



Instruction

Z-Wave 700 Getting Started for Controller Devices

Document No.:	INS14281
Version:	2
Description:	-
Written By:	AMUNKHAUS
Date:	2019-02-17
Reviewed By:	JFR;JRM;MDUMBARE;SAMBAT;DCHOW;HAKRONER;JCC;SCBROWN
Restrictions:	Public

Approved by:

Date	CET	Initials	Name	Justification
2019-02-17	04:30:17	NTJ	Niels Johansen	

This document is the property of Silicon Labs. The data contained herein, in whole or in part, may not be duplicated, used or disclosed outside the recipient for any purpose. This restriction does not limit the recipient's right to use information contained in the data if it is obtained from another source without restriction.



REVISION RECORD

Doc. Rev	Date	By	Pages affected	Brief description of changes
1	20181206	AMUNKHAUS	ALL	Initial release of document

Table of Contents

1	ABBREVIATIONS	5
2	INTRODUCTION	5
2.1	Purpose.....	5
2.2	Audience and Prerequisites.....	5
3	OVERVIEW OF CONTROLLER SDK	6
3.1	Z/IP Gateway SDK	6
3.2	Z-Ware SDK.....	6
3.3	Requirements	7
4	GETTING STARTED WITH Z/IP GATEWAY	8
4.1	Z/IP Gateway Running on Ubuntu Linux.....	8
4.1.1	Install Z/IP Gateway	8
4.1.2	Configure Z/IP Gateway	9
4.1.3	Start the Z/IP Gateway	10
4.2	Z/IP Gateway Running on Raspberry Pi 3B.....	11
4.2.1	Install Z/IP Gateway on the Raspberry Pi	11
4.2.2	Configure and Start the Z/IP Gateway on the Raspberry Pi	12
4.3	Using PyZ/IP for Debugging.....	13
4.4	Z/IP Gateway Documentation	14
5	GETTING STARTED WITH Z-WARE	15
5.1	Z-Ware C API Library.....	15
5.1.1	Build the C API Library on Ubuntu.....	15
5.1.2	Build the C API Library on Raspberry Pi.....	16
5.1.3	Running the Sample Applications.....	17
5.2	Z-Ware Web API	18
5.2.1	Install the Web Server for the Web API	18
5.2.2	Run the Sample Web Portal	19
5.2.3	Log Files.....	20
5.3	Start Developing with the Web-API.....	21
5.3.1	A quick View of the API with the PyZWare.....	21
5.3.2	First Web Site Using the Web API	22
5.4	Generate the Z-Ware Documentation.....	23
6	NETWORK SETUP	24
6.1	Z/IP Gateway Network Setup	24
6.2	Z-Ware Local.....	24
6.3	Z-Ware Portal (Cloud).....	25
6.4	Z-Ware Local with an Optional Cloud	26
6.5	Running Z/IP Gateway and Z-Ware on the Same Host Processor	26

REFERENCES.....	27
------------------------	-----------

Table of Figures

<u>Figure 1: List of Connected USB Devices</u>	9
<u>Figure 2: Z/IP Configuration File</u>	9
<u>Figure 3: Failed to Start Z/IP Gateway. Check settings</u>	10
<u>Figure 4: Z/IP Gateway Service Should Be 'running'</u>	10
<u>Figure 5: Install File Copied to Target</u>	12
<u>Figure 6: Py/ZIP Running on Ubuntu</u>	13
<u>Figure 7: Z-Ware Source Copied to Target and Extracted in Folder zwportal</u>	16
<u>Figure 8: Example of bin_switch Sample Application Running</u>	17
<u>Figure 9: Configure Services to Auto-Start</u>	19
<u>Figure 10: PyZWare Client</u>	21
<u>Figure 11: Google Chrome Debugger</u>	22
<u>Figure 12: Setup with Z-Ware Local. No Support for Cloud</u>	24
<u>Figure 13: Setup with Z-Ware Portal. Using Z-Ware Web Portal as Cloud</u>	25
<u>Figure 14: Setup with Z-Ware Local Using Customer C Application. Can be Extended with Customer 3rd Party Cloud Solution</u>	26

1 ABBREVIATIONS

Abbreviation	Explanation
API	Application Programming Interface
DTLS	Datagram Transport Layer Security
IP address	Internet Protocol address
LAN	Local Area Network
PAN	Personal Area Network
SDK	Software Development Kit
TAP	Layer 2, link interface
TLS	Transport Layer Security
TUN	Layer 3, IP Interface
UDP	User Datagram Protocol
Z/IP	Z-Wave to IP
ZIPGW	Z/IP Gateway

2 INTRODUCTION

2.1 Purpose

This document describes how to get started with Z-Wave 700 development for Controller devices.

2.2 Audience and Prerequisites

The audience is Z-Wave developers.

3 OVERVIEW OF CONTROLLER SDK

The Z-Wave Controller SDK includes software for gateway development. The SDK includes:

- Z/IP Gateway SDK
- Z-Ware SDK

The hardware reference platform is the Raspberry Pi 3B (for Z-Wave 700 Beta. For mature release 3B+ will be supported).

3.1 Z/IP Gateway SDK

Z/IP Gateway is a UDP/IP wrapper for Z-Wave command classes. The Z/IP Gateway is an application which allows internet Z/IP clients to contact and control nodes in a Z-Wave network. Through the Z/IP Gateway each node on the Z-Wave network behaves as an IP client on the network. The Z/IP Gateway handles all Z-Wave housekeeping such as network management, Z-Wave Security, mailbox for battery-driven devices, Z/IP packaging, and multichannel support. Z/IP Gateway uses DTLS for LAN security and can also connect to a remote server through a secure TLS1.1 tunnel making it ideal for use with a portal server.

Starting with Z-Wave 700 series, it is now mandatory for all to use Z/IP Gateway. The Z/IP Gateway is therefore not only an example application, it is the preferred implementation for your Z-Wave Gateway to the Internet of Things. By using the Z/IP Gateway you will get the new features, such as S2 and SmartStart without worrying about implementing them yourself.

The Z/IP Gateway is developed for the Linux® OS. For development purposes use Oracle VM VirtualBox, if a dedicated Linux computer is not available.

See Chapter 4 for the Z/IP Gateway Getting Started Guide.

3.2 Z-Ware SDK

The Z-Ware SDK contains 5 packages:

- Z-Ware Library C API
- Z-Ware Library C API Sample Apps (client examples build using the Z-Ware C API)
- Z-Ware Web Server (build using the C API)
- Z-Wave Web API (API that connects against the Web Server)
- Z-Wave Web API Sample Web site (client build using Web API)

The Z-Ware Library is a Z/IP Gateway client C API for easier development and certification of Z-Wave controller applications. The C API can connect to a Z/IP Gateway and discover all connected Z-Wave devices exposing them as software objects. One Z-Ware Library Client is the Z-Ware Web Server. The Web Server can be compiled into Consumer Electronics (CE) or Portal mode. In Portal mode, multiple ZIPGWs connect to the Web Server over TCP encrypted with TLS where the Web Server is

expected to run in the Cloud. In CE mode, the Web Server connects to the ZIPGW via UDP encrypted with DTLS where the Web Server is expected to run on the same target as ZIPGW.

Because this Getting Started Guide covers the CE mode, it does not cover the Portal mode, as CE mode is more frequently used and implemented.

See Chapter 5 for the Z-Wave Getting Started Guide.

3.3 Requirements

Download the [Controller SDK](#), including Z/IP Gateway and Z-Wave.

You need a USB Bridge Controller; A hardware USB controller flashed with Serial API Bridge Controller. This is part of the Z-Wave Development Kit.

Optional

You can download Ubuntu from [Ubuntu Official Web site](#). The required version is Ubuntu 16.04.

It is also possible to run the Gateway and Z-Wave from a virtual machine. This guide is tested with [Oracle VM VirtualBox](#).

4 GETTING STARTED WITH Z/IP GATEWAY

This chapter will guide you through the following steps:

- Z/IP Gateway Running on Ubuntu Linux
- Z/IP Gateway Running on Raspberry Pi 3B
- Using PyZ/IP for Debugging
- Z/IP Gateway Documentation

4.1 Z/IP Gateway Running on Ubuntu Linux

This section describes how to install and run the Z/IP Gateway on Ubuntu Linux. The assumption is that the SDK is already downloaded to your machine.

4.1.1 Install Z/IP Gateway

a. Update

```
$ sudo apt-get update
```

b. Install dependencies

32bit Ubuntu

```
$ sudo apt-get install libusb-1.0-0 libssl1.0.0 radvd parprouted  
bridge-utils
```

64bit Ubuntu

```
$ sudo apt-get install libusb-1.0-0:i386 libssl1.0.0:i386 radvd:i386  
parprouted:i386 bridge-utils:i386
```

c. Install Z/IP Gateway Debian package

Locate the Debian package from the SDK download, in the 'Binaries' folder.

```
$ sudo dpkg -i zipgateway-7.00.0-Linux-i386.deb
```

Installation might fail if any of the Z/IP Gateway dependencies are not installed for any reason. Steps below can fix this issue by installing the dependencies automatically.

```
$ sudo apt-get update  
$ sudo apt-get -f install
```

d. Installation wizard prompts for the following information

- Serial port for the Z-Wave Controller. When using the UZB Controller that ships with the Development Kit, the value should usually be 'ttyUSB0'. This setting can also be changed later, when the correct port is found.
- IPV6 address of Z/IP Gateway. Leave default.
- IPV6 prefix of Z-wave Network. Leave default.
- The type of network interface: 'wireless' or 'wired'. The network interface in question here is the interface where Z/IP Gateway will listen for Z/IP Client connection requests. This guide is using 'wired'.

e. Reboot system

Because of various network configuration changes, reboot the system after the Z/IP Gateway installation.

4.1.2 Configure Z/IP Gateway

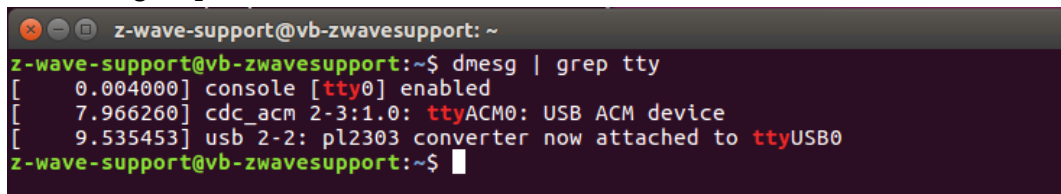
a. Plug in hardware

Plug in the Z-Wave Bridge Controller.

Determine which port the USB device is using, by using the following command after the USB device is plugged in:

```
$ dmesg | grep tty
```

In this guide, devices are both attached to 'ttyACM0' and 'ttyUSB0'. Be sure to choose the correct port. If you are unsure which port to use, disconnect your device and run the command again. In this guide, we are using 'ttyUSB0'.



```
z-wave-support@vb-zwavesupport: ~
z-wave-support@vb-zwavesupport:~$ dmesg | grep tty
[ 0.004000] console [tty0] enabled
[ 7.966260] cdc_acm 2-3:1.0: ttyACM0: USB ACM device
[ 9.535453] usb 2-2: pl2303 converter now attached to ttyUSB0
z-wave-support@vb-zwavesupport:~$
```

Figure 1: List of Connected USB Devices

b. Configuration file

If the port differs from the one during installation, the Z/IP Configuration file needs to be changed. The config-file is located:

```
/usr/local/files/zipgateway.cfg
```

Nano can be used as editor, which comes preinstalled on Ubuntu. Change the variable 'ZipSerialAPIPortName'.



```
z-wave-support@vb-zwave: /
GNU nano 2.5.3 File: usr/local/etc/zipgateway.cfg
#ZipPortal=192.168.1.1
#ZipPortalPort=44123
#ZipTunPrefix = 2000::
#ZipTunIp6PrefixLength = 128
#ZipManufacturerID=0
#ZipHardwareVersion=1
#ZipProductID=1
#ZipProductType=1
#ZipMBPort=41230
#ZipMBDestinationIp6=
#ZipMBMode=1
ZipPSK=123456789012345678901234567890AA
#ExtraClasses= 0x42 0x75
ZipSerialAPIPortName=/dev/ttyUSB0
ZipLampID=f300:cccc:13
^G Get Help ^O Write Out ^W Where Is ^K Cut Text ^J Justify ^C Cur Pos
^X Exit ^R Read File ^\ Replace ^U Uncut Text ^T To Spell ^_ Go To Line
```

Figure 2: Z/IP Configuration File

A simpler user interface for changing the port can be found by calling the following command, which will have the same prompts as while installing:

```
$ sudo dpkg-reconfigure zipgateway
```

4.1.3 Start the Z/IP Gateway

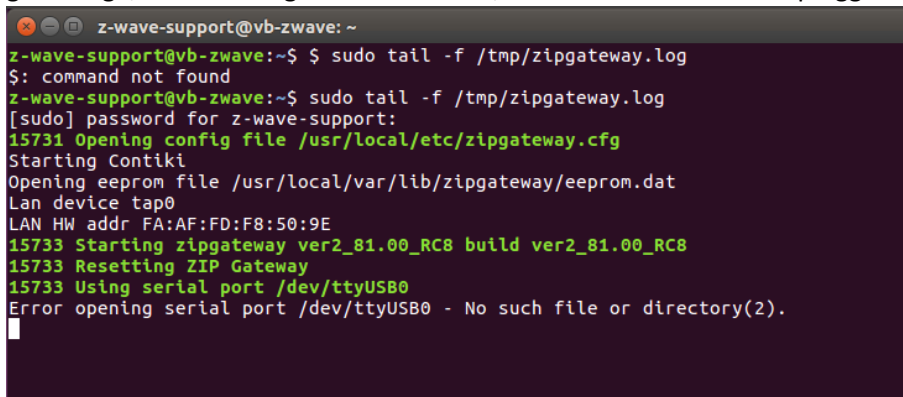
The Z/IP Gateway service can be controlled with these commands:

```
$ sudo /etc/init.d/zipgateway start
$ sudo /etc/init.d/zipgateway stop
$ sudo /etc/init.d/zipgateway restart
$ sudo /etc/init.d/zipgateway status
```

In another terminal, open up the Z/IP Gateway log file:

```
$ sudo tail -f /tmp/zipgateway.log
```

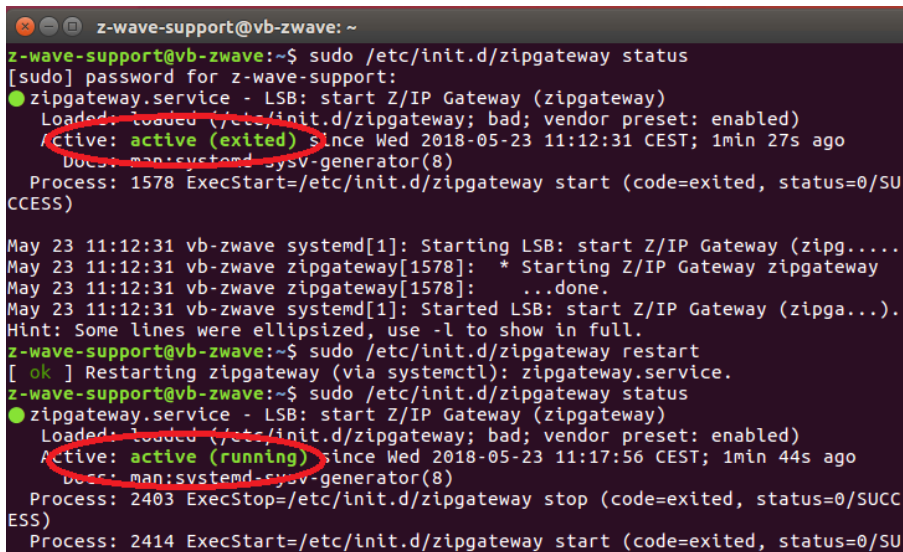
If the following message, some settings are not correct, or the USB device is not plugged in:



```
z-wave-support@vb-zwave: ~
z-wave-support@vb-zwave:~$ sudo tail -f /tmp/zipgateway.log
$: command not found
z-wave-support@vb-zwave:~$ sudo tail -f /tmp/zipgateway.log
[sudo] password for z-wave-support:
15731 Opening config file /usr/local/etc/zipgateway.cfg
Starting Contiki
Opening eeprom file /usr/local/var/lib/zipgateway/eeprom.dat
Lan device tap0
LAN HW addr FA:AF:FD:F8:50:9E
15733 Starting zipgateway ver2_81.00_RC8 build ver2_81.00_RC8
15733 Resetting ZIP Gateway
15733 Using serial port /dev/ttyUSB0
Error opening serial port /dev/ttyUSB0 - No such file or directory(2).
```

Figure 3: Failed to Start Z/IP Gateway. Check settings.

Change the port name and / or plug in the USB, and then restart the service. The log file should start writing a lot of log information, indicating the connection is successful. Check the status of the service. If the status is 'exited', the service is not running. The status should show 'running'.



```
z-wave-support@vb-zwave: ~
z-wave-support@vb-zwave:~$ sudo /etc/init.d/zipgateway status
[sudo] password for z-wave-support:
● zipgateway.service - LSB: start Z/IP Gateway (zipgateway)
   Loaded: loaded (/etc/init.d/zipgateway; bad; vendor preset: enabled)
   Active: active (running) since Wed 2018-05-23 11:17:56 CEST; 1min 44s ago
     Docs: man:systemd-sysv-generator(8)
   Process: 1578 ExecStart=/etc/init.d/zipgateway start (code=exited, status=0/SUCCESS)

May 23 11:12:31 vb-zwave systemd[1]: Starting LSB: start Z/IP Gateway (zipg...
May 23 11:12:31 vb-zwave zipgateway[1578]: * Starting Z/IP Gateway zipgateway
May 23 11:12:31 vb-zwave zipgateway[1578]: ...done.
May 23 11:12:31 vb-zwave systemd[1]: Started LSB: start Z/IP Gateway (zipga...).
Hint: Some lines were ellipsized, use -l to show in full.
z-wave-support@vb-zwave:~$ sudo /etc/init.d/zipgateway restart
[ ok ] Restarting zipgateway (via systemctl): zipgateway.service.
z-wave-support@vb-zwave:~$ sudo /etc/init.d/zipgateway status
● zipgateway.service - LSB: start Z/IP Gateway (zipgateway)
   Loaded: loaded (/etc/init.d/zipgateway; bad; vendor preset: enabled)
   Active: active (running) since Wed 2018-05-23 11:17:56 CEST; 1min 44s ago
     Docs: man:systemd-sysv-generator(8)
   Process: 2403 ExecStop=/etc/init.d/zipgateway stop (code=exited, status=0/SUCCESS)
   Process: 2414 ExecStart=/etc/init.d/zipgateway start (code=exited, status=0/SUCCESS)
```

Figure 4: Z/IP Gateway Service Should Be 'running'

The Z/IP Gateway Service is now up and running!

4.2 Z/IP Gateway Running on Raspberry Pi 3B

The Raspberry Pi 3B comes with an SD card loaded with Raspbian Jessie with a Desktop interface. This guide will connect to the Raspberry Pi using SSH, but you can also choose to connect a monitor, mouse, and keyboard to the Pi.

In addition, you can choose to load the Raspbian Stretch Lite image to the Pi, which only comes with a command line interface.

Manually enable the SSH interface. Follow the [official Raspberry SSH guide](#). A simple way to enable SSH, is to mount the SD card on your host PC and create an empty file named “ssh” (no extension) in the root of the boot partition.

When you are all set up, check your router (or use an IP Scanner) to detect the IP address of the Raspberry Pi.

4.2.1 Install Z/IP Gateway on the Raspberry Pi

a. Connect to the Raspberry Pi

On a Windows host PC, you can use PuTTY to connect using SSH to the Raspberry Pi.

On a Linux / Mac host PC run the following command to connect using SSH to the Raspberry Pi.

```
$ ssh -l pi ipaddress
```

The default username / password for the Raspberry is: pi / raspberry

Upgrade the target to get the latest fixes:

```
$ sudo apt-get update
$ sudo apt-get upgrade
```

You can check the version using:

```
$ cat /etc/debian_version
```

This guide uses Raspbian Jessie for demos and explanations.

b. Copy the Z/IP Gateway Debian Package to the Raspberry Pi

On the host PC, navigate to the download path of the Gateway binaries from the SDK and locate

“zipgateway-7.00.0-Linux-armhf.deb”, which will give you the debian package to transfer.

Open a terminal / command prompt in the folder containing the file (**not** from the terminal which is connected to the Pi) and run the follow command to transfer the file to the root directory of the Pi:

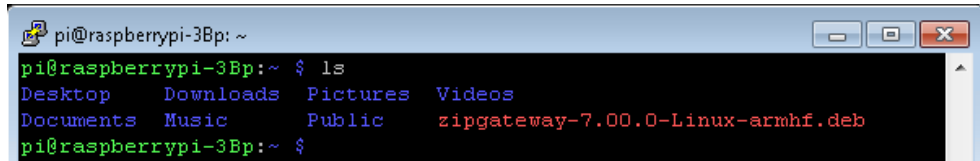
If you are using a Linux / Mac Host PC:

```
$ scp zipgateway-7.00.0-Linux-armhf.deb pi@ipaddress:
```

If you are using a Windows Host PC:

```
$ pscp zipgateway-7.00.0-Linux-armhf.deb pi@ipaddress:
```

From the terminal connected to the target, you should now see the file in the root directory.



```
pi@raspberrypi-3Bp: ~  
pi@raspberrypi-3Bp:~ $ ls  
Desktop  Downloads  Pictures  Videos  
Documents Music      Public    zipgateway-7.00.0-Linux-armhf.deb  
pi@raspberrypi-3Bp:~ $
```

Figure 5: Install File Copied to Target

c. Install the Z/IP Gateway on the Raspberry Pi

In the terminal connected to the Raspberry Pi, do the following:

```
$ sudo apt-get install libusb-1.0-0 libssl1.0.0 radvd parprouted  
bridge-utils  
$ sudo dpkg -i zipgateway-7.00.0-Linux-armhf.deb
```

d. Installation wizard prompts for the following information

- Serial port for the Z-Wave Controller. When using the USB Controller that ships with the Development Kit, the value should usually be `'ttyUSB0'`. This setting can also be changed later, when the correct port has been found.
- IPV6 address of Z/IP Gateway. Leave default.
- IPV6 prefix of Z-Wave Network. Leave default.
- The type of network interface: `'wireless'` or `'wired'`. The network interface in question here is the interface where Z/IP Gateway will listen for Z/IP Client connection requests. This guide is using `'wired'`.

e. Reboot system

Because of various network configuration changes, reboot the system after the Z/IP Gateway installation.

4.2.2 Configure and Start the Z/IP Gateway on the Raspberry Pi

To configure and start the Z/IP Gateway, see [4.1.2 Configure Z/IP Gateway](#) and [4.1.3 Start the Z/IP Gateway](#), as these steps are independent of the hardware platform.

4.3 Using PyZ/IP for Debugging

PyZ/IP is a GUI application written using Python. You may use PyZ/IP to manage and test your Z-Wave network.

This guide will demonstrate how to install the client on Ubuntu Linux.

a. Source code

When downloading the Gateway SDK, part of this package is the source code for the PyZ/IP Client. Extract the files and change the directory to the uncompressed files:

```
$ unzip pyzip_ver1_17.zip
$ cd pyzip
```

b. Install Python.

Set the PYTHONPATH to where the Pyzip sources are uncompressed and install Python.

```
$ export PYTHONPATH=$PWD
$ sudo apt-get install python-wxgtk3.0
```

c. Run the application.

```
$ cd pyzip
$ python2 gui.py
```

d. Set up the network.

The PyZ/IP client is now running and will automatically detect the gateway. Connect to it and start adding nodes to the network.

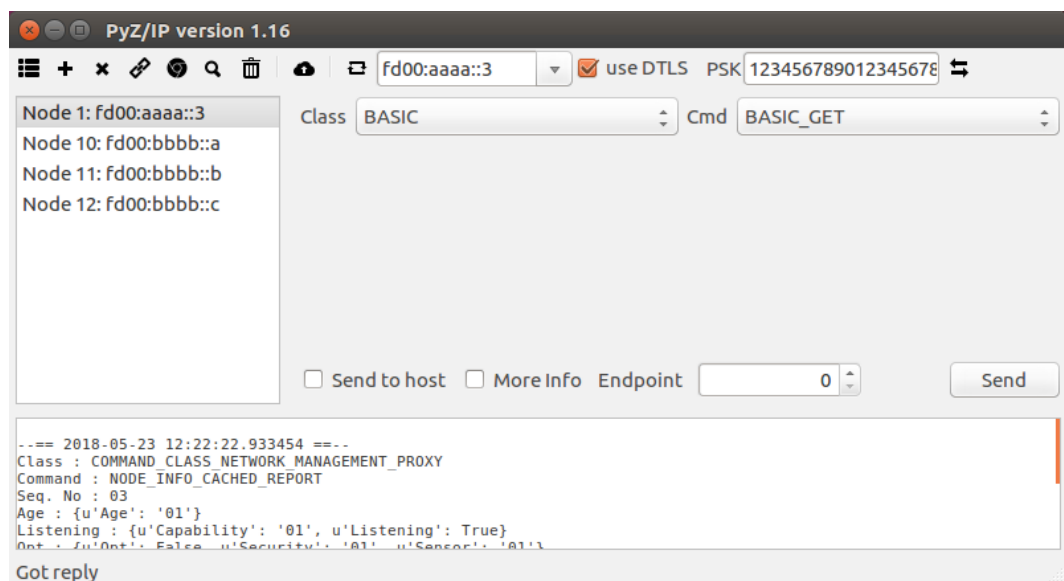


Figure 6: PyZ/IP Running on Ubuntu

4.4 Z/IP Gateway Documentation

The Z/IP Gateway SDK comes with a lot of documentation.

Basic information and documentation on all settings can be found using the *man* command. The man pages are built into the Z/IP Gateway distribution.

```
$ man zipgateway
```

The Doxygen documentation contains detailed information on building and cross-compiling the gateway for other targets as well as documentation for the source code. The Doxygen documentation is usually part of the SDK zip-file but can also be generated using Doxygen.

a. Install dependencies

```
$ sudo apt-get install doxygen roffit cmake gcc
```

b. Build documentation

Navigate to the source code directory, create a new folder called 'build', and enter that folder:

```
$ mkdir build  
$ cd build/
```

Make the documentation:

```
$ cmake ..  
$ make doc
```

c. See the user guide for detailed description on compiling and using Z/IP Gateway

Open `src/doc/html/index.html` in browser.

```
$ xdg-open src/doc/html/index.html
```

5 GETTING STARTED WITH Z-WARE

This chapter will guide you through the following steps:

- Z-Ware C API Library
- Z-Ware Web API
- Start Developing with the Web-API
- Generate the Z-Ware Documentation

Before proceeding with this guide, the assumption is that the Z/IP Gateway is installed and running. See chapter 4 *Getting Started with Z/IP Gateway*.

5.1 Z-Ware C API Library

The Z-Ware C API allows you to connect to a Z/IP Gateway and control all the nodes in the network. For a detailed overview of all API methods, build settings, and so on, see “INS14416 Z-Ware Library User Guide” [1].

With the Z-Ware C API Library, you can develop your own application which connects to a Z/IP Gateway. To use the Z-Ware Web Server with the Z-Ware Web API, skip this section and go to 5.2 Z-Ware Web API.

The source code and sample applications are located in (NB, the path should not contain white-spaces):

```
<download-path>/src/zportal/src/zwave/hcapi
```

5.1.1 Build the C API Library on Ubuntu

In this directory, build the External Library:

```
$ source install_openssl_lib.sh
$ source build_openssl_lib.sh linux debug no-shared
```

and then build the Z-Ware C API library:

```
$ make TARGET_PLATFORM=LINUX_ZIP2 DEBUG=1 SHARED=0
```

When the C API has been built, enter the /demos directory and build the sample applications:

```
$ make TARGET_PLATFORM=LINUX_ZIP2 DEBUG=1 SHARED=0
```

5.1.2 Build the C API Library on Raspberry Pi

This approach copies the entire C API source code to the target. Another approach is to cross-compile from a Ubuntu machine. For instructions to set up the build environment and toolchain for cross-compile, see *Z-Wave Library User Guide* [1], section *Build System Setup*.

On the host PC navigate to the download path of the Z-Ware SDK and locate the file “zwportal.tar.gz”. Open a terminal / command prompt in the folder containing the file (NB, **not** from the terminal which is connected to the target) and run the follow command to transfer the file to the root directory of the target:

If using a Linux / Mac Host PC:

```
$ scp zwportal.tar.gz pi@ipaddress:
```

If using a Windows Host PC:

```
$ pscp zwportal.tar.gz pi@ipaddress:
```

In a terminal to the target, extract the source code.

```
$ tar -zxvf zwportal.tar.gz
```

From the terminal connected to the target, you should now see the extracted files in a new folder called “zwportal” in the root directory.

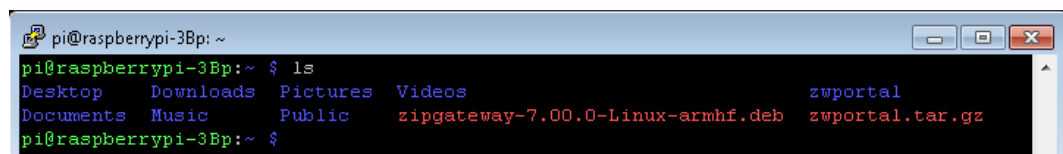


Figure 7: Z-Ware Source Copied to Target and Extracted in Folder zwportal

From the C-API directory `~/zwportal/src/zwave/hcapi`, build the External Library:

```
$ source install_openssl_lib.sh
$ source build_openssl_lib.sh raspberry debug no-shared
```

This might take several minutes.

When finished, build the Z-Ware C API library:

```
$ make TARGET_PLATFORM=RASPBERRY_ZIP2 DEBUG=1 SHARED=0
```

When the C API has been built, enter the `/demos` directory and build the sample applications:

```
$ make TARGET_PLATFORM=RASPBERRY_ZIP2 DEBUG=1 SHARED=0
```


5.1.3 Running the Sample Applications

Each sample application is in a separate folder. All sample applications except *Gateway Discovery* sample application require a configuration file, named *app.cfg*, to be configured.

Entry Name	Description
ZipLanPort	The host (where the sample application resides) listening and sending port. To allow the OS to select the port, enter port number 0.
ZipRouterIP	The ZIPGW IPv4 or IPv6 address.
DTLSPSK	DTLS pre-shared key (PSK) in a hexadecimal string with maximum string length of 64 (i.e., 32 hexadecimal bytes).

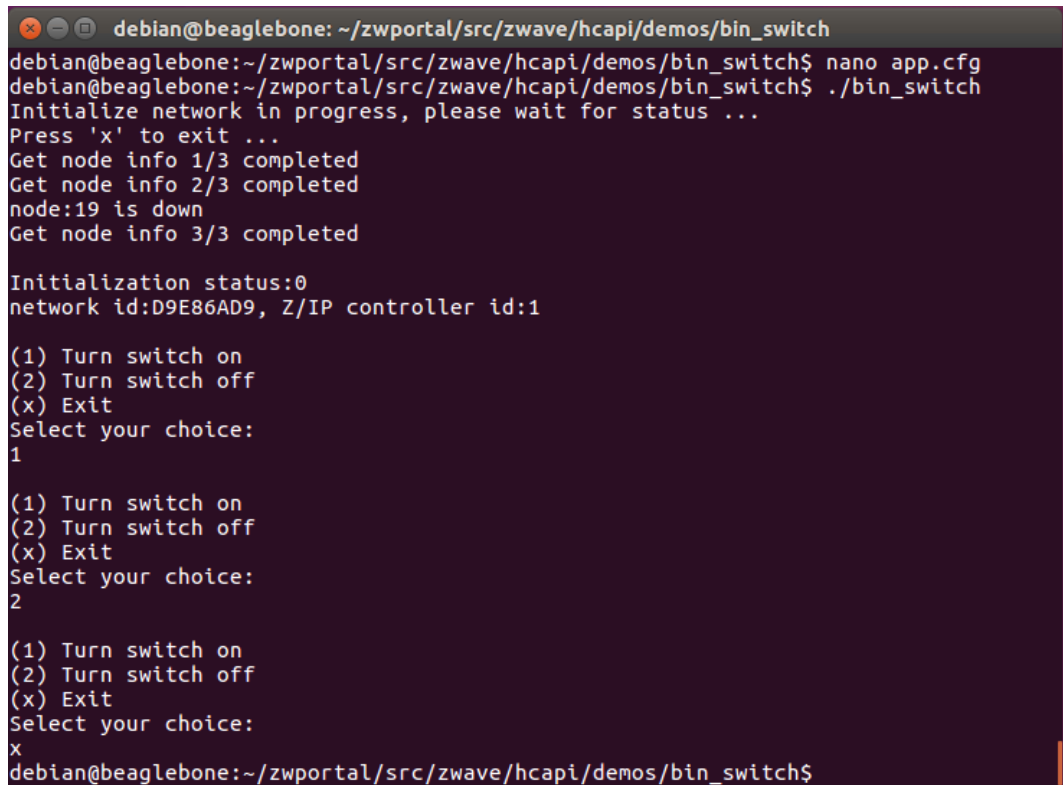
Ensure the ZipRouterIP matches your Gateway IP. The Gateway IP can be seen in the gateway log file, or by using the Avahi daemon:

```
$ sudo apt-get install avahi-utils
$ avahi-browse _z-wave._udp -r
```

Run the sample apps. The command below is an example from the “bin_switch” directory.

```
$ ./bin_switch
```

This will allow you to turn a switch on and off, if it is already included in the Z-Wave network. For a complete list and instructions to run each sample app, see *Z Wave Library User Guide* [1], chapter *Sample Applications*.



```

debian@beaglebone: ~/zwportal/src/zwave/hcapi/demos/bin_switch
debian@beaglebone:~/zwportal/src/zwave/hcapi/demos/bin_switch$ nano app.cfg
debian@beaglebone:~/zwportal/src/zwave/hcapi/demos/bin_switch$ ./bin_switch
Initialize network in progress, please wait for status ...
Press 'x' to exit ...
Get node info 1/3 completed
Get node info 2/3 completed
node:19 is down
Get node info 3/3 completed

Initialization status:0
network id:D9E86AD9, Z/IP controller id:1

(1) Turn switch on
(2) Turn switch off
(x) Exit
Select your choice:
1

(1) Turn switch on
(2) Turn switch off
(x) Exit
Select your choice:
2

(1) Turn switch on
(2) Turn switch off
(x) Exit
Select your choice:
x
debian@beaglebone:~/zwportal/src/zwave/hcapi/demos/bin_switch$

```

Figure 8: Example of bin_switch Sample Application Running

5.2 Z-Ware Web API

The Z-Ware Web API is built on top of the C API and allows to you develop a Web site for easy end-user experience. This guide demonstrates how to set up the CE mode of the library, where the Web Server and client is running in the home, normally in the same device as the Z/IP Gateway.

You will need the following documents:

- INS14486 Z-Ware Web Server & Native Apps Installation Guide [2]
- INS14428 Z-Ware Web User Guide [3]
- INS14430 Z-Ware Web Developer Guide [4]

5.2.1 Install the Web Server for the Web API

This section describes how to install a local Web Server to build Web sites using the Z-Ware Web API. The Web Server uses the Z-Ware C API to connect to the Z/IP Gateway, so, in a way, it is a sample of how to use the C API but is also needed to use the Web API. The full source code is available as part of the SDK.

This Getting-Started will not focus on how to build the source code, but use the precompiled installers, which will work on Ubuntu and Raspberry Pi. For instructions to build the source code for your specific target and for more information, see *Web Server & Native Apps Installation Guide* [2], chapter *Building*.

From the *image* folder, extract the installer that matches your target:

zwarelocal-x86_64.tar.gz	=>	64-bit
zwarelocal-i386.tar.gz	=>	32-bit
zwarelocal-beaglebone.tar.gz	=>	32-bit for the Raspberry Pi.

If using the Raspberry, copy the installer to the target, before proceeding.

If you are using a Linux / Mac Host PC:

```
$ scp zwarelocal-beaglebone.tar.gz pi@ipaddress:
```

If you are using a Windows Host PC:

```
$ pscp zwarelocal-beaglebone.tar.gz pi@ipaddress:
```

On the target, extract the file, browse to the folder `zwarelocal-beaglebone`, and run the install script.

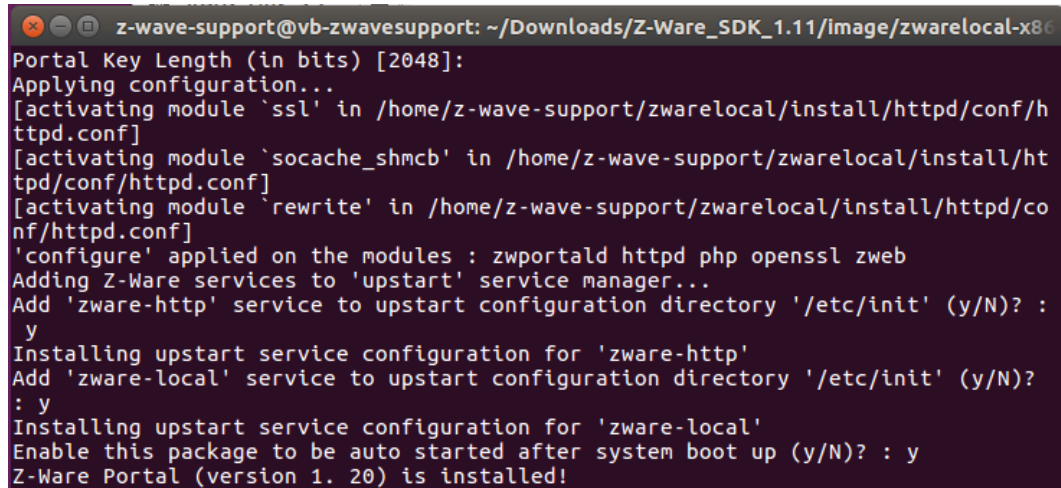
```
tar -zxvf zwarelocal-beaglebone.tar.gz
./install.sh /home/<user name>/zwarelocal
```

The installer will ask for various configuration settings during installation. You can leave the default value by clicking enter. For a more detailed understanding of the settings or to change the settings later, see the *Web Server & Native Apps Installation Guide* [2].

Two services must be up and running when using the local Z-Ware Web Server:

- Apache HTTP Server
- Z-Ware Portal Daemon

During installation, it is possible to enable auto-start of the Z-Ware services after system boot. If the target platform is PC, the option will be OFF by default. For Raspberry, the default value is ON. Below, the services are forced to start automatically, independently of the target.



```

z-wave-support@vb-zwavesupport: ~/Downloads/Z-Ware_SDK_1.11/image/zwarelocal-x86
Portal Key Length (in bits) [2048]:
Applying configuration...
[activating module `ssl' in /home/z-wave-support/zwarelocal/install/httpd/conf/httpd.conf]
[activating module `socache_shmcb' in /home/z-wave-support/zwarelocal/install/httpd/conf/httpd.conf]
[activating module `rewrite' in /home/z-wave-support/zwarelocal/install/httpd/conf/httpd.conf]
'configure' applied on the modules : zwportal httpd php openssl zweb
Adding Z-Ware services to 'upstart' service manager...
Add 'zware-http' service to upstart configuration directory '/etc/init' (y/N)? :
y
Installing upstart service configuration for 'zware-http'
Add 'zware-local' service to upstart configuration directory '/etc/init' (y/N)? :
y
Installing upstart service configuration for 'zware-local'
Enable this package to be auto started after system boot up (y/N)? : y
Z-Ware Portal (version 1. 20) is installed!

```

Figure 9: Configure Services to Auto-Start

With this configuration, you can start the services:

```
$ sudo /etc/init.d/zware-service start
```

but it should now automatically start on system boot.

If you turn off the auto-start, you can start the services manual from the install directory `/home/<user name>/zwarelocal`

```
$ ./service/service.sh start
```

When the services are running, you are ready to use the Web Server.

5.2.2 Run the Sample Web Portal

With the Web Server up and running, the sample Web site can now be access through any browser.

<http://localhost> or <http://ip-address>

When 'y' is selected for "Use Secure HTTP?" configuration option, even when the browser accesses unsecure URL (HTTP), it gets redirected to a secure URL (HTTPS). The browser will show a security warning, such as "Connection is not secure" or "The server certificate is self-signed", which you will have to accept in the test setup. In a production setup, such warnings are typically not acceptable and need an appropriate fix in the Web Server.

The default username / password for the sample Web site is: user / smarthome.

From here, you can add and remove nodes, control them, and set up scenes.

For a more advanced Engineering Interface, see:

<http://localhost/ui/eng/index.html>

This gives you a more detailed view, with more information about the nodes, the possibility for firmware update, and more, but the GUI is less intuitive.

For more help and information about the GUI, see *Z-Wave Web User Guide* [3].

5.2.3 Log Files

Below are locations of the relevant log-files.

- Apache HTTP Server
Location for access-log: *<install-path>/install/httpd/logs/access_log*
Location for error-log: *<install-path>/install/httpd/logs/error_log*
- Z-Wave Portal Daemon
Location: *<install-path>/install/zwportald/var/log/zwportald.log*
- Z-Wave Web
Location for access-log: *<install-path>/install/zweb/logs/access_log*
Location for error-log: *<install-path>/install/zweb/logs/error_log*

5.3 Start Developing with the Web-API

This section describes two approaches to develop with the Web API.

5.3.1 A quick View of the API with the PyZWare

The sample client application written in Python, PyZWare, is not part of the SDK, but can be downloaded from [github](#). The documentation can be found [here](#).

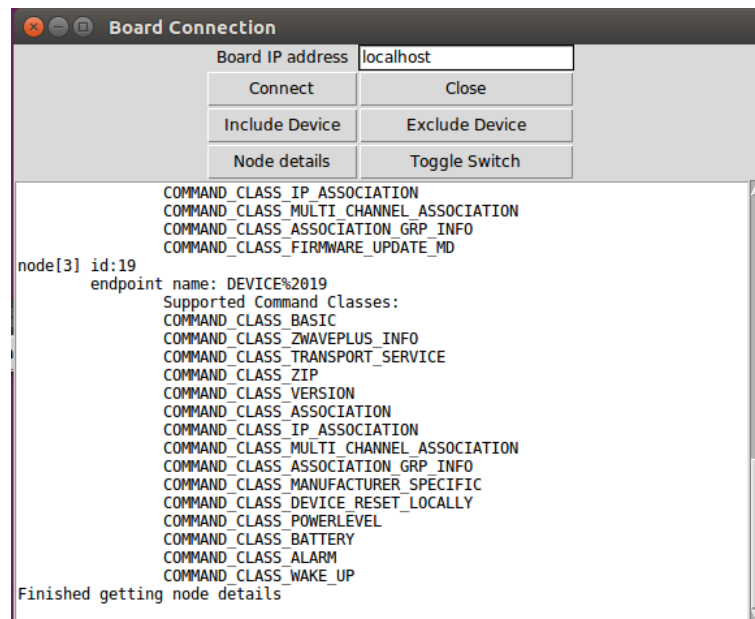


Figure 10: PyZWare Client

The documentation mentioned above is a good starting point to understand the API. The application can be compiled for both Windows and Linux operating systems. If compiled for Linux OS, it can run on the same machine as the Z-Ware Web Server.

Python3 is required and makes use of tkinter GUI toolkit, which comes preinstalled with Python3 on Windows OS, but must be installed separately on Linux OS.

```
$ sudo apt-get install python3-tk
```

With this, you should be able to run the `zwareClient.py` script.

```
$ python3 zwareClient.py
```

5.3.2 First Web Site Using the Web API

To better understand how the Web API can be integrated into a Web site, use the sample portal:
<http://localhost/ui/eng/index.html>

Use the built-in debugger in Google Chrome to understand the flow and the function calls. As an example, add a binary switch to the network and toggle the value.

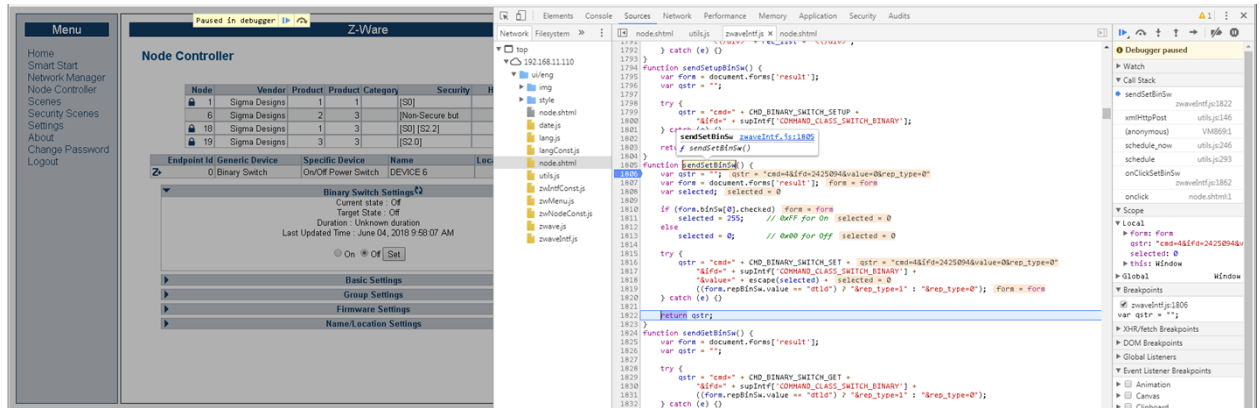


Figure 11: Google Chrome Debugger

After understanding the Web API, start modifying the sample source code, located in:

`<install-path>/install/zweb/htdocs/`

Depending on the selected GUI, the locations can also be as follows:

`<install-path>/install/zweb/htdocs/ui/pc`

`<install-path>/install/zweb/htdocs/ui/eng`

5.4 Generate the Z-Ware Documentation

In addition to user guides listed in this document, Doxygen can be used to generate the documentation for the source code.

Z-Ware C API

```
<download-path>/src/zwportal/src/zwave/hcapi/doc/doxygen
$ chmod +x generate_doc.sh
$ ./generate_doc.sh ce moderate
```

Z-Ware portal daemon

```
<download-path>/src/zwportal/src/zwave/zwportald
$ doxygen
```

Z-Ware web (CGI)

```
<download-path>/src/zwportal/src/zwave/zweb/classic
$ doxygen
```

Z-Ware Scenes library (libzwscene)

```
<download-path>/src/zwportal/src/zwave/libzwscene
$ doxygen
```

The generated documentation can be viewed in any browser.

6 NETWORK SETUP

This chapter provides an overview of various network setups.

6.1 Z/IP Gateway Network Setup

Z/IP Gateway is a native IPv6 host, mapping IPv4 to IPv6 internally. Z/IP Gateway requests IPv4 addresses from the existing IPv4 network via DHCP and maps the IPv4 addresses to individual Z-Wave nodes.

On the Linux OS, the raw Ethernet connectivity is achieved by using the Linux TAP/TUN driver. Z/IP Gateway application works as an IPv6 gateway between a LAN network and a Z-Wave PAN (Personal Area Network).

The Z/IP Gateway creates a TAP interface, usually named tap0. The tap interface is by default bridged to the physical network interface.

Use the Z/IP Gateway “locally” to connect directly to Z-Ware on the same host. As a result, external incoming/outgoing connections are not needed, so you can use the tap0 interface directly, without attaching it to a bridge.

6.2 Z-Ware Local

By using the Z-Ware Local setup, the Web Server is hosted on the local device in each home. The users connect directly to the Web Server in their home. Some port forwarding might be needed to open for external access.

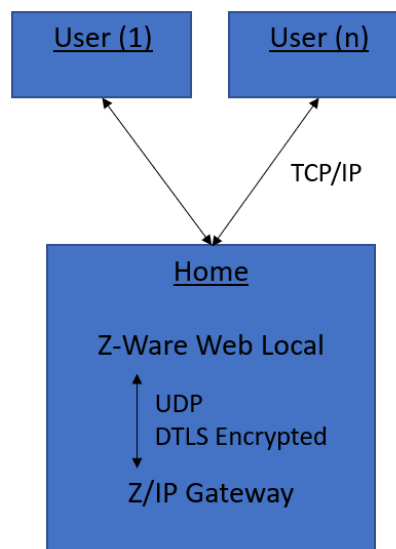


Figure 12: Setup with Z-Ware Local. No Support for Cloud.

6.3 Z-Ware Portal (Cloud)

By using the Z-Ware Portal setup, the Z-Ware Web Server is hosted in the cloud. Every user connects to the cloud to get access to their specific home, based on login rights.

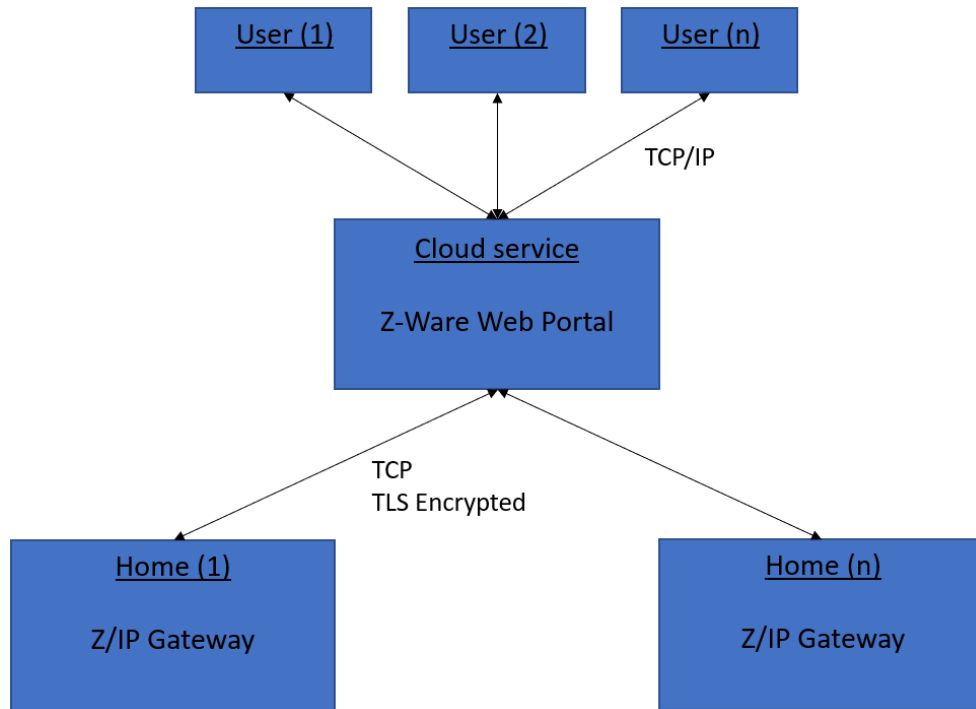


Figure 13: Setup with Z-Ware Portal. Using Z-Ware Web Portal as Cloud.

6.4 Z-Ware Local with an Optional Cloud

The most used solution is based on the Z-Ware C-API. By building your own application running side-by-side with the Z/IP Gateway, you can connect to a 3rd party cloud service. Each user connects to your cloud service to get access to their home.

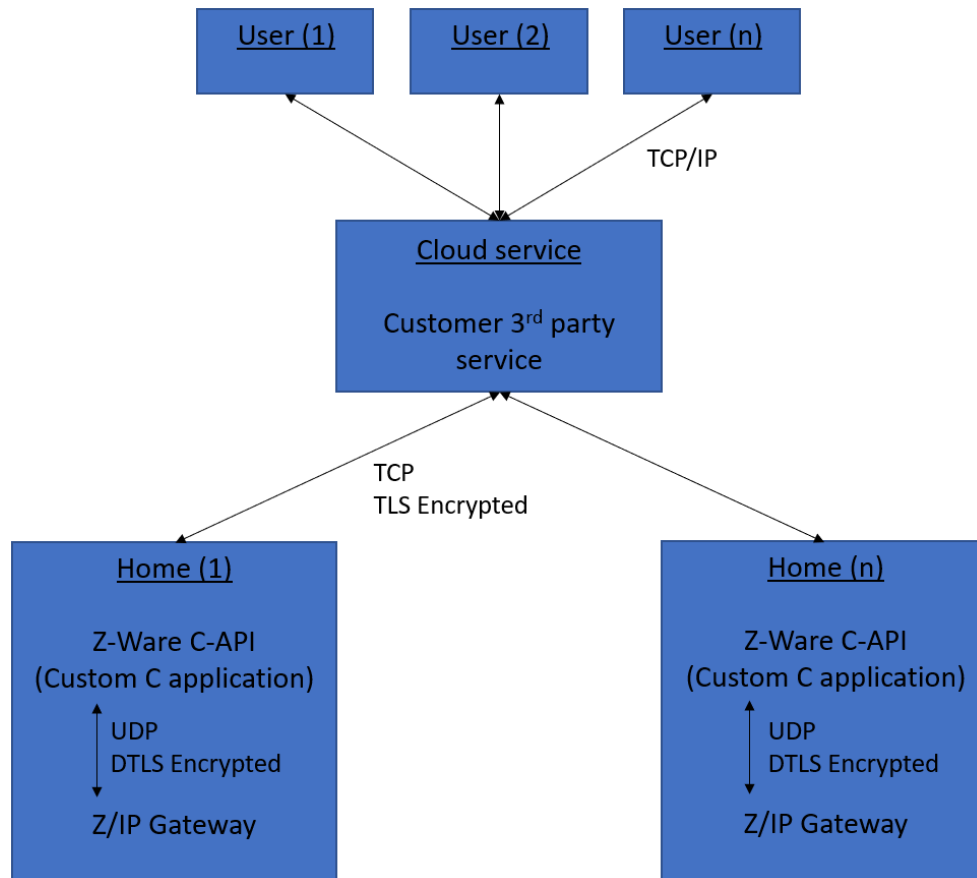


Figure 14: Setup with Z-Ware Local Using Customer C Application. Can be Extended with Customer 3rd Party Cloud Solution.

6.5 Running Z/IP Gateway and Z-Ware on the Same Host Processor

When running both the Z/IP Gateway and Z-Ware on the same host processor, the connection is DTLS-encrypted between the two applications. Though adding an extra layer of safety, it also adds time to encrypt and decrypt messages as well as latency, which is inconvenient when sending the same command to multiple devices.

Currently, users can't disable DTLS encryption.

REFERENCES

- [1] INS14416 Z-Ware Library User Guide
- [2] INS14486 Z-Ware Web Server & Native Apps Installation Guide
- [3] INS14428 Z-Ware Web User Guide
- [4] INS14430 Z-Ware Web Developer Guide