

Live Programming IoT devices

With Pharo Things

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Section 1

Introduction

Introduction

- Live programming platform for IoT projects based on Pharo. It includes:
 - development tools to lively program, explore and debug remote boards (based on TelePharo).
 - board modeling library which simplifies board configuration.
 - Raspberry driven by WiringPi library.
 - Arduino driven by Firmata, soon.
 - Beaglebone, soon.

Section 2

Arduino

Arduino

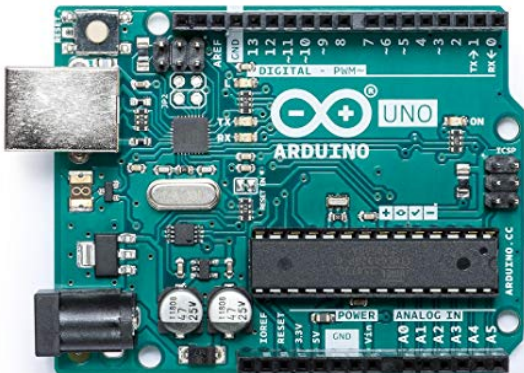


Figure 1: Arduino Uno

Section 3

Raspberry pi

Raspberry Pi

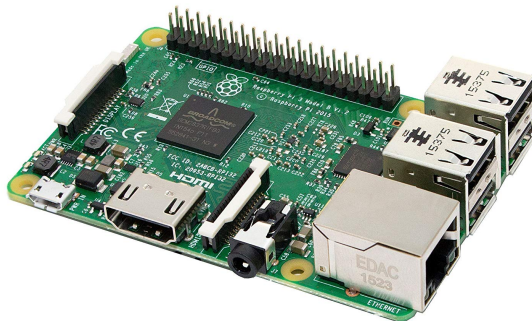


Figure 2: Raspberry Pi 3B

Section 4

Workshop Objectives

Workshop Objectives

- In this workshop we will show you how to develop a **little application** that **collect weather information**.
- We will start to show how we can play with leds and others.

Section 5

Objective

Objective

- Run Pharo IoT in a Raspberry Pi that has Raspbian already installed.
- Install Pharo IoT and Raspbian from scratch in headless mode (without keyboard/mouse/screen);
- Run and use Pharo IoT IDE on your Linux, Windows or Mac OSX computer.

Section 6

SSH

How to use?

- Know the Raspberry Pi IP address.
 - In linux you can use a package called arp-scan

Install

Ubuntu:

```
sudo apt install arp-scan
```

Arch:

```
sudo pacman -S arp-scan
```

How to use

```
sudo arp-scan -l
```

Section 7

Installation

Install in a Raspberry that has Raspbian

- If you already have Raspbian running on your Raspberry Pi, you can simply use the Pharo IoT zero-conf.
- Open a terminal window in your Rpi (local or remote SSH)

Install in a Raspberry that has Raspbian

- Enter:

```
wget -O - get.pharo/server | bash
```

- => You will download the server side and extract the files to the pharoiot-server folder

Install in a Raspberry that has Raspbian

- Goto the folder and run pharo server

```
cd pharoiot-server  
./pharo-server
```

- If everything is alright, you will see this message: ‘a TlpRemoteUIManager is registered on port 40423’.
 - This means that you have TelePharo running on your Raspberry on TCP port 40423.
- Now you can use Pharo IoT on your computer to connect to your Raspberry and create IoT applications remotely.

Install Raspbian and Pharo IoT from scratch (Raspberry Pi Headless Setup)

- There are many options to install Raspbian on your Raspberry. The most common way is to download the ISO image from the official Raspberry website and follow the steps to install it.
 - Basically, they are: copy an ISO image to an SD card, insert it in Raspberry Pi, turn On the Rasp and use a keyboard/mouse/screen to use it as a normal computer.
- But we will not use keyboard/mouse/screen to install Raspbian and run Pharo IoT! We do not need them.

Install Raspbian and Pharo IoT from scratch (Raspberry Pi Headless Setup)

- We will use a third-party program to perform these tasks automatically:
 - Install Raspbian Full OS
 - Setting the Raspberry Pi hostname
 - Set boot to console
 - Enable the I2C and SPI modules
 - Connect it in your WiFi network
 - Download Pharo IoT (requires Raspberry Pi connected on the internet)
 - and start the Pharo IoT server at every boot

Pibakery

- Download the Pibakery.
- Download the configuration file.

`http://get.pharoiot.org/pibakeryPharoIoT.xml`

- Write to your Rpi SD card.

Pibakery

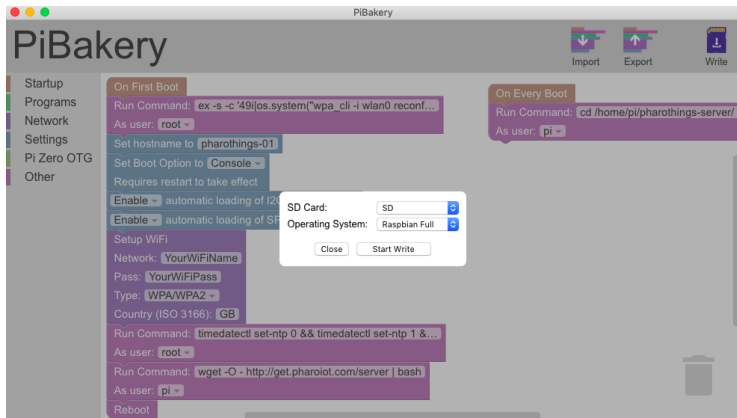


Figure 3: Configuration

Pibakery

- Change your hostname and WiFi configuration in PiBakery;
- Insert the SD card into your machine, click Write and select the Operation System Raspbian Full;
- After the process, insert the SD in the Raspberry and wait about 3 minutes to complete the automatic configuration. Time depends on the speed of your internet;
- You can now find your Raspberry by the Hostname you defined above.
- You do not need to do anything else on your Raspberry Pi. It is already loaded with Pharo IoT starting at every boot on the TCP port 40423

Run Pharo IoT IDE on your Linux, Windows or Mac OSX computer

Download Pharo from

`get.pharoiot.com/multi.zip`

Run Pharo IoT IDE on your Linux, Windows or Mac OSX computer

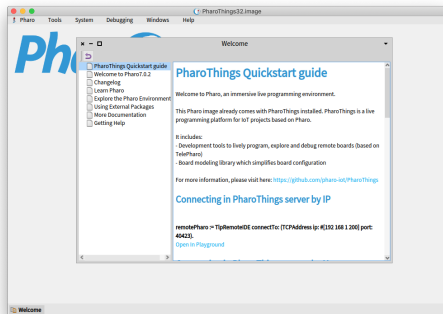


Figure 4: Pharo IDE

Section 8

Get Started

Connecting from your computer to Raspberry Pi

Connecting in Pharo IoT server by Hostname

```
ip := NetNameResolver addressForName: 'pharoiot-01'.  
  
remotePharo := TlpRemoteIDE connectTo:  
    (TCPAddress ip: ip port:40423).
```

Connecting in Pharo IoT server by IP

```
remotePharo := TlpRemoteIDE connectTo:  
    (TCPAddress ip: #[192 168 1 200] port: 40423).
```

Working remotely

- If you don't receive any error, this means that you are connected.
- Now you can call the Remote Playground, Remote System Browser, and Remote Process Browser.

Remote control

```
remotePharo openPlayground.  
remotePharo openBrowser.  
remotePharo openProcessBrowser.
```

Inspect the remote Raspberry Pi GPIO board

- You can inspect the physical board of your Raspberry Pi.
- For Raspberry, it will be one of the RpiBoard subclasses. Currently, you can use the following classes according to the models:
 - RpiBoardBRev1: Raspberry Pi Model B Revision 1
 - RpiBoardBRev2: Raspberry Pi Model B Revision 2
 - RpiBoard3B: Raspberry Pi Model B+, Pi2 Model B, Pi3 Model B, Pi3 Model B+

With the chosen class evaluate the following code to open an inspector:

```
remoteBoard := remotePharo evaluate: [  
    RpiBoard3B current].  
remoteBoard inspect.
```

Remote GPIO inspector

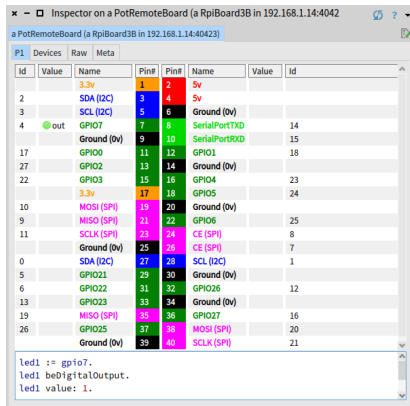


Figure 5: Remote GPIO inspector

GPIOs

- A live tool which represents the current pins state.
- The evaluation pane in the bottom of the inspector provides bindings to gpio pins which you can script by `#dolt/printIt` commands
- Digital pins are shown with green/red icons which represent high/low (1/0) values.
- Able to toggle the value.

Saving the remote image

```
remotePharo saveImage.
```

Disconnect all remote sessions

```
TlpRemoteIDE disconnectAll.
```