



ThingWorx Raspberry Pi 2 Model B Setup Guide

August 2015

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1. Introduction

The Edge MicroServer is a powerful component of the ThingWorx architecture. The Edge MicroServer allows for the rapid deployment of connections between the ThingWorx platform and an associated data reporting device, with minimal design requirements on the part of the user.

The Edge MicroServer provides an “always-on” connection to the platform, and it opens a local web server that interacts with the REST API available on the platform.

This document provides installation and usage instructions for setting up the Raspberry Pi – 2 on the ThingWorx Platform. Note that this guide utilizes the ThingWorx C SDK built on the Raspberry Pi device to create an application server, and will not provide guidance on configuring the Raspberry PI-2 with the Edge MicroServer (EMS).

About the Raspberry Pi 2

The Raspberry Pi 2 is a single board computer that runs on a quad core Broadcom BCM2836 CPU with a 1 GB RAM. The Raspberry Pi 2 Model B is a second generation Raspberry Pi with 4 USB ports, 40 GPIO, Full size HDMI port, Ethernet port, composite video port, CSI camera port and DSI display port.

This guide will detail the steps to get the Raspberry Pi 2 connected with the ThingWorx platform and to pull data from and push data into the Raspberry Pi serial port.

2. Installation

Before beginning, please note that the raspbian OS (Download from: <https://www.RaspberryPi.org/downloads/>) needs to be loaded into a micro SD and loaded on to the Raspberry Pi device.

Please note that this guide was written for a computer running Microsoft Windows.

Connect the Raspberry Pi to a local machine

There are two ways to log on to the device:

Connect the device via the full size HDMI port of Raspberry Pi through an HDMI connector to a display monitor, the USB port to a keyboard in use, another USB port to a mouse in use and Ethernet port to a LAN connection.

Raspberry Pi Default Login Credentials:

Username: pi

Password: raspberry

The password and keyboard layout can be changed by system configuration using the following command on the Raspberry Pi terminal:

```
sudo raspi-config
```

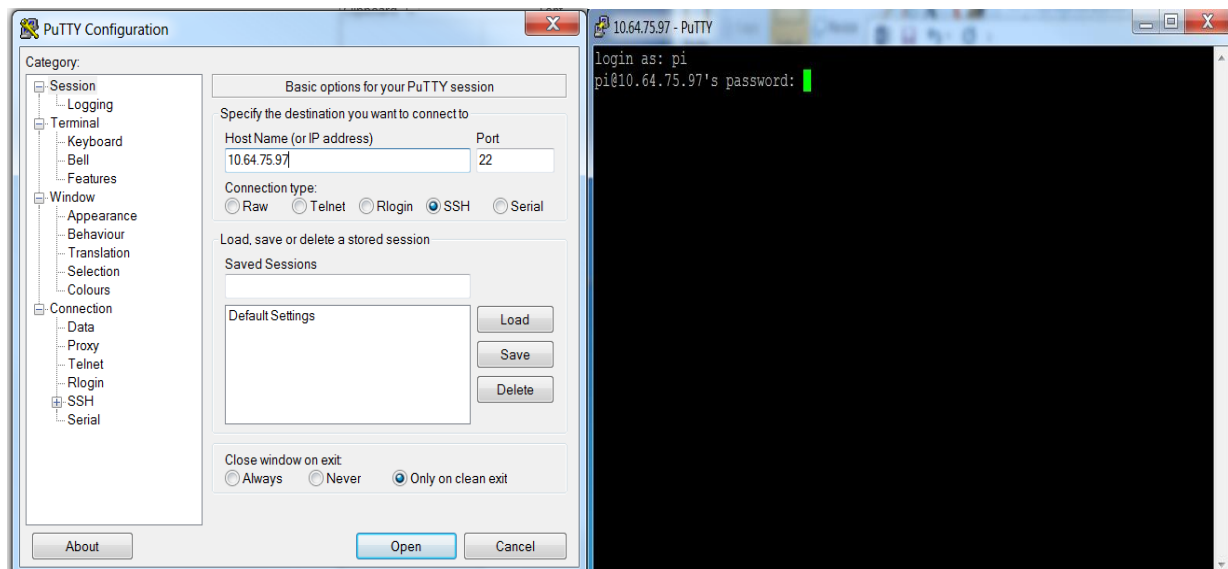
Once logged into the Raspberry Pi device, the IP address of the device can be checked using the following command on the Raspberry Pi terminal:

```
ifconfig
```

```
pi@raspberrypi: ~  
the exact distribution terms for each program are described in the  
individual files in /usr/share/doc/*/copyright.  
  
Debian GNU/Linux comes with ABSOLUTELY NO WARRANTY, to the extent  
permitted by applicable law.  
Last login: Mon Aug  3 14:54:14 2015 from nvelagaleti01.ptcnet.ptc.com  
pi@raspberrypi ~ $ ifconfig  
eth0      Link encap:Ethernet  HWaddr b8:27:eb:7e:3a:c5  
          inet addr:10.64.75.97  Bcast:10.64.75.255  Mask:255.255.254.0  
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1  
          RX packets:79261 errors:0 dropped:632 overruns:0 frame:0  
          TX packets:7243 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:1000  
          RX bytes:8614917 (8.2 MiB)  TX bytes:2022571 (1.9 MiB)  
  
lo        Link encap:Local Loopback  
          inet addr:127.0.0.1  Mask:255.0.0.0  
          UP LOOPBACK RUNNING  MTU:65536  Metric:1  
          RX packets:72 errors:0 dropped:0 overruns:0 frame:0  
          TX packets:72 errors:0 dropped:0 overruns:0 carrier:0  
          collisions:0 txqueuelen:0  
          RX bytes:6288 (6.1 KiB)  TX bytes:6288 (6.1 KiB)  
  
pi@raspberrypi ~ $
```

The IP address of the device is the inet address of eth0.

The Raspberry Pi can be used remotely by SSH connection at this IP address using terminal or PuTTY session.



Download and Install the Thingworx C SDK Package

1. Download the latest version of ThingWorx C SDK from the PTC Software Downloads site under Thingworx Edge SDK at <https://support.ptc.com>

PTC Software Download [Help]

Download Software - ThingWorx Edge SDK

Step 2 : Choose Release & Download

Use the list below to select the release you desire to download. If you need assistance refer to the [help notes](#).

NOTE: Employees using the Download Manager button will only launch the Download Manager functionality outside of our network. Inside the network the file will download directly via HTTPS.

Release SDKs

ThingWorx Edge SDK

Most Recent Datecode

Datecode: M010

ThingWorx-ADOEdge-5-5-0-93 (682 kb)	Download now: HTTPS or Download Manager
ThingWorx-C-SDK-1.2-1-261 (3 MB)	Download now: HTTPS or Download Manager
ThingWorx-DotNet-SDK-5-5 (1 MB)	Download now: HTTPS or Download Manager
ThingWorx-Java-SDK-5-0-1-103 (4 MB)	Download now: HTTPS or Download Manager
ThingWorx-OpcDAEdge-5-5-0-93 (842 kb)	Download now: HTTPS or Download Manager
ThingWorx-IOS-SDK-1-0-1-2 (7 MB)	Download now: HTTPS or Download Manager

Show all Other Available Datecodes

To download gzip or for instructions on using gzip, please go to <http://www.gzip.org>.

Related Information

- [Reference Documents](#)
- [Software Updates](#)

2. After extracting the files into the directory: tw-c-sdk;
Secure copy the entire directory to the Raspberry Pi device by using a SFTP client such as WinSCP or my typing the command (to the right) in a Linux terminal.
3. Enter “raspberry” if prompted for a password. The copy should complete successfully.

`scp -r tw-c-sdk pi@10.64.75.97:`

Note that this command will only work if the tw-c-sdk folder, which was downloaded from the PTC Downloads site, is located in the root directory **of the terminal program you are using** to connect to the Raspberry Pi. It will copy the ThingWorx SDK on the root directory of Raspberry Pi device. For example, ensure the tw-c-sdk root folder is copied to the home/username/ directory inside the Cygwin installation directory if you are using Cygwin terminal. Be sure to use the IP address of your actual device in place of the one listed above. You can find the IP address of the device by connecting to the Raspberry Pi Linux terminal and using “ifconfig” command as used in the installation part of the set up guide.

3. Configuration and Setup

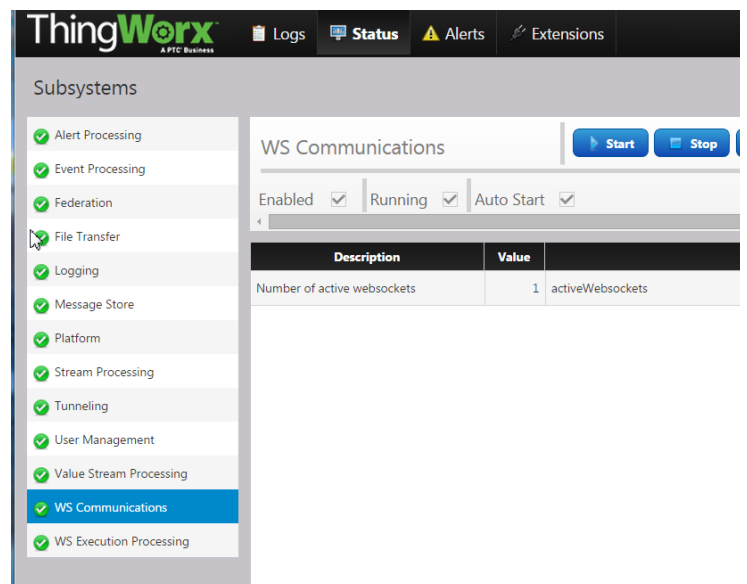
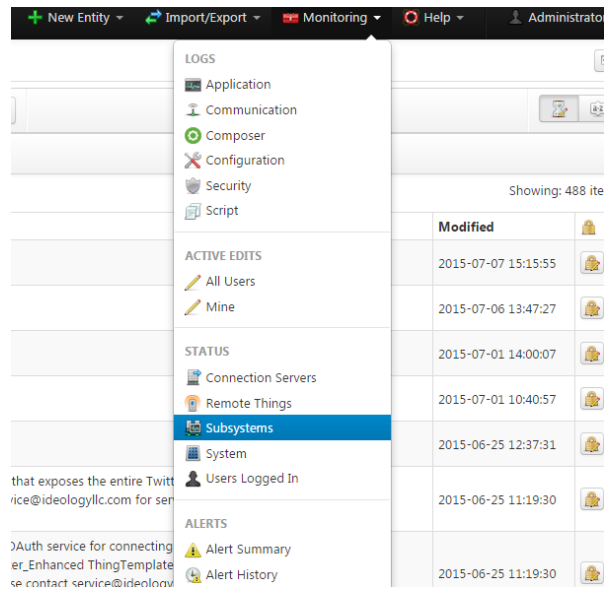
For the purposes of this setup guide, you can use an example from the ThingWorx C SDK folder to test the connectivity of the device with the ThingWorx application platform. We will use the SteamSensor example which can be found in the following directory within the C-SDK:

/tw-c-sdk/examples/SteamSensor/

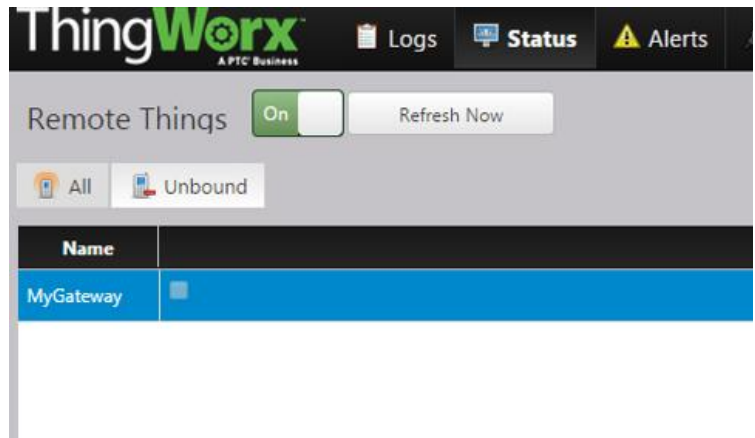
Testing the SteamSensor example

1. Navigate to the SteamSensor example in the path: tw_c_sdk/examples/SteamSensor/ **Note:** tw_c_sdk represents the folder containing the ThingWorx C SDK files downloaded earlier from www.support.ptc.com
2. The SteamSensor directory has different folders for different platforms such as Linux, OSX, Win32. Since Raspberry Pi is basically a Linux supported terminal, we will navigate to the Linux directory in the SteamSensor example.
3. The Linux folder consists of the Makefile to build the source code of the SteamSensor. Build the Makefile with the command on the right.
make BUILD=release
4. After the build, navigate to bin/gcc-linux-x86-64/release folder from the Linux folder. The release folder consists of the SteamSensor executable file. Run this file using the command on the right.
./SteamSensor
5. The SteamSensor server has been started on Raspberry Pi.
6. Connect to the ThingWorx Composer from your computer.

7. In ThingWorx Composer, click the “Monitoring” drop-down, choose “subsystems”, and then click “WS Communications” and “Refresh Now”. You should see an active web socket listed.

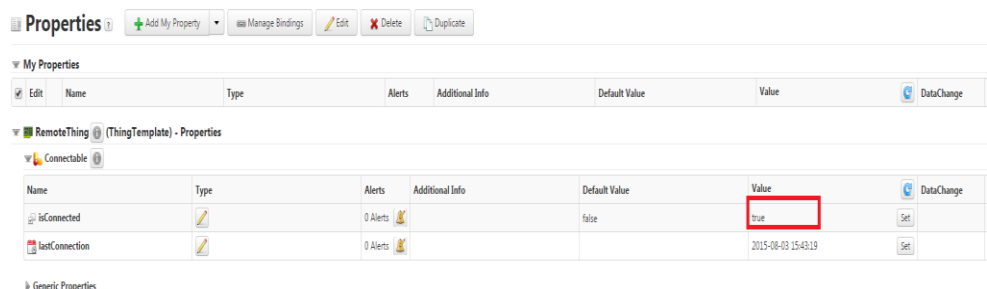


- An unbound remote thing representing the SteamSensor1 running on the Raspberry Pi device should be listed here. The name is dependent on that supplied in the configuration file.



Configuring and Running an Application

- Create a new Thing in Composer that implements the “RemoteThing” Thing Template. Name the thing as “SteamSensor1”
- Click “Properties” on the left, and check the value under “isConnected”. It should be set to true now.
- Finally, click “Manage Bindings”, and then the “Remote” tab. Here, you should see a list of available properties to bind, from the SteamSensor remote device.



Communicating via Serial Port

This section will guide you through the process of using a connected PC to simulate a data-reporting device using the ThingWorx Data Injector, and using it to connect to the SteamSensor server running on the Raspberry Pi device.

1. Verify that the SteamSensor executable is up and running. Connect one end of the serial cable to your computer and the other end to one of the USB ports of the Raspberry Pi device.
2. In Google Chrome, download and install the Chrome ThingWorx Data Injector extension at:
<https://chrome.google.com/webstore/detail/thingworx-data-injector/fplddibkdnnainjhgdkgnlbiebnabc?hl=en-US>
3. Run the ThingWorx Data Injector application. Choose “3-Bar Protocol” from the Device drop-down, and ensure the value for Port is a recognized valid Port (use default value if in doubt), and choose 9600 for Baud Rate.

Click “Connect”. You should see the Status Message change to “Connected”.

The screenshot shows the ThingWorx Data Injector application interface. At the top is the ThingWorx logo with the tagline 'A PTC Business'. Below the logo, there are two dropdown menus: 'Device' set to '3-Bar Protocol' and 'Port' set to 'COM3'. To the right of the 'Port' dropdown is a 'Baud' dropdown set to '9600'. Below these dropdowns is a 'Disconnect' button. Underneath the button, the status is shown as 'Status: Connected' in green text. Below the status section is a 'Data Items' section. It contains a table with three columns: 'Name', 'Type', and 'Value'. There are two rows of data items: 'PowerConsumption' with type 'Analog (Number)' and value '2', and 'Temperature' with type 'Analog (Number)' and value '2'. Each row has a red 'x' button to its right. Below the table is a 'Send' button. At the bottom of the interface is a 'Response' section, which is currently empty.

Name	Type	Value	
PowerConsumption	Analog (Number)	2	x
Temperature	Analog (Number)	2	x

4. To test the connection between the PC and the SteamSensor server running on Raspberry

Note: The SteamSensor example has to be configured in the SteamSensor/src/main.c file. The function

Pi, press the “Send” button on the Data Injector.

dataCollectionTask() can be modified accordingly to send data to a particular property via the serial port.

5. In the Raspberry Pi (via terminal), from the root directory, type the following command (on right):
6. The values sent from the ThingWorx Data Injector can be seen in the terminal.
7. Next, type the following command:
8. You should see the “OK” response in the data injector.

```
cat < /dev/ttyUSB0
```

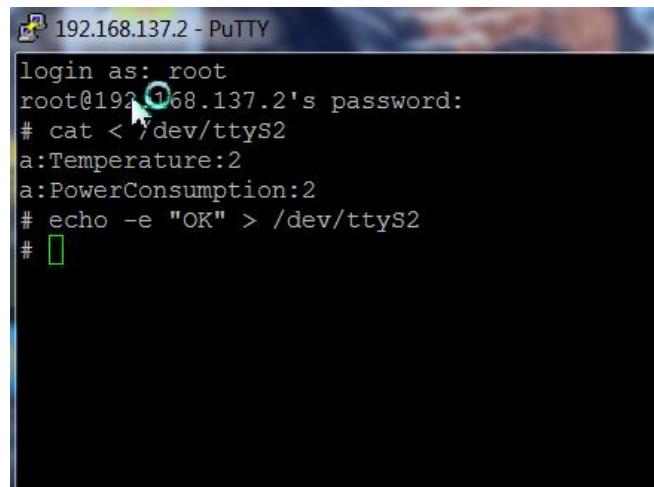
Note that the serial port representing the serial connection between the computer and Raspberry Pi here is /dev/ttyUSB0. This may vary for a different connection.

```
echo -e "OK" > /dev/ttyUSB0
```

The screenshot shows the ThingWorx Data Injector web interface. At the top is the ThingWorx logo with the tagline "A PTC Business". Below the logo, there's a "Device:" dropdown menu set to "3-Bar Protocol". Underneath, there are "Port:" and "Baud:" dropdown menus, both set to "COM3" and "9600" respectively. A "Disconnect" button is visible, and the "Status:" is "Connected". Below this, there's a "Data Items:" section with a table. The table has four columns: "Name", "Type", "Value", and a status icon. It contains two rows: "PowerConsumption" and "Temperature", both of type "Analog (Number)" and with a value of "2". Each row has a red "x" icon in the status column. Below the table is a "Send" button. At the bottom, there's a "Response:" section showing "OK".

Name	Type	Value	
PowerConsumption	Analog (Number)	2	x
Temperature	Analog (Number)	2	x

9. Refer to the terminal window screenshot at right to verify your commands:

A screenshot of a PuTTY terminal window titled "192.168.137.2 - PuTTY". The terminal shows a login sequence where the user is prompted for a password. After logging in as root, the user runs the command "# cat < /dev/ttyS2", which outputs "a:Temperature:2" and "a:PowerConsumption:2". The user then runs "# echo -e 'OK' > /dev/ttyS2", and the prompt returns to "#".

```
192.168.137.2 - PuTTY
login as: root
root@192.168.137.2's password:
# cat < /dev/ttyS2
a:Temperature:2
a:PowerConsumption:2
# echo -e "OK" > /dev/ttyS2
#
```

4. Troubleshooting

	Problem	Solution(s)
1.	Cannot connect to My ThingWorx Composer.	1. Before starting tomcat, check if there are any other servers running. Restart Tomcat and connect to http://localhost on your browser. The manager app should indicate that the ThingWorx application is running.
2.	Cannot see the “SteamSensor1” thing on the ThingWorx Monitoring / Remote Things page.	1. Ensure that the SteamSensor executable is up and running on the terminal. 2. Go to the SteamSensor1 thing created on the ThingWorx composer. Check the properties, ensure that the isConnected property is true. In case it is false, it means that the server SteamSensor is not running on your device.
3.	Not able to read data from the remote data injector.	1. Choose “3-Bar Protocol” on the Data Injector. Do NOT choose “Raspberry Pi 2. Change the Baud value to that accepted by your Raspberry Pi device. 3. Ensure your serial cable is well connected to the Raspberry Pi through a serial to USB connector.
4.	Unable to send data, or cannot see any COM ports for sending data to the Raspberry Pi from the Data Injector.	1. Ensure your serial cable is well connected to one of the USB port of Raspberry Pi through a serial to USB connector. To check whether serial connection is established on your Raspberry Pi device, Go to the Raspberry Pi terminal and check the devices by using the command: ls -a /dev/tty*. You should be able to see ttyUSBx. a. Open Device Manager from Control Panel in Windows. b. Click on “Ports (COM & LPT)”, and click “Action > Add Hardware / Add Legacy Hardware” c. Follow the steps in the wizard to manually add serial port (COM) drivers.

		<p>d. Restart your computer and attempt to send data again.</p> <p>2. Try using an alternative COM port from the data injector.</p> <p>3. Attempt to send data <u>without</u> using the data injector, by utilizing the Windows PowerShell through Windows Command Prompt (tutorials available through Microsoft).</p>
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This guide has been tested for compatibility with the Raspberry Pi 2 Model B and the following ThingWorx platform and operating system:

ThingWorx Platform Version	OS
ThingWorx 6.0.1	Windows 7, Service Pack 1