

Application Note:

*Demo programs for PremierWave EN and
PremierWave XN*

Overview

The Lantronix PremierWave EN and PremierWave XN products have powerful, 400MHz ARM9 processors and 64MB of SDRAM as well as 64MB of Flash. These products run the Linux operating system, and they allow the engineer to customize the firmware that runs on them. This customization can be done via the Timesys LinuxLink SDK.

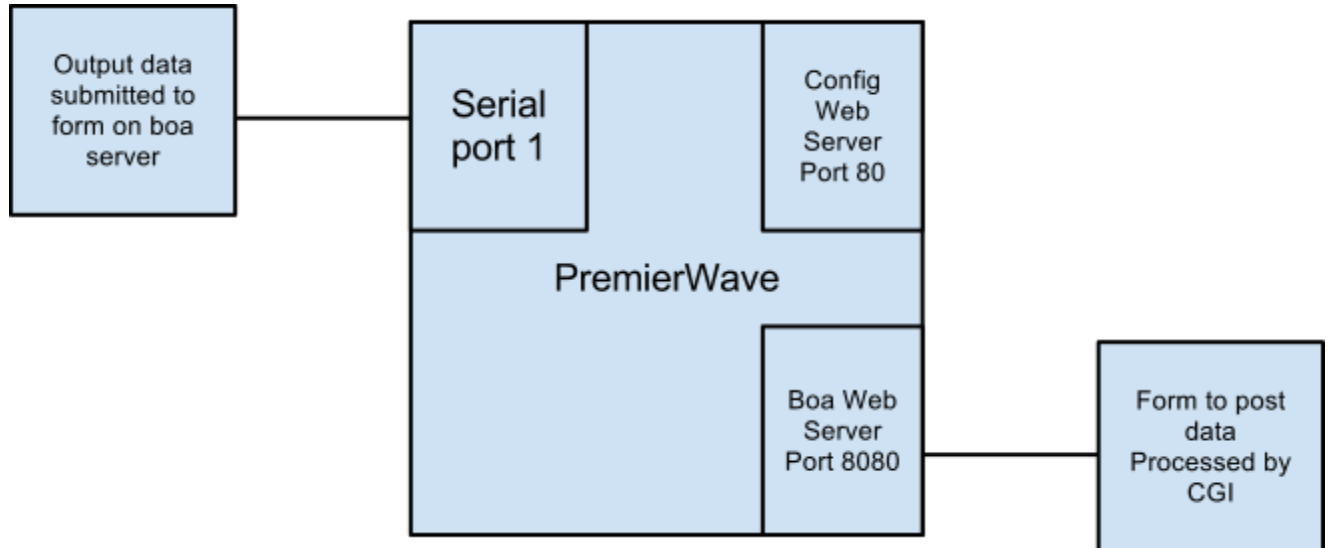
This Application Note will show how to use that SDK to create some custom Linux programs running on the Lantronix products.

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Demo 1: Post to local web server and output to serial port (f2s demo)

Demo description



This demo adds the boa webserver to the PremierWave firmware. It then configures it to listen on port 8080, as our configuration web server runs on port 80. The demo includes a file, f2s.html that sets up a very simple form that uses the HTTP POST method to submit a string to the boa webserver. The f2s.c file implements a CGI program that gets called when the form is submitted. It then opens serial port 1 and sends the string out the serial port. It waits 3 seconds for input back from the serial port, and returns a webpage that displays whatever was returned from the serial port during those 3 seconds.

Create a firmware image with Timesys free webbuild

Sign up for Timesys LinuxLink account, and sign in. Click on Build BSP/SDK and then Create a Project. Give your project a name, select your PremierWave product (EN or XN) as the Board.

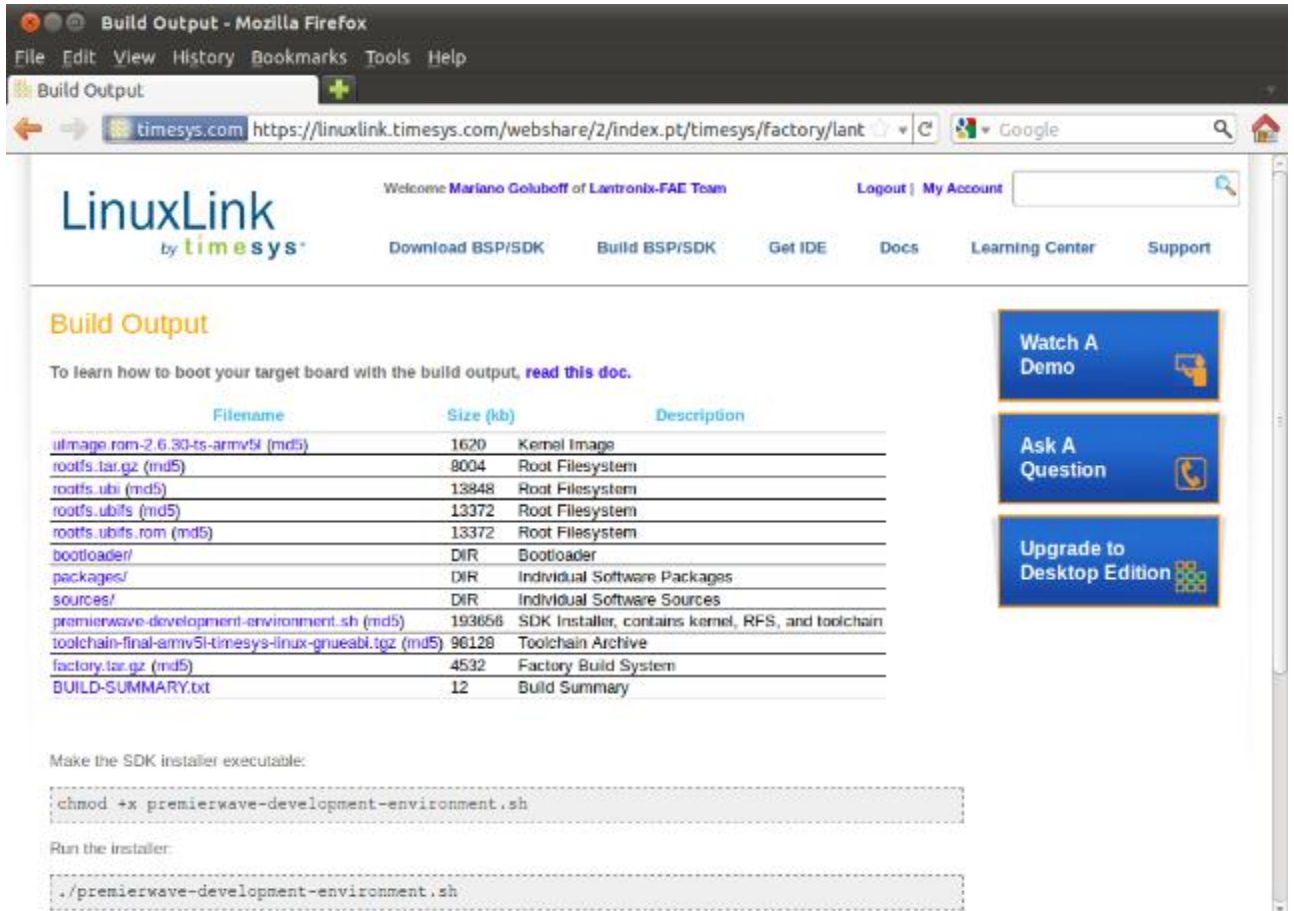
Then click on Create a Workorder, give it a name, and click Next. Keep the defaults for kernel and libc (keep clicking Next). When you get to the Packages page, expand Networking and select the package boa. Expand System and select ltrx-rfs-base and ltrx-fwupgrade. Click Next.

Leave the defaults for Build Options and click Next, then click Build.

Install SDK

Once the build above is done, you will receive an email with a link to the output of the web factory. Follow the link, and you will be able to download the SDK setup script named premierwave-development-environment.sh

Setup a VMWare image, or a Linux host. Make the SDK setup script executable (chmod +x), then run it to install the SDK.



Build Output - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Build Output

timesys.com https://linuxlink.timesys.com/webshare/2/index.pt/timesys/factory/lant

Welcome Mariano Goluboff of Lantronix-FAE Team Logout | My Account

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Build Output

To learn how to boot your target board with the build output, [read this doc](#).

Filename	Size (kb)	Description
uImage.rom-2.6.30-ts-armv5l (md5)	1620	Kernel Image
rootfs.tar.gz (md5)	8004	Root Filesystem
rootfs.ubi (md5)	13848	Root Filesystem
rootfs.ubifs (md5)	13372	Root Filesystem
rootfs.ubifs.rom (md5)	13372	Root Filesystem
bootloader/	DIR	Bootloader
packages/	DIR	Individual Software Packages
sources/	DIR	Individual Software Sources
premierwave-development-environment.sh (md5)	193656	SDK Installer, contains kernel, RFS, and toolchain
toolchain-final-armv5l-timesys-linux-gnueabi.tar.gz (md5)	96128	Toolchain Archive
factory.tar.gz (md5)	4532	Factory Build System
BUILD-SUMMARY.txt	12	Build Summary

Make the SDK installer executable:

```
chmod +x premierwave-development-environment.sh
```

Run the installer:

```
./premierwave-development-environment.sh
```

Watch A Demo

Ask A Question

Upgrade to Desktop Edition

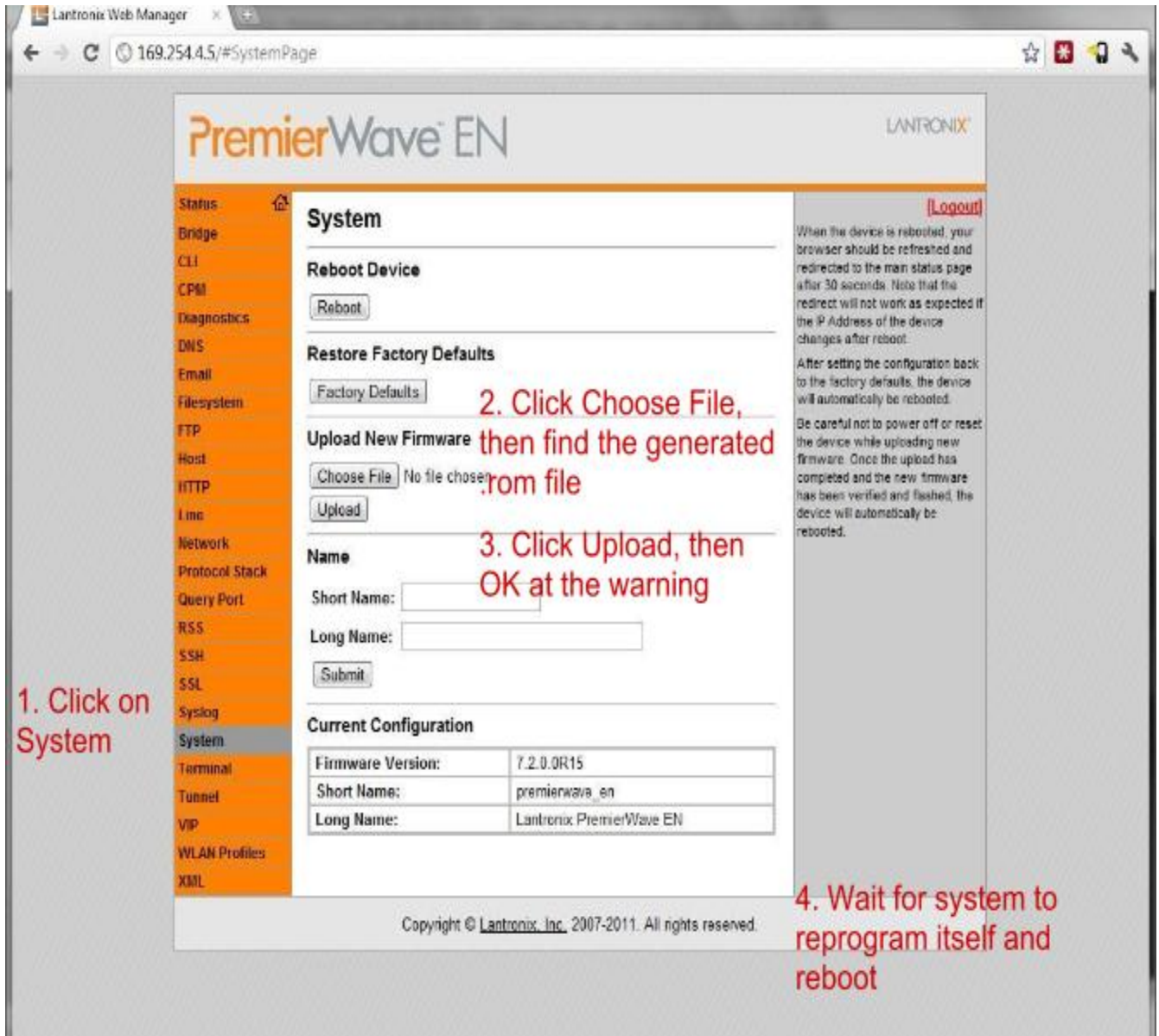
Add toolchain/bin to the \$PATH variable (for example, in your ~/.profile file), and add the environment variable CC=armv5l-timesys-linux-gnueabi-gcc

Configure PremierWave

Put new firmware image on PremierWave

From Timesys website, download the bootloader/premierwave-x_x_x_xRx.rom file, this is the new firmware file.

Follow the instructions in the Quick Start Guide and the User's Guide to configure the PremierWave module and put it on the network. Once it is on the network, use your web browser to navigate to the PremierWave's configuration web server. Follow this picture to upload the new .rom image:



Enable telnet authentication

Once it reboots, go back to the configuration web server and enable Telnet authentication by following the steps below.

The screenshot shows the Lantronix Web Manager interface for PremierWave EN. The browser address bar shows the URL 169.254.4.5/#CLIConfigPage. The interface has a navigation menu on the left with the following items: Status, Bridge, CLI, CPM, Diagnostics, DNS, Email, Filesystem, FTP, Host, HTTP, Line, Network, Protocol Stack, Query Port, RSS, SSH, SSL, Syslog, System, Terminal, Tunnel, VIP, WLAN Profiles, and XML. The 'CLI' item is highlighted. The main content area is titled 'Command Line Interface Configuration' and contains a table of settings:

Login Password:	<Configured>
Enable Level Password:	<None>
Quit Connect Line:	<control>L
Inactivity Timeout:	15 minutes
Line Authentication:	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
Telnet State:	<input checked="" type="radio"/> Enabled <input type="radio"/> Disabled
Telnet Port:	23
Telnet Max Sessions:	3
Telnet Authentication:	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
SSH State:	<input checked="" type="radio"/> Enabled <input type="radio"/> Disabled
SSH Port:	22
SSH Max Sessions:	3

Red annotations on the screenshot indicate the following steps:

1. Click on CLI
2. Click on Configuration
3. Enable Telnet authentication
4. Click Submit

The right sidebar contains a (Logout) link and a warning: 'The Command Line Interface may be accessed via Telnet, via SSH, or via a serial line. For the SSH server, the SSH Server Authorized Users are used for initial login access.'

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Configure boa web server

For this demo, we will be using the boa web server. Here we will configure it to listen on a different port than the configuration web server.

Telnet into the PremierWave EN, use root as both username and password. Unmount the /etc ramdisk (umount /etc) to make sure changes are persistent. Edit (with vi, for example) the file /etc/boa/boa.conf and make the following changes:

- Port 8080

- ScriptAlias /cgi-bin/ /ltrx_user/www/cgi-bin
- DocumentRoot /ltrx_user/www

While /etc is unmounted, also edit the /etc/inittab file, and add a line to start boa on startup. For example, after the line that starts /bin/ltrx_as, you could enter:

- null::sysinit:/usr/sbin/boa &

Reboot the PremierWave by typing the reboot comand.

Compile code with SDK

Take the attached f2s.tar.gz file and put it in a working directory (say, ~/projects/) in your Linux VMWare image or host. Unpack it: tar -xzf f2s.tar.gz

Go into the f2s directory and type make to build the f2s.cgi file.

Put files on PremierWave filesystem

Ftp to the PremierWave module (login with username=admin, password=PASS), create the www directory and change to it (mkdir www then cd www) and put the f2s.html file. Then create the cgi-bin directory and change to it, and put the f2s.cgi file there. Use chmod to set the correct permissions to the files (755 for directories www and cgi-bin and executable f2s.cgi, and 644 for f2s.html).

Test it

Connect serial port 1 of the PremierWave board to your computer and open Tera Term (or some other terminal emulator).

Point your browser to the IP address of the PremierWave EN, port 8080, and the f2s.html file (e.g. <http://192.168.1.105:8080/f2s.html>)

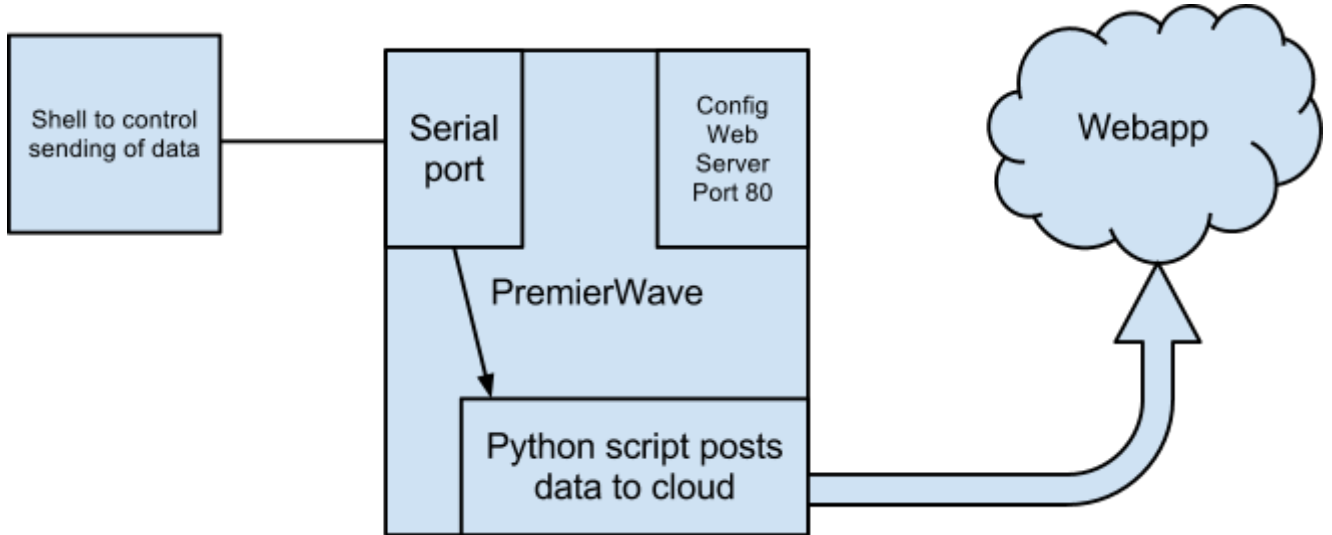
You should see a form to enter a string. When you hit the submit button, whatever is entered there will go out the serial port. The cgi program will also wait 3 seconds and present whatever is entered from the serial port on the webpage.

Notes

This demo calls for editing configuration files and adding files to the PremierWave itself once the image with boa has been programmed into it. For production purposes, it would make sense to create a .rom image with those modifications already done. Look at the section called “Put Image Together Using SDK” in the following demo (Demo 2) for instructions on how to do that.

Demo 2: Python scripting, post data to cloud

Demo description



These instructions demonstrate two capabilities of the PremierWave module. First, it shows you how to get the Python scripting interpreter and the Pyserial library installed on your PremierWave module. Then, it shows how to use Python to setup a command shell on the serial port that allows an edge device connected on that serial port to send data to a webapp in the cloud.

Create a firmware image with Timesys free webbuild

Sign up for Timesys LinuxLink account, and sign in. Click on Build BSP/SDK and then Create a Project. Give your project a name, select your PremierWave product (EN or XN) as the Board.

Then click on Create a Workorder, give it a name, and click Next. Keep the defaults for kernel and libc (keep clicking Next). When you get to the Packages page, expand Runtimes, and select the python and pyserial packages. Expand System and select ltrx-rfs-base and ltrx-fwupgrade. Click Next.

Leave the defaults for Build Options and click Next, then click Build.

Install SDK

Once the build above is done, you will receive an email with a link to the output of the web factory. Follow the link, and you will be able to download the SDK setup script named premierwave-development-environment.sh

Setup a VMWare image, or a Linux host. Make the SDK setup script executable (chmod +x), then run it to install the SDK.

Add toolchain/bin to the \$PATH variable (for example, in your ~/.profile file), and add the environment variable CC=armv5l-timesys-linux-gnueabi-gcc

Put new image on PremierWave

Put image together using SDK

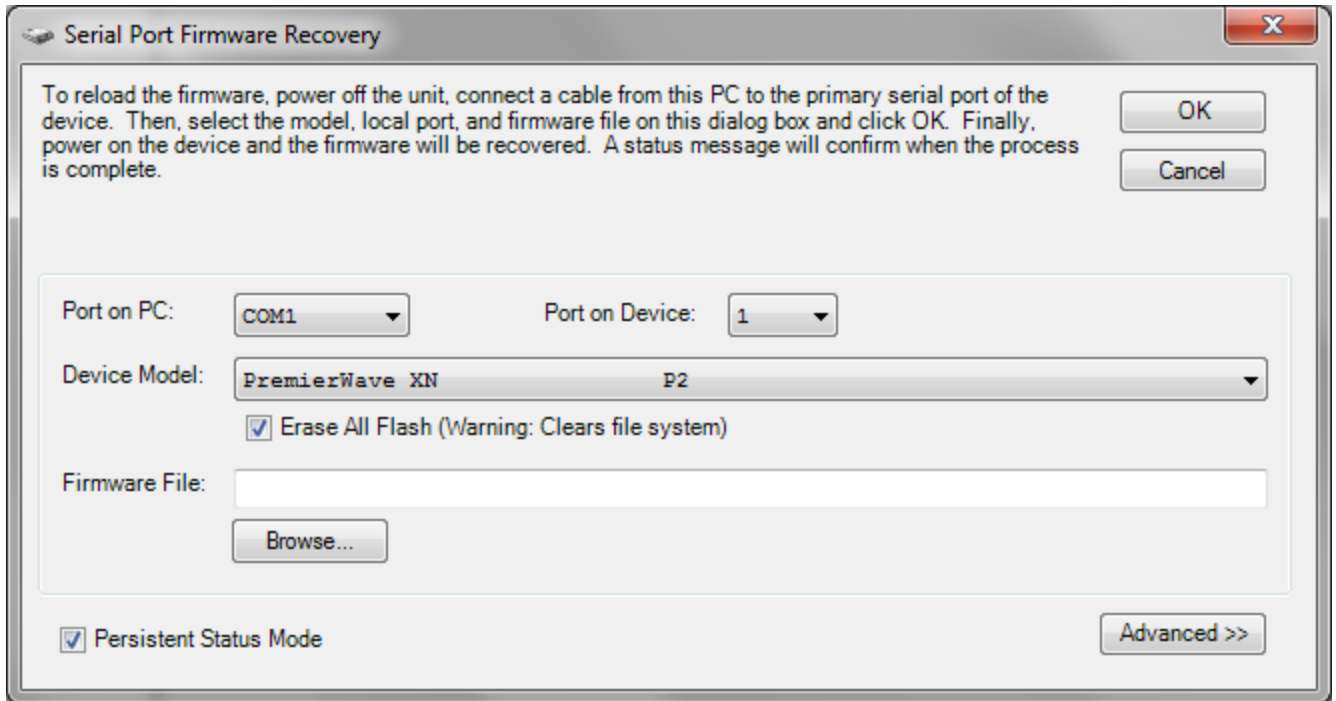
If our created rootfs was less than 16MB, we could flash the .rom file that is in the bootloader directory directly. Because we added Python, which is a large package, we will need to resize the flash partitions to use the larger rootfs. Refer to the Application Note entitled Flash Partitions on PremierWave Modules if you would like more details on partitioning.

Follow these steps in the Linux host or VMWare to create an image (change paths if SDK is not installed at default location):

- Create a directory to work in, for example ~/projects/fs and change to it
- `sudo tar xzf ~/timesys/premierwave/rfs/rootfs.tar.gz`
- (If needed, modify filesystem files here)
- `cd ..`
- `sudo ~/timesys/premierwave/toolchain/bin/mkfs.ubifs -m 512 -e 15872 -c 4096 -r ./fs -o rootfs.ubifs`
- For PremierWave EN:
 - `ltrx-makeimage -t10 rootfs.ubifs -v7.3.0.1R2 -iP1 -pimg28672 -ptot0`
- For PremierWave XN:
 - `ltrx-makeimage -t10 rootfs.ubifs -v7.3.0.1R2 -iP2 -pimg28672 -ptot0`
- `ltrx-makeimage -c ~/timesys/premierwave/ulmage.rom-2.6.30-ts-armv5l rootfs.ubifs.rom premierwave-full.rom`

You will now have a file called premierwave-full.rom that when installed as detailed below will resize the filesystem from 16MB to 28MB and fit the new image that we created. Now copy the premierwave-full.rom file to a Windows computer running DeviceInstaller.

Connect serial port 1 on PremierWave module to your PC. Start DeviceInstaller and press F8, or Tools->Recover Firmware. The following window will open.



Select the Port on your PC that you're using, the correct Device Model for your PremierWave module (EN or XN). Make sure that Erase All Flash checkbox is checked, then select the premierwave-full.rom

Enable telnet authentication

Once it reboots, use the instructions in the Quick Start guide to get the PremierWave on the network, and enable Telnet authentication by following the steps below.

The screenshot shows the Lantronix Web Manager interface for PremierWave EN. The browser address bar shows the URL `169.254.4.5/#CLIConfigPage`. The interface has a sidebar menu on the left with the following items: Status, Bridge, CLI, CPM, Diagnostics, DNS, Email, Filesystem, FTP, Host, HTTP, Line, Network, Protocol Stack, Query Port, RSS, SSH, SSL, Syslog, System, Terminal, Tunnel, VIP, WLAN Profiles, and XML. The main content area is titled "Command Line Interface Configuration" and contains a table with the following fields:

Login Password:	<input type="text" value="<Configured>"/>
Enable Level Password:	<input type="text" value="<None>"/>
Quit Connect Line:	<input type="text" value="<control>L"/>
Inactivity Timeout:	<input type="text" value="15"/> minutes
Line Authentication:	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
Telnet State:	<input checked="" type="radio"/> Enabled <input type="radio"/> Disabled
Telnet Port:	<input type="text" value="23"/>
Telnet Max Sessions:	<input type="text" value="3"/>
Telnet Authentication:	<input type="radio"/> Enabled <input checked="" type="radio"/> Disabled
SSH State:	<input checked="" type="radio"/> Enabled <input type="radio"/> Disabled
SSH Port:	<input type="text" value="22"/>
SSH Max Sessions:	<input type="text" value="3"/>

Red annotations on the screenshot indicate the following steps:

1. Click on CLI
2. Click on Configuration
3. Enable Telnet authentication
4. Click Submit

The footer of the page contains the text: "Copyright © Lantronix, Inc. 2007-2011. All rights reserved."

Run demo

Put files on PremierWave filesystem

Ftp to the PremierWave module (login with username=admin, password=PASS), and put the dataPost.py file.

Optional: put the ltrxpost.cfg file if you wish to use it to change configuration of the program options. Defaults can also be changed by editing the dataPost.py file.

Connect board and execute

Connect a terminal emulator like Tera Term to serial port 1 of the PremierWave module, 9600 baud, 8n1, no flow control. Telnet into PremierWave, login with root/root username/password. In the telnet prompt:

- `cd /ltrx_user`
- `chmod +x dataPost.py`
- `./dataPost.py`

This will execute the Python script, and output a shell serial port 1. In the terminal emulator you will be able to send commands. The commands currently implemented are:

- `send`: Anything entered after the `send` will be sent as a string to the webapp
- `name`: Anything entered after the `name` will be assigned as a “nice name” for the device. This will display in the webapp instead of the Uid. The name can be changed multiple times, but the data is always associated with the Uid
- `exit`: End the program

When you type “send this is a test” (without the quotes), the script will use the HTTP POST method to send the following values to a webapp:

- `Data`: the data entered (in this case: this is a test)
- `Port`: the port sending the data (in this case: `/dev/ttyS1`)
- `Uid`: the ID of the device (in this case: MAC address)

The webapp is at the location pointed to by the url variable. For demonstration purposes, we have created a webapp at the following url using the Google App Engine:

<http://ltrxpost.appspot.com>

You can access that website on your web browser, enter the Uid or Name you want to open (your MAC address, or the name you gave it by using the name command), and see the data posted and datestamp.

Make Python scripts start on boot-up

It might be useful to have your python script start on system boot, instead of having to telnet into the PremierWave and execute it. One way to achieve this is

to modify the `/etc/inittab` file to start the Python script. When putting together the image, after the `untar` statement and before the `mkfs.ubifs` statement, edit the file and add the following lines at the end:

```
null::sysinit:/usr/bin/python /ltx_user/start.py &
```

This will make it so that at start-up the `start.py` file will be run with the Python interpreter. You can call the `dataPost.main()` from within the `start.py` (or any other Python script).