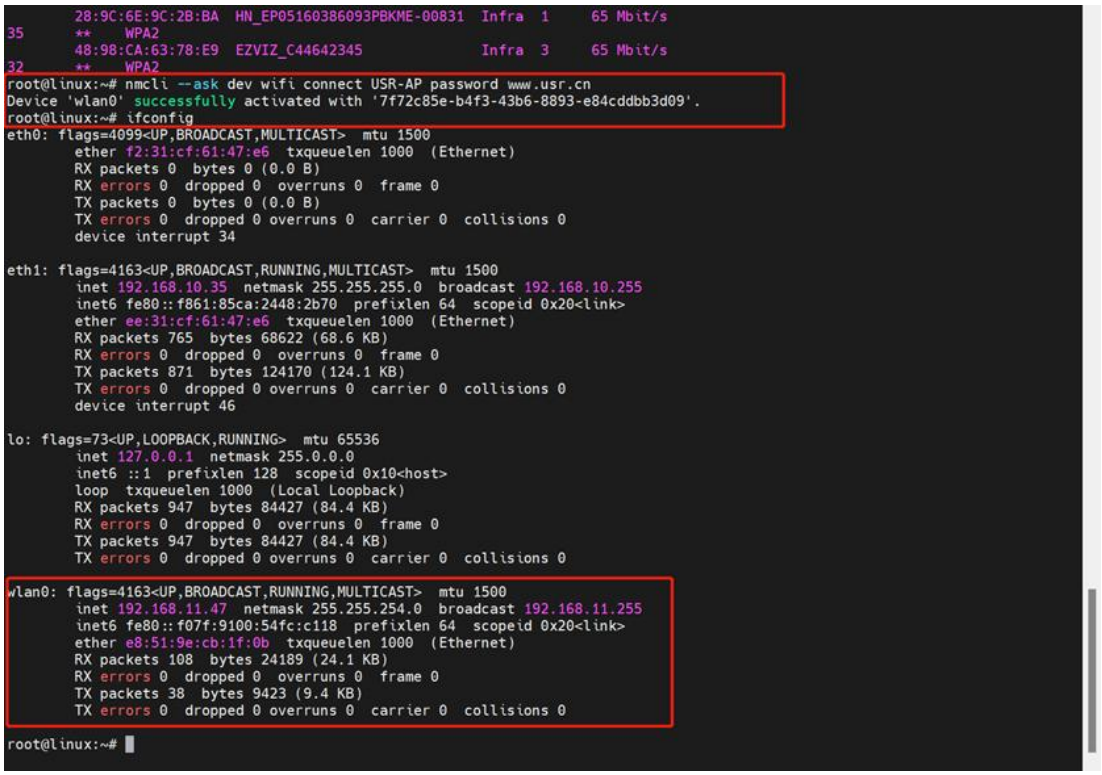
The ICCID is the SIM card number used for top-up. For the secondary development, you can query the ICCID using the following commands:

Command	Function
cat /dev/ttyUSB2 &	Enable echo
echo -e "at+qdsim=1\r\n" > /dev/ttyUSB2	Switch SIM card，0 as card 1, 1 as card 2
echo -e "at+qccid\r\n" > /dev/ttyUSB2	Query ICCID of SIM card

2.3. WIFI

SH800 supports STA mode. Connect to an AP using the following commands:

Command	Function
nmcli dev wifi list	Scan WiFi AP
nmcli --ask dev wifi connect <SSID> password <password>	Connect to a WiFi AP
ifconfig	Query network status (WLAN0)
nmcli device disconnect wlan0	Disconnect WiFi
nmcli connection delete id <SSID>	Clear WiFi configuration



2.4. GPS

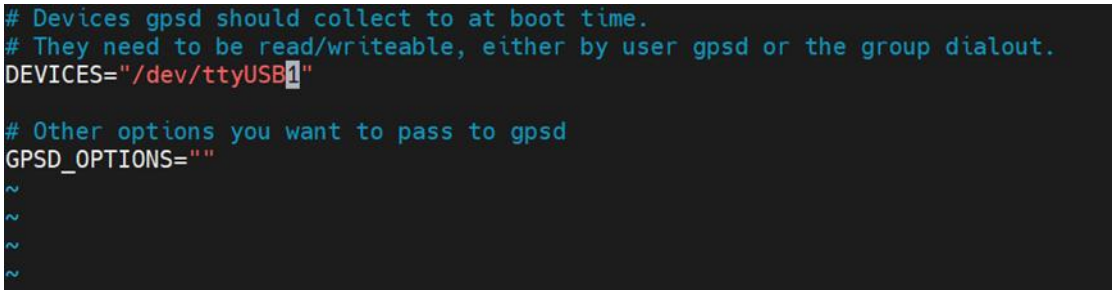
USR-SH800 supports GPS feature. Obtain GPS data as follows:

Command	Function
apt-get install gpsd gpsd-clients	Install GPSD Client
vim /etc/default/gpsd	Modify GPS Interface
echo -ne "at+qgps=1\r\n" > /dev/ttyUSB2	Enable GPS function
cgps -s	View positioning data

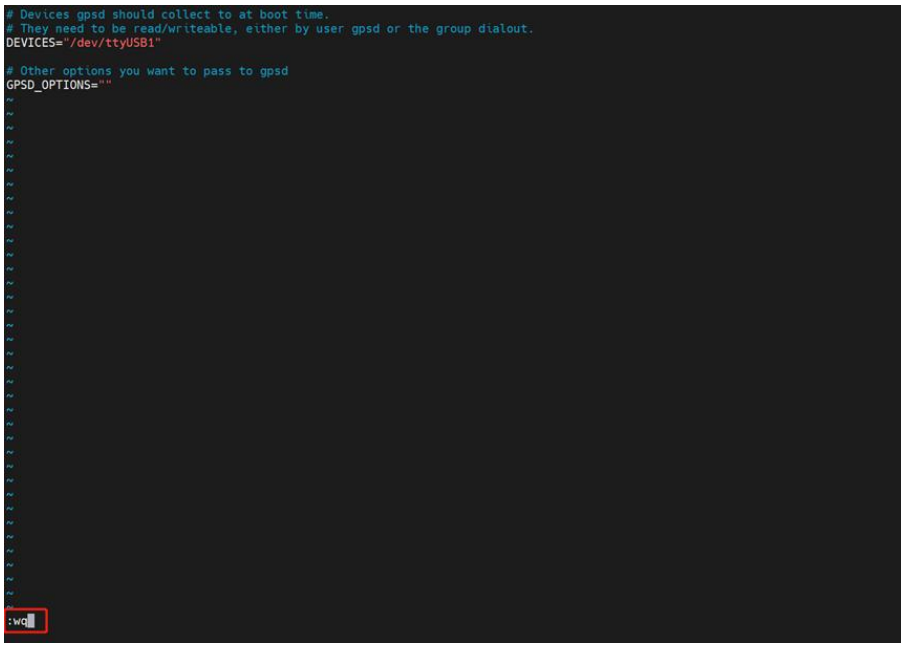
Steps:

1. Install GPSD Client: apt-get install gpsd gpsd-clients
2. Modify GPS interface:

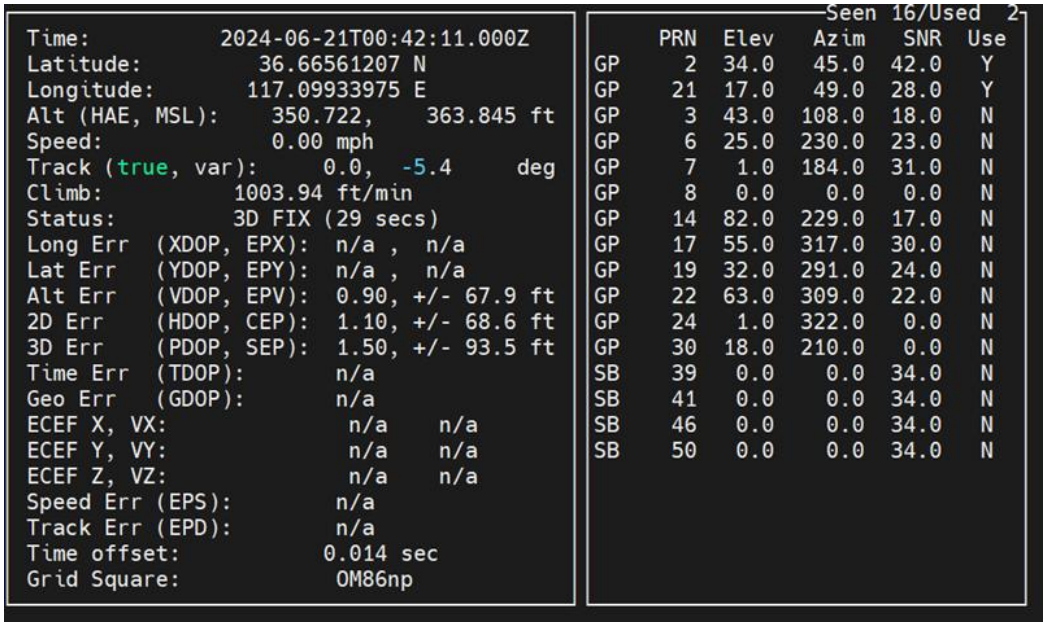
   Open the **gpsd** file by running **vim /etc/default/gpsd**. Then, press **i** to enter the insert mode. After that, change the information interface to USB1. The specific details are shown in the figure below.



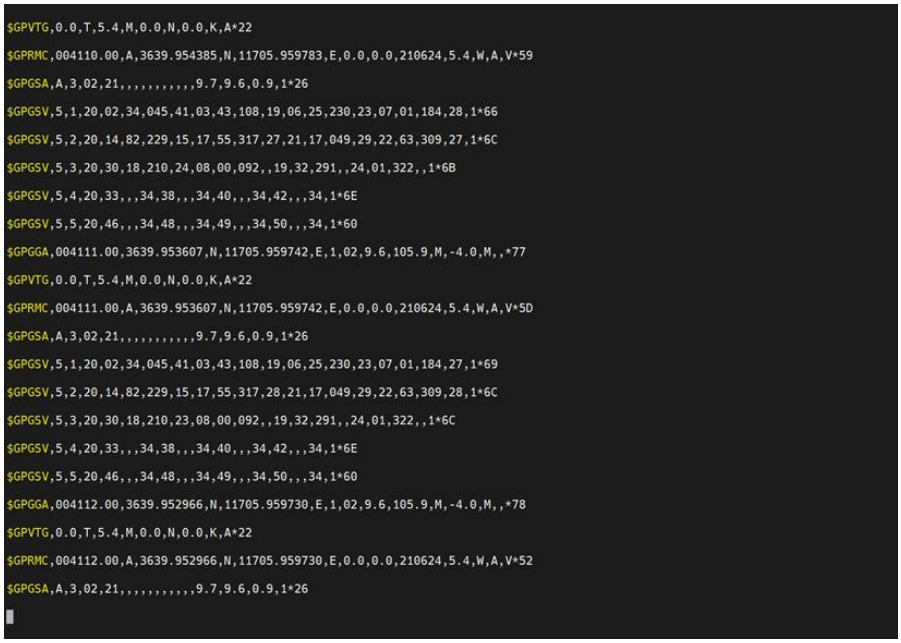
3. After the modification is completed, hold down **Ctrl + X** to save (It's best to press it twice) Then, press the **esc** key to exit the input mode. Enter **:wq** to save the file and return to the command interface.



4. Before turning on the GPS, first ensure that the command channel is clear. Execute the command **cat /dev/ttyUSB2** to check if the channel is working properly. If you receive a command echo, it means the channel is normal, as shown in the figure below. Then, exit to the command mode.
5. Execute the command **echo -ne "at+qgps=1\r\n" > /dev/ttyUSB2** to turn on the GPS function
6. Execute the command **cgps -s** to enter the GPS information display interface. After waiting for a while, the GPS positioning information will appear.



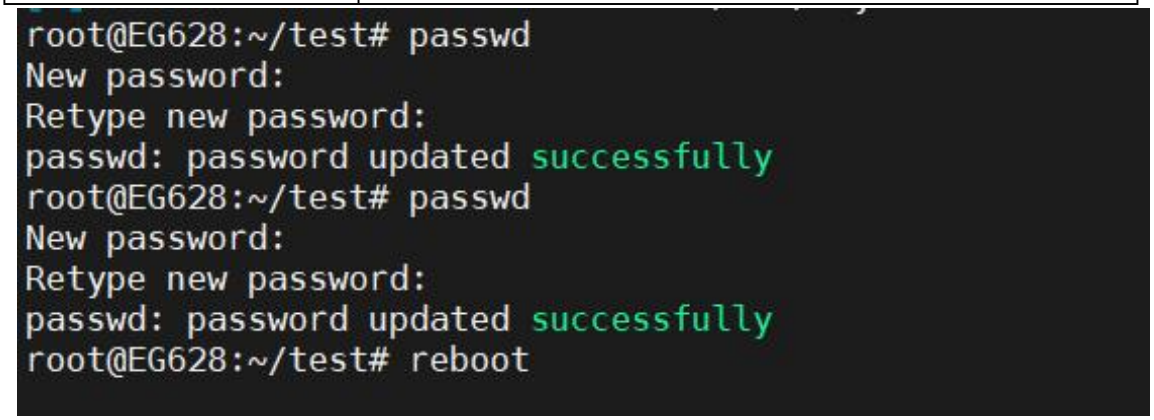
7. You can also view the raw GPS data by executing the command **cat /dev/ttyUSB1**. Additionally, you can obtain and process the data through the USB1 interface driver.



2.5. SSH Function

The USR-SH800 has the SSH function enabled and root privileges opened. The username is root, and the default password is 123456. After logging in with the root account, it is recommended to change the root user password promptly to ensure system security. The instructions for changing the password are as follows:

Command	Interface
passwd	After execution, you will be prompted to enter a new password. Once the new password is entered consistently twice, the new password will be successfully modified.
reboot	Restart the device

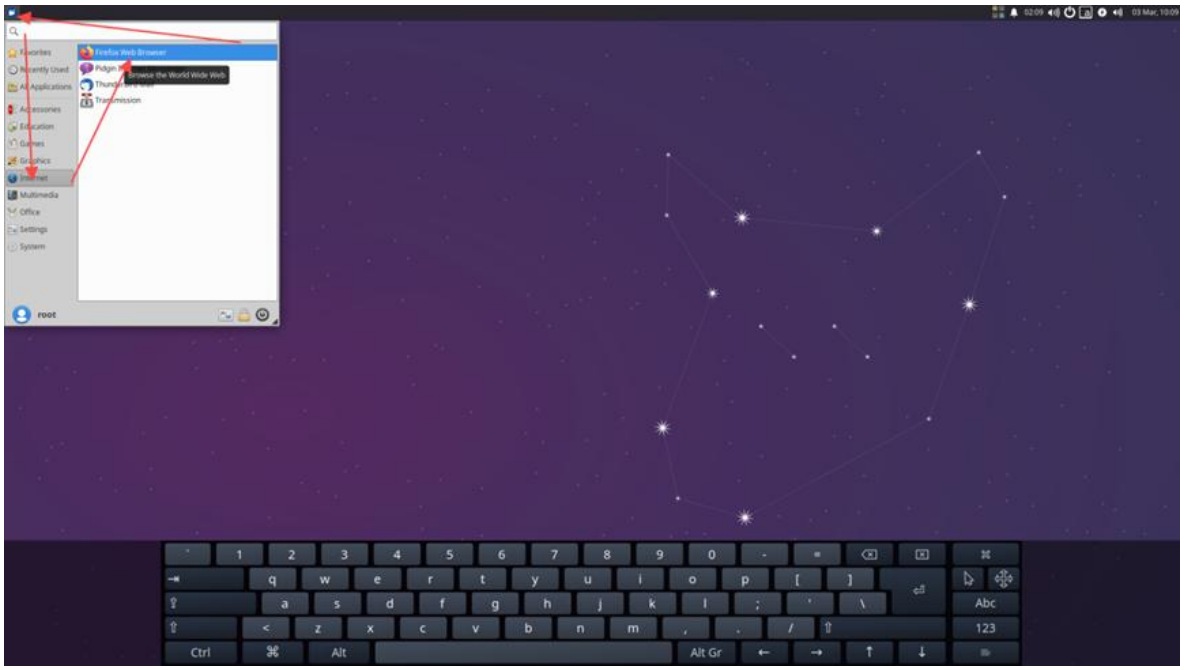


2.6. WukongEdge Application

WukongEdge is a 4-i -1 intelligent data-processing architecture integrating edge computing, network management, local configuration, and PLC programming. It's easy to use, with a parameter-config webpage. Users log in to the WEB interface to use it.

There are two login methods:

1. **Desktop login:** For EG628 (with a desktop system), connect a mouse, keyboard, and HDMI screen. Open a browser on the desktop, enter the default LAN IP (192.168.1.1) to log in. If no browser, open it as follows.



2. External PC login: Connect PC's network port to the device's LAN port. Set PC to auto-obtain IP. Open a browser on PC, enter the device's LAN IP to log in to the WEB for parameter configuration.

For function details, check the WukongEdge manual:
https://www.pusr.com/support/download/User-Manual-WukongEdge-V1.html

2.7. WukongEdge Application Deactivation

When doing secondary development, if you don't need the WukongEdge function, you can turn it off via commands. You can execute commands through SSH or on the desktop. Just follow the commands below.

Command	Interface
gateway_tool switch 0	Disable WukongEdge
gateway_tool switch 1	Enable WukongEdge
reboot	Reboot Device

3. Secondary Development

EG devices support Linux-based secondary development and have the WukongEdge edge-computing function built-in. Scenarios where the two are used in combination are common.

Therefore, WukongEdge provides API interfaces for secondary development to call edge data, making it convenient for customers to integrate WukongEdge with Linux application development.

3.1 Read Data

Read-only Interface Function for Edge Computing Function:
Read the data collected in the edge computing data point table.

```
Function declaration：BOOL edge_read(edge_rw_msg_t *edge_operate_msg,
edge_access_multi_node_t *edge_response_msg);

Parameters：
edge_operate_msg：Query data information
edge_response_msg：Returned result

Information related to the position point:
edge_rw_msg_t structure parameters
client_name：Task name,can be customized but not repeatable
server_name：read the channel name,the default readng is edge_read，can’t be modified
```

3.2 Write Data

Write Data Read&write Interface Function for Edge Computing Function:
Write data into the edge computing data point table to achieve data- sending control.

```
BOOL edge_read_write(edge_rw_msg_t *edge_operate_msg, edge_access_multi_node_t
*edge_response_msg);
Parameters：
edge_operate_msg：Query data information
edge_response_msg：Returned result

Information related to the position point:
edge_rw_msg_t structure parameters
client_name：Task name,can be customized but not repeatable
server_name：read the channel name,the default readng is edge_read，can’t be modified
```

You can refer to the "Data Reading and Writing" demo for the specific parameters when using and testing.

4. Ubuntu System

4.1 Common Command

Command	**Interface**
cd /Path	**Switch directory**
rm File name	Delete a file
Mkdir File name	Create a new folder
Touch File name	Create a new file
df -h	Check flash space

4.2 Linux GCC Download the compiler

Command	**Interface**
apt-get update	Update the Linux software
apt-get install gcc	Download and install the GCC compiler
gcc hello.c -o hello	Compile the hello.c file
gcc --version	Check the GCC version

* If you use a cross - compiler, you need to download it from a specific website.

4.3 Ubuntu Version Upgrade

The commonly used commands are as follows: (If you don't have root privileges, you need to add the `sudo` command.)

Command	**Function**
apt-get update	Update the software sources
apt-get upgrade	Update the installed software packages
apt-get dist-upgrade	Handle the dependencies
apt-get install update-manager-core	Install the upgrade tool
do-release-upgrade	Perform the upgrade
lsb_release -a	Check the version

4.4 Query the version of Linux system

Command	Feature
lsb_release -a	Display information such as the Ubuntu distribution ID, description, version number, and code.
uname -a	Show all system information, including the kernel version and system architecture.
hostnamectl	Display the static, dynamic, and transient hostname settings of the system

4.5 Linux Modify hostname

Command	Function
hostnamectl set-hostname <hostname>	<hostname>Delete the current routing interface for the new desired hostname.

4.6 Switch the network card communication

Command	Function
ip route del default	Delete the current routing interface.
ip route add default via <eth1_gateway_ip> dev eth1	Add eth1 as the default routing interface. The eth1_gateway_ip is the gateway address of the eth1 network card, which can be found via `ip route show
ping ip_addr	Check the network by pinging an address
apt-get update	Update the package sources
apt install ifmetric	Install ifmetric
ifmetric eth1 200	

4.7 Modify system language

Change the system language as English

Command	Function
apt update	Update the package sources
apt install language-pack-en	Install the English language pack.
update-locale LANG=en_US.UTF-8	Update the system language environment to English
Reboot	Restart the system for the changes to take effect.

4.8 Use the Systemd service startup file

Command	Function
gcc test.c -o /usr/local/bin/test	Complete the writing of test.c and finish the compilation, then store it in a specific path
vim /etc/systemd/system/test.service	Create a new test.service service and open the file
[Unit] Description=My custom test application [Service] ExecStart=/usr/local/bin/test [Install] WantedBy=multi-user.target	In the test.service service, add content and then save the file.
sudo systemctl enable test.service sudo systemctl start test.service	Enable and start the service
systemctl list-units --type=service	Check the status of all services
systemctl list-units --type=service --state=running	Check all the running services.

4.9 Uninstallation and installation of xubuntu desktop

Uninstall command	**Function**
apt-get remove xubuntu-desktop	Uninstall the current desktop environment
apt-get remove xubuntu*	Delete files related to the current desktop
apt-get autoremove	Delete related dependencies
reboot	Restart the device

Install Command	**Function**
apt-get update	Update sources
apt-get install Xubuntu-desktop	Install the desktop
reboot	Restart the device

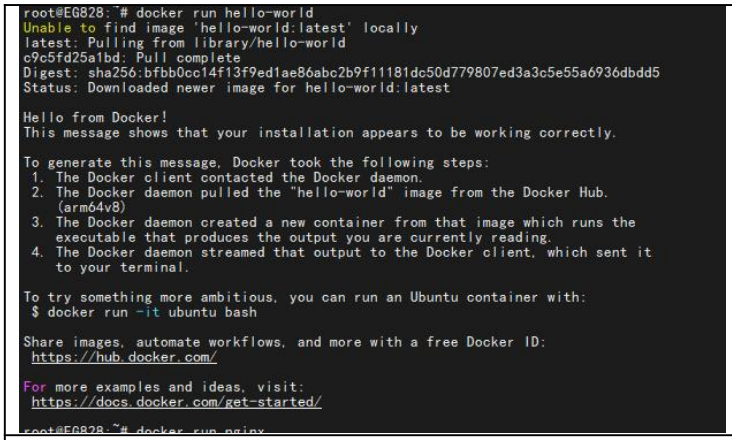
5. Application Installation

5.1 Docker Container

Command	Function
apt-get update	Updated Source
apt-get upgrade	
apt install apt-transport-https ca-certificates curl software-properties-common	Install necessary software packages to allow apt to use repositories via HTTPS.
curl -fsSL https://mirrors.aliyun.com/docker-ce/linux/ubuntu/gpg | apt-key add -	Add the domestic Docker repository to your system. Here, we take Alibaba Cloud as an example.
apt-key list	List all the GPG keys added to the system.
add-apt-repository "deb [arch=arm64] https://mirrors.aliyun.com/docker-ce/linux/ubuntu $(lsb_release -cs) stable"	Add the Docker repository to the APT sources (using the Alibaba Cloud source as an example).
apt-get update	Update the apt package index again
apt-get install docker.io	Install the latest version of Docker CE (Community Edition).

mkdir -p /etc/docker
tee /etc/docker/daemon.json <<-'EOF'
{
"registry-mirrors": ["https://dnbf7xuh.mirror.aliyuncs.com"],
"iptables":false,
"ip6tables": false,
"ipv6":false
}
EOF
systemctl daemon-reload
sudo systemctl restart docker
OR
mkdir -p /etc/docker
tee /etc/docker/daemon.json <<-'EOF'
{
"registry-mirrors": ["https://docker-0.unsee.tech"],
"iptables":false,
"ip6tables": false,
"ipv6":false
}
EOF
systemctl daemon-reload
systemctl restart docker
	Configure Docker to use the Alibaba Cloud image accelerator.

docker -- version	Verify that Docker is installed and running correctly.
docker run hello-world	Test if the container can be run

	
systemctl stop docker.socket systemctl disable docker.socket systemctl stop docker systemctl disable docker	docker Stop and disable Docker.
systemctl status docker	Check docker status
apt-get remove docker.io	Uninstall docker
rm -rf /var/lib/docker rm -rf /var/lib/containerd	Clean up the residual files.

5.2 Install OpenPLC Runtime

Official tutorial：1.1 OpenPLC Overview – Autonomy

Command	Function
apt-get update	Update Source
apt-get upgrade	
apt-get install git	Install git
git clone https://github.com/thiagoralves/OpenPLC_v3.git	Install OpenPLC Runtime
CD OpenPLC_v3	Switch the patch to OpenPLC_v3
./install.sh linux	Perform the installation on Linux.

After the installation is complete, log in via a browser at http://local_IP:8080. The default username and password are openplc (login) and openplc (password).

5.3 Install Todesk

Command	Function
apt-get update	Update source
apt-get upgrade -y	Update installed software packages
lscpu	Query the architecture (aarch64 is the arm64 architecture)
wget https://dl.todesk.com/linux/todesk_4.0.3_aarch64.deb	Download the installation package of Todesk with the arm64 architecture

dpkg -i todesk_4.0.3_aarch64.deb	Install Todesk
apt-get install -f	During the installation process, it is prompted that dependencies are missing. Execute this command
todesk	Enable ToDesk
After starting, you can see the running Todesk on the Ubuntu desktop.	
systemctl stop todesk	Stop ToDesk
apt-get remove --purge todesk	Uninstall ToDesk
rm -rf /opt/todesk rm -rf ~/.local/share/todesk rm -rf ~/.config/todesk	Clean up residual configurations
apt-get autoremove apt-get autoclean	Clean up dependencies