XWAY TCP/IP <=> FIPWAY GATEWAY

May 2025

1 Features

- X-WAY addressing support
- UNI-TE messaging support
- FIPWAY
  - Bitrate support : 1Mbps
  - Turn-around time : 10us
  - Silence time : 94us
  - UNI-TE messaging
- XWAY over TCP/IP

3 Applications

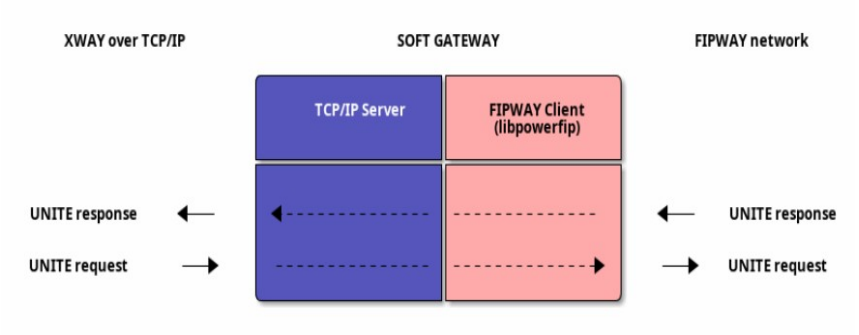
- Inter-automates communication
- Retrofit

2 Description

This *EXOLIGENT* software gateway enables inter-automate communication on older Schneider Electric installations based on FIPWAY protocol throught Ethernet TCP/IP.

The purpose of this gateway is to communicate with older FIPWAY equipment (TSX 17, TSX 37, TSX 57, ...) via Ethernet TCP/IP communication.

XWAY addressing and UNI-TE messaging frames are retrieved and transferred from the Ethernet physical and data link layers to FIP fieldbus, and vice versa.



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4 Revision History

Revision	Changes	Authors	Date
Rev.A	Initial Version	MC	5/25

5 Installation

5.1 GNU/Linux

The FIP part of the gateway is based on the Exoligent's PowerFIP coprocessor. The software distribution (Drivers, C API ...) is available on the Exoligent website (see Download Section). Here are the Linux commands for retrieving and installing the archive on the gateway machine :

LINUX COMMANDS :

```
# Retrieving powerfip distribution from the internet
$ cd Documents
$ wget --header 'User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:53.0)' https://www.exoligent.com/wiki/worldfip/pwrfip/download/1.4.6/powerfip-1.4.6-linux.tar.gz

# Archive decompression
$ tar -xzf powerfip-1.4.6-linux.tar.gz

# Firmware and powerfip library installation
$ cd powerfip-1.4.6-linux
$ sudo ./install.sh

# Driver compilation and installation
$ cd drivers/linux
$ make
$ sudo ./install.sh
```

We will now install an overlay software for the FIPWAY protocol. This software distribution (C API, Examples ...) is available on the Exoligent website (see Download Section). The open source examples include: an ethway client, a fipway client, and the gateway. Here are the Linux commands for retrieving and installing the archive on the gateway machine :

LINUX COMMANDS :

```
# Retrieving fipway distribution from the internet
$ cd Documents
$ wget --header 'User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:53.0)' https://www.exoligent.com/wiki/worldfip/fipway/download/0.1.0/fipway-0.1.0-beta-linux.tar.gz

# Archive decompression
$ tar -xzf fipway-0.1.0-beta-linux.tar.gz

# Fipway library installation
$ cd fipway-0.1.0-beta-linux
$ sudo ./install.sh

# Compilation of the gateway
$ cd tools/xway_gateway/
$ make

# Checking for correct fip board detection
$ ./ethfipd -l
[05-26 12:40:18.089967] fip  => [info]  ** board 1:
[05-26 12:40:18.089988] fip  => [info]    index      : 1
[05-26 12:40:18.090002] fip  => [info]    fsn        : 0xf1a1556d084f
[05-26 12:40:18.090021] fip  => [info]    vid        : 0x11aa
[05-26 12:40:18.090038] fip  => [info]    did        : 0x1556
[05-26 12:40:18.090054] fip  => [info]    ssvid      : 0x11aa
[05-26 12:40:18.090070] fip  => [info]    ssdid      : 0x5811
[05-26 12:40:18.090086] fip  => [info]    bar_cnt    : 2
[05-26 12:40:18.090102] fip  => [info]    bar_bsz[0]  : 4096
[05-26 12:40:18.090119] fip  => [info]    bar_base[0]  : 0xb4000000
[05-26 12:40:18.090135] fip  => [info]    bar_bsz[1]  : 33554432
[05-26 12:40:18.090152] fip  => [info]    bar_base[1]  : 0xb2000000
```

```
[05-26 12:40:18.090168] fip  => [info]     irq_number   : 160
[05-26 12:40:18.090184] fip  => [info]     drv_version  : 1.6.0

# Installing the gateway as a service
$ cd svc
$ sudo ./install_svc.sh

# Service checking
$ sudo systemctl status ethfipd.service
● ethfipd.service - XWAY over TCP/IP <-> FIPWAY gateway
     Loaded: loaded (/etc/systemd/system/ethfipd.service; enabled; preset: enabled)
     Active: active (running) since Mon 2025-05-26 11:20:08 CET; 7min ago
   Main PID: 1889 (ethfipd)
      Tasks: 3 (limit: 8892)
     Memory: 352.0K (peak: 1.5M)
        CPU: 32.766s
     CGroup: /system.slice/ethfipd.service
             └─1889 /usr/bin/ethfipd -n 2 -a 1 -p 5094 -L /var/log/ethfipd.log
```

The gateway is now active and listening by default on TCP port number **5094**. If the PC is rebooted, the service will restart automatically. We will now describe the gateway settings in more detail. (§ Gateway Configuration)

6 Uninstallation

6.1 GNU/Linux

In this section, we'll look at uninstalling previously installed software. We'll start by stopping and disabling the gateway service. Then we'll uninstall the FIPWAY protocol overlay. And finally, we'll uninstall the PowerFIP distribution :

LINUX COMMANDS :

```
# Stop the gateway service
$ sudo systemctl stop ethfipd.service

# Uninstall service autostart on boot
$ sudo systemctl disable ethfipd.service

# Uninstall gateway service
$ cd Documents/fipway-0.1.0-beta-linux/tools/xway_gateway/svc
$ sudo ./uninstall_svc.sh

# Fipway distribution uninstallation
$ cd Documents/fipway-0.1.0-beta-linux
$ sudo ./uninstall.sh

# Delete archive
$ cd Documents
$ rm -rf fipway-0.1.0-beta-linux
$ rmdir fipway-0.1.0-beta-linux

# Firmware and powerfip library uninstallation
$ cd powerfip-1.4.6-linux
$ sudo ./uninstall.sh

# Driver uninstallation
$ cd drivers/linux
$ sudo ./uninstall.sh

# Delete archive
$ cd Documents
$ rm -rf powerfip-1.4.6-linux
$ rmdir powerfip-1.4.6-linux
```

7 Gateway Configuration

When the gateway is correctly installed, you can find its configuration parameters by querying the **ethfipd** binary with the **-h** parameter in **/usr/bin** directory.

LINUX COMMANDS :

```
$ cd /usr/bin
$ ethfipd -h
Usage: ethfipd [OPTION]...
XWAY over TCP/IP <=> FIPWAY gateway.
Options:
   -i  device index [default=0]
       note: 0: automatically opens a free device index
   -n  network address [min=0,max=63] [default=1]
   -a  station address [min=0,max=127] [default=1]
   -m  enable master [default=disabled]
   -p  tcp port     [default=5094]
   -L  output log trace file [default=/dev/stdout]
   -l  list the FIP boards present on the host machine
   -h  show this help and exit
   -v  show version and exit
Examples:
   ethfipd -i 1 -m -n 1 -a 1
```

The **-n** and **-a** parameters form the gateway's XWAY address (ex: **-n 2 -a 1** for *XWAY{2.1}*).
The **-p** parameter specifies the TCP/IP server's listening port for incoming XWAY requests.

If you use the **ethfipd** binary as a daemon, you can modify these parameters in the */etc/systemd/system/ethfipd.service* file. For example, in the example below we change the TCP port number to **6078** :

LINUX COMMANDS :

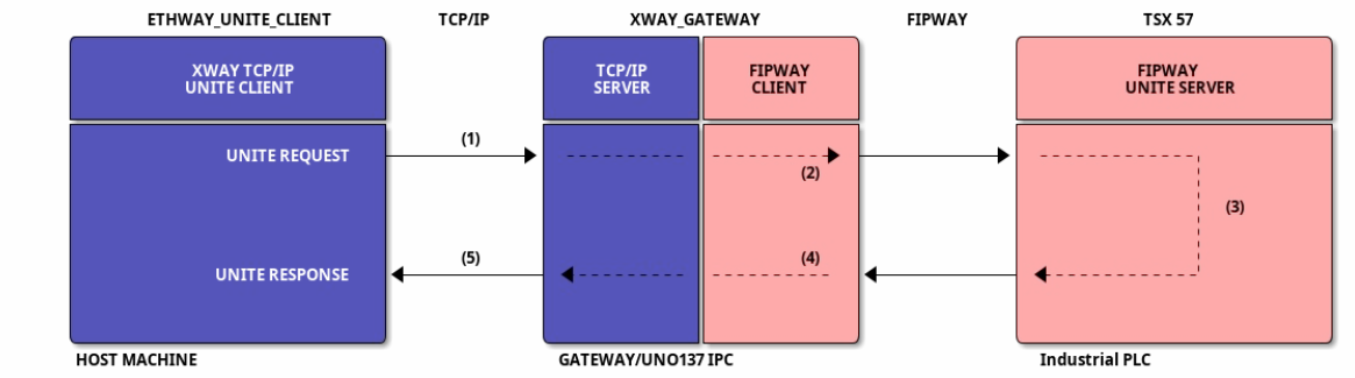
```
# Change daemon configuration
$ sudo nano /etc/systemd/system/ethfipd.service
[Unit]
Description=XWAY over TCP/IP <-> FIPWAY gateway
[Service]
Type=simple
ExecStart=/usr/bin/ethfipd \
        -n 2 \
        -a 1 \
        -p 6078 \
        -L /var/log/ethfipd.log
User=root
Restart=on-failure
RestartSec=3
[Install]
WantedBy=multi-user.target

# Daemon reloading
$ sudo systemctl daemon-reload

# Restart the gateway
$ sudo systemctl start ethfipd.service
```

8 Example

In this section, we assume that the gateway is installed and active on a remote machine. The gateway is connected via a FIP cable to a TSX 57 device. The aim here is to interrogate the TSX 57 using UNI-TE XWAY requests over TCP/IP from a host machine. The XWAY requests over TCP/IP will be converted by the gateway into FIPWAY frames. And the TSX's FIPWAY responses will be converted back into XWAY frames over TCP/IP and returned to the host machine.



Exoligent's distribution of FIPWAY software provides open source sample code for sending UNI-TE requests over TCP/IP.

From your host machine, download the FIPWAY software distribution from the Exoligent website (see Download Section).

The example is located in the *tools/ethway_unite_client* directory of the unpacked archive. Enter the folder and compile the example :

LINUX COMMANDS :

```
# Retrieving fipway distribution from the internet
$ cd Documents
$ wget --header 'User-Agent: Mozilla/5.0 (X11; Linux x86_64; rv:53.0)' https://www.exoligent.com/wiki/worldfip/fipway/download/0.1.0/fipway-0.1.0-beta-linux.tar.gz

# Archive decompression
$ tar -xzf fipway-0.1.0-beta-linux.tar.gz

# Example compilation
$ cd fipway-0.1.0-beta-linux/tools/ethway_unite_client
$ make

# Show example parameters
$ ./ethway_unite_client -h
Usage: ethway_unite_client [OPTION]...
It sends/receives UNI-TE requests/responses using XWAY on TCP/IP.
By default, if no option is added,
Options:
  -a  ip address    [default=127.0.0.1]
  -p  tcp port      [default=5094]
  -t  timeout in ms [default=1000]
  -h  show this help and exit
  -v  show version and exit
```

To connect to the gateway, we need the **-a** and **-p** parameters. The default TCP port number for the gateway is **5094**. However, depending on the gateway configuration, the IP address may change dynamically. So here we're going to search for the IP address using the gateway's MAC address (unique number).

LINUX COMMANDS :

```
# Search IP from MAC.
```

```
# --> cc:82:7f:5e:71:9b : Example of MAC address for gateway
$ arp -a | grep cc:82:7f:5e:71:9b
fipuno.home (192.168.1.25) à cc:82:7f:5e:71:9b [ether] sur eno1
```

Now that we know the gateway's IP address, we can run the utility to query the TSX 57 using TCP/IP frames via the gateway.

LINUX COMMANDS :

```
# Search IP from MAC cc:82:7f:5e:71:9b
$ ./ethway_unite_client -a 192.168.1.25 -p 5094
[05-27 15:47:33.248974] app  => [info]  *** ethway_unite_client v1.0.0 ***
[05-27 15:47:33.248999] eth  => [info]  [eth] initialization
[05-27 15:47:33.249228] eth  => [event] [eth] client connected
[05-27 15:47:33.249237] eth  => [event] [eth] server connection ok (192.168.1.25:5094).
[05-27 15:47:33.249240] app  => [info]  CTRL+C to close app.
eth_tx: f1 01 20 02 20 09 3e 36 07 68 07 00 00 0a 00
eth_rx: f1 02 20 01 20 19 3e 66 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
eth_tx: f1 01 20 02 20 09 3e 36 07 68 07 00 00 0a 00
eth_rx: f1 02 20 01 20 19 3e 66 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
eth_tx: f1 01 20 02 20 09 3e 36 07 68 07 00 00 0a 00
eth_rx: f1 02 20 01 20 19 3e 66 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
eth_tx: f1 01 20 02 20 09 3e 36 07 68 07 00 00 0a 00
eth_rx: f1 02 20 01 20 19 3e 66 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
eth_tx: f1 01 20 02 20 09 3e 36 07 68 07 00 00 0a 00
eth_rx: f1 02 20 01 20 19 3e 66 07 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
[…]
```

We've done it! We're now communicating with the TSX 57 using XWAY frames and UNI-TE messaging over TCP/IP.

9 Application Notes

9.1 Terms, abbreviations and definitions

Term	Description
API	Application Programming Interface
FIP	Factory Instrumentation Protocol
IP	Internet Protocol
TCP	Transmission Control Protocol

9.2 Resources

Additional Resources

Official Website	www.exoligent.com
PowerFIP API	https://www.exoligent.com/wiki/worldfip/pwrfip/library.html
FIPWay API	https://www.exoligent.com/wiki/worldfip/fipway/fipway.html
E-mail (Technical Support)	info@exoligent.com