Bringing Tizen to a Raspberry PI 2 Near You...

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ABSTRACT

- Raspberry Pi and Tizen are becoming integral tools in the growing market for the Internet of Things.
- With Tizen's improved support for a low-power and low-memory devices, it makes an ideal supplement to be run on an RPi.
- Understand the story that it takes to begin developing IoT apps using these platforms and their value.
- Learn the process about how to get Tizen up and running on a Raspberry Pi 2 and lend a hand to the audience on how to set it up themselves.
- In addition, the technical hurdles that were overcome to create the Tizen port for the Raspberry Pi 2 and where this work will head in the future will be discussed.

WHY RASPBERRY PI2 (RPI2)?

- The Raspberry Pi (RPi) is the most popular board:
  - More than 5 million RPi sold
  - This will bring Tizen to a large developer audience
- The Raspberry Pi 2 brings several advantages:
  - It has a quad-core CPU
  - It runs at 900 MHz
  - It uses a CPU using ARM Cortex-A7 instruction set
    - Most ARM distros are targeted to run on ARM Cortex-A7 CPU.
    - This is also popular on Tizen development, as the Samsung's Exynos 5 CPUs found on Odroid boards use this instruction set.

RASPBERRY PI2 INTERFACE PINS (1)

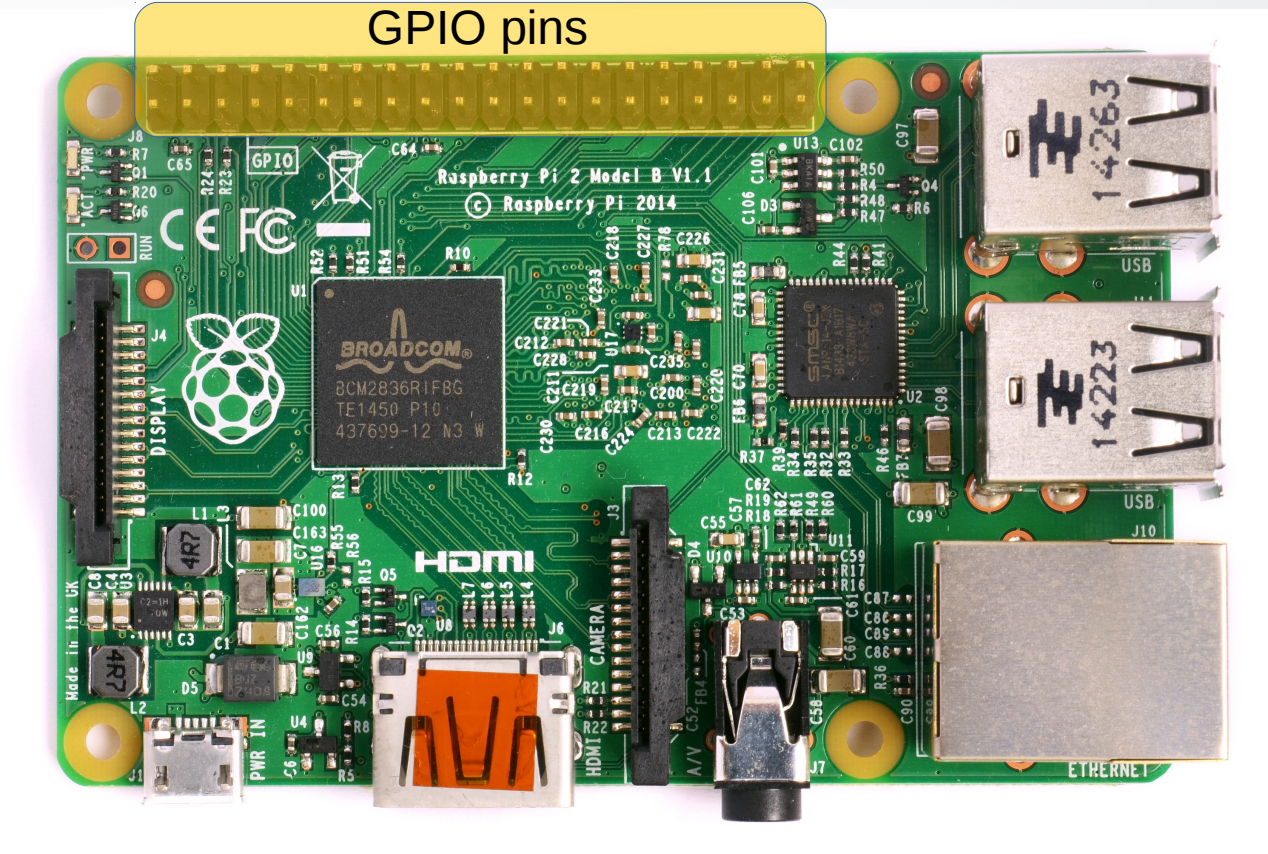
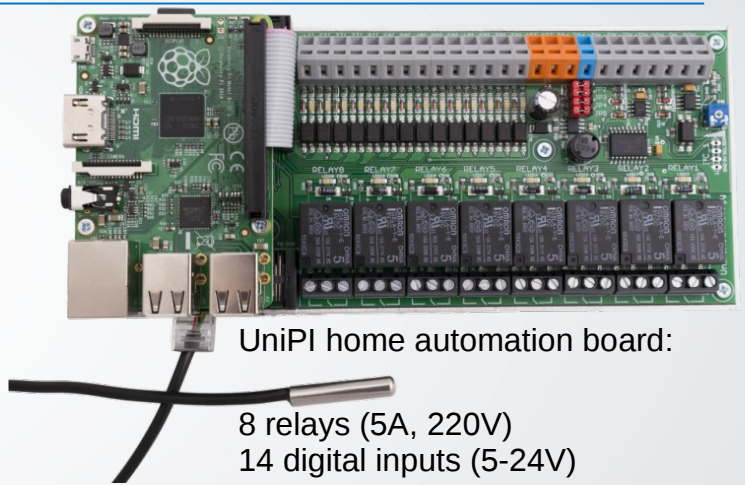


Image source https://commons.wikimedia.org/wiki/File:Raspberry_Pi_2_Model_B_v1.1_top_new.jpg released under CC Attribution-ShareAlike 4.0 International

RASPBERRY PI2 INTERFACE PINS (2)

- It has 40 pins providing things like:
  - I2C, SPI and UART interfaces;
  - 3.3 and 5 V power supply;
  - Generic Input/Output (GPIO);
  - Display, Camera Sensor, Ethernet and 4 USB connectors
  - Hardware Attached on Top (HAT) expansion boards
    - Providing extra functionality, like proto-boards, servo control, relays control, digital inputs/outputs, leds control, etc.
    - Lots of HAT boards already available in the market



UniPI home automation board:

8 relays (5A, 220V)
14 digital inputs (5-24V)
2 analog inputs (0-10V)
0-10V analog output

Image source: http://elinux.org/File:UniPi_set.png
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TIZEN, RPI2, AND THE INTERNET OF THINGS

- This combo creates an IoT trifecta:
  - The RPi2 provides a low-cost, widely-used hardware platform with optional boards ready to be used for IoT
  - Tizen provides an efficient software platform
  - IoTivity provides a full-featured IoT platform
- Samsung is targeting Tizen as the primary platform for smart devices in the future.
  - Our goal with this project is to bring IoT development with Tizen to the masses

GBS VS. YOCTO BUILD

- There are two ways to build Tizen 3.0:
  - GBS (Git Build System)
    - Has its roots at Suse's OBS (Open Build Service)
    - Based on source RPM files (srpm), developed by Red Hat and used also on derivaded distros (Suse, Mageia, etc.)
    - RPM source files are distro-specific: they contain their own set of macros and install directories, being hard to share srpm files among different distros.
  - Yocto
    - It is a collaboration project that provides templates, tools and methods to create custom distros for embedded products.

BUILDING WITH YOCTO

- Yocto is a derivative of a popular embedded distro, called OpenEmbedded
  - It was built to share packages among different distros.Several popular embedded distros are built from it: Open Embedded, Angstrom, etc.
  - It uses the concept of layers. One of the layers is called BSP (Board Support Package) and contains arch-specific bits
- The Yocto build uses a tool called bitbake
  - Bitbake uses files called recipes
  - Bitbake downloads and builds packages and the image files

PROS AND CONS OF USING YOCTO ON TIZEN (1)

- Advantages of using Yocto:

  - Easy to share the same package/recipe on different distros
    - In long term, it saves money
  - There are a vast number of packages already ported to it;
  - There are plenty resources at the Internet describing it;
  - Doesn't require a dedicated build server: any machine with a copy of the Tizen on Yocto tree can build it.
    - Reduces the cost of development
    - Can attract more developers

PROS AND CONS OF USING YOCTO ON TIZEN (2)

- Disadvantages of using Yocto on Tizen:
  - By default, bitbake assumes that it can freely access the Internet to download the needed packages. That could be a problem on some networks.
    - Internal mirrors are possible, though not trivial to setup;
  - Tizen packages need to be converted to bitbake recipes
    - Several packages were converted with auto tools, but they have some issues.
      - So, manual review is needed.
    - It increases the cost in short term

TIZEN ON RASPBERRY PI2

- As we didn't have a GBS build server handy, and there were already an existing Yocto BSP layer for RPi2, it was decided to use Yocto instead of GBS:
  - That allowed us to have Tizen running on RPi2 in about one week (not full time, as I have the Media Linux Kernel subsystem to maintain).
  - It keeps helping us to add nice things to the distribution, like Qt5;
  - Several Samsung Open Source Group developers were able to work without the need of building/setting up a GBS server.

MAJOR CHALLENGES (1)

- Getting Yocto to Work
  - Tizen on Yocto were prepared only for x86 build
  - Several bugs hit when we started the work
- Necessary Upstream Changes
  - We want to use Tizen on yocto upstream (tizen-distro) as-is
    - Got maintainership on Yocto-based packages, together with Leon Anavi, mainly: tizen-distro, meta-tizen
    - Sent the needed patches to Tizen
  - Patches to meta-raspberrypi are also being developed;
    - Takes more time to reach upstream, as it is based on a new GPU driver still under development.

MAJOR CHALLENGES (2)

- Hardware Acceleration
  - This is always a challenge on ARM: GPU IP block developers are usually not keen on upstreaming their drivers.
  - Broadcom (CPU vendor used on RPi) started to develop a new upstream driver for GPU, called VC4.
    - Still has some things to be solved, but driver works on Tizen
- Smart Package Manager
  - Have a way to dynamically add/remove packages from a repository
    - Added a repo at http://files.s-osg.org/tizen-on-rpi2/rpm/

WORK IN PROGRESS

- This is still an ongoing project, and we are working on adding support for a number of important elements
  - **Crosswalk** – This will enable the installation of web apps (written in HTML/CSS and JavaScript)
  - **IoTivity –** This will enable greater levels of device-to-device connectivity with the RPi2.
  - **Rust / Servo** – This will bring the next generation of web browsers to this platform.

STEPS TO BUILD TIZEN ON YOCTO FOR RPI2

1. Clone tizen-distro

```
git clone git://git.s-osg.org/tizen-distro.git -b 3d_accel_vc4
```

2. Add RPi2 meta repository

```
cd tizen_ditro
git clone git clone git://git.s-osg.org/meta-raspberrypi.git -b 3d_accel_vc4
```

3. Prepare for the build

```
source ./tizen-common-init-build-env build && cd build

wget http://files.s-osg.org/tizen-on-rpi2/local.conf.3d_accel_vc -O conf/local.conf

wget http://files.s-osg.org/tizen-on-rpi2/bblayers.conf -O conf/bblayers.conf
```

4. Build tizen with:

```
bitbake tizen-core-image-minimal-dev
```

TRY IT YOURSELF!

- Keep up with the latest developments on our blog:
  - http://blogs.s-osg.org/tizen-on-rpi2
  - We have full guides to build the images yourself. A powerful computer and fast Internet connection are recommended for the build process
  - New article released this week about using WiFi on RPi2 with Tizen.
- Download the LATEST image directly from us:
  - http://files.s-osg.org/tizen-on-rpi2/
  - Save yourself the hassle of a huge download and lengthy build process
- We seek any developers interested in creating things for Tizen and the RPi2.