EDJE PROJECT

The Software Foundation for IoT Devices

https://projects.eclipse.org/projects/iot.edje

PRESENTER

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Edje Project Leader

10 years expertise in Java Embedded Systems

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EDJE AND IOT INTRODUCTION

EDJE PROJECT

The Hardware Abstraction Java API for the IoT embedded systems

- Peripheral management
- Controller Communication Interfaces (Serial connection, CAN, SPI, I^2C)
- Digital and Analog I/O (GPIO, ADC, DAC)

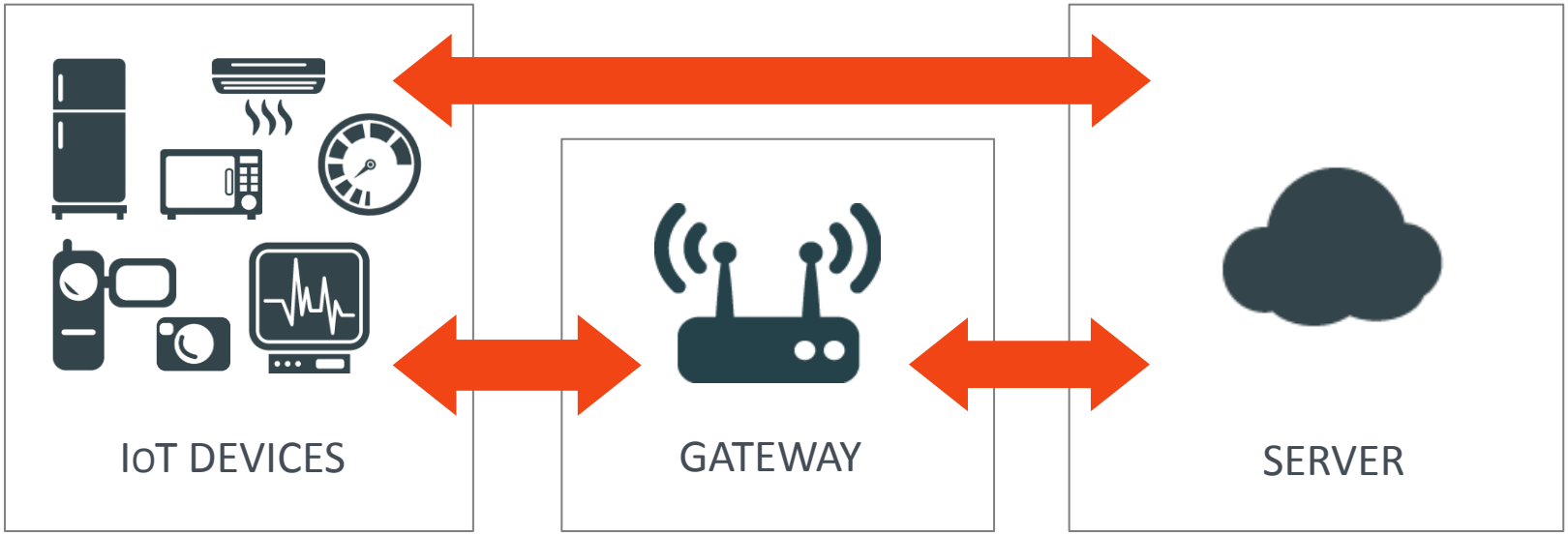
Scope

- Target resource-constrained micro-controller
- Provide ready-to-use software packages for target hardware
- Define a modular and easy to port framework

Project Status

- Eclipse IoT project
- Incubation

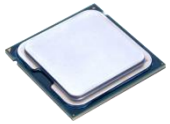
IOT TOPOLOGY



MCU

8/16/32-bit MCU Mono-Core
Frequency: < 200 MHz
Flash: < 1 MB
RAM: < 512 KB

freeRTOS



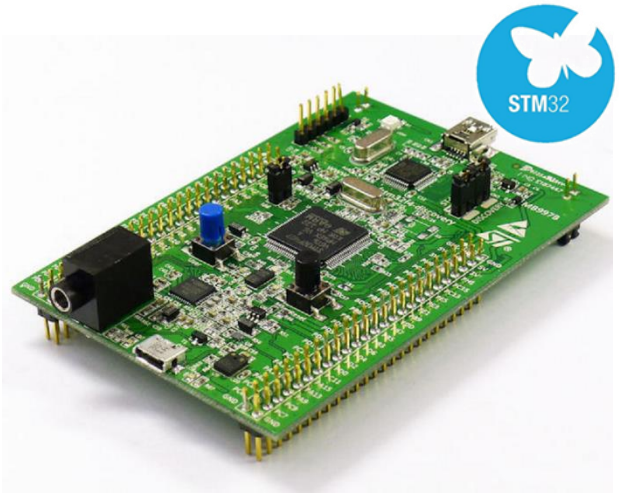
MPU

32/64-bit MPU Multi-Core
Frequency: in GHz
Flash: in GB
RAM: in GB

IOT HARDWARE

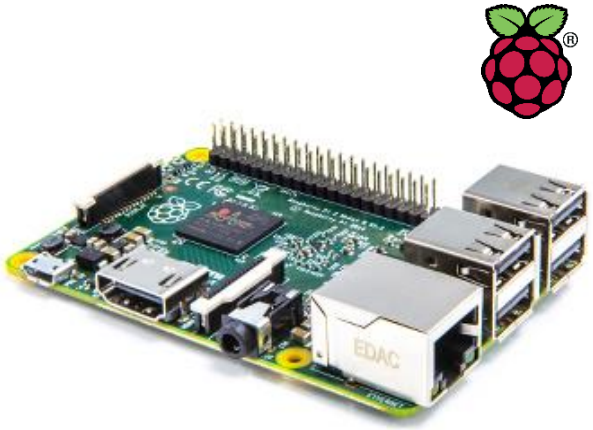
STM32F4 Discovery

- Processor: 32-bits Cortex-M4 (STM32F407VGT6)
- Frequency: 168 MHz
- RAM: 192 KB
- Flash: 1 MB



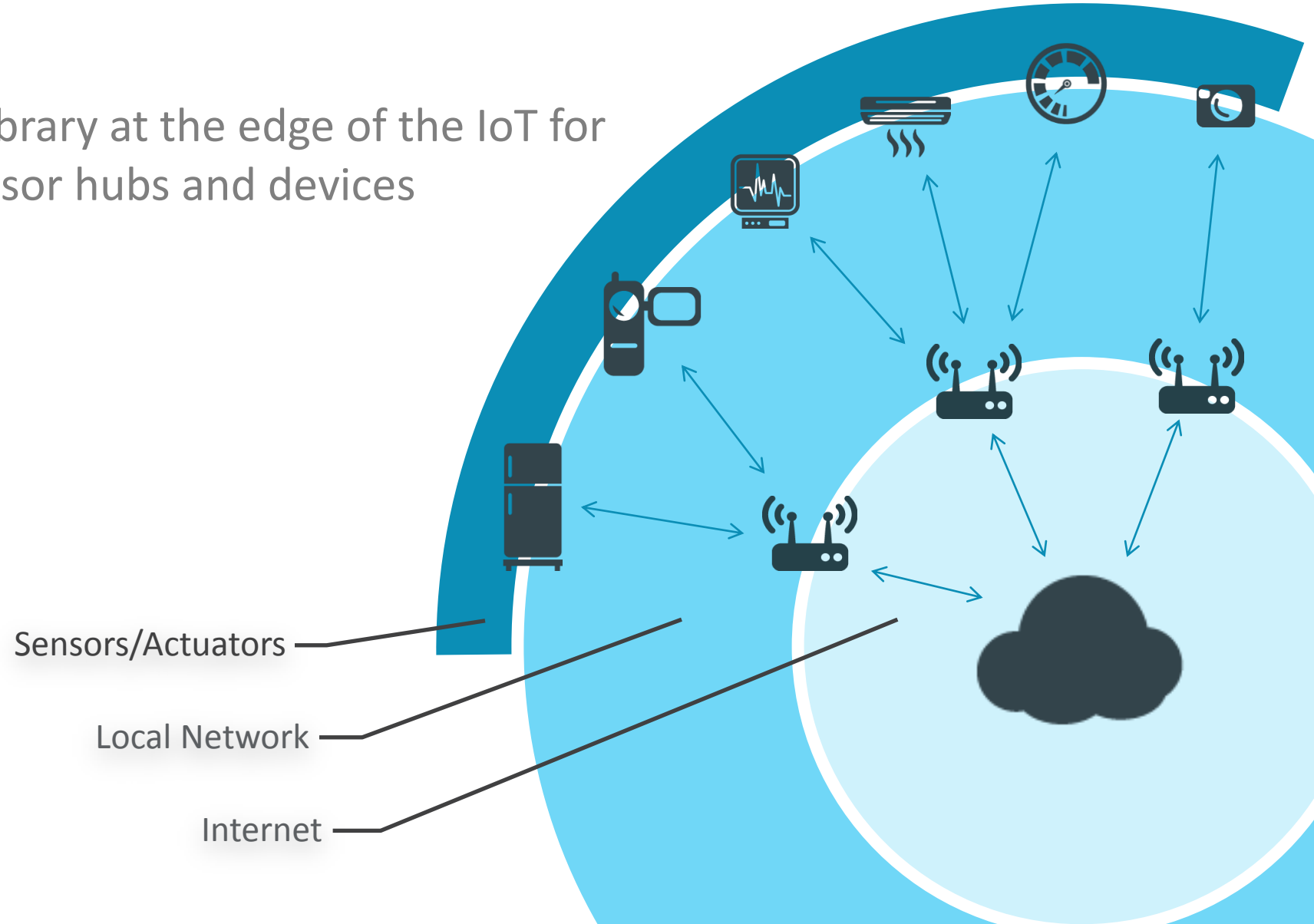
Raspberry PI 2

- Processor: 32-bits quad-core Cortex-A7 (BCM2836)
- Frequency: 900 MHz
- RAM: 1 GB
- Flash: SD Card



EDJE APPLICATION FIELD

A library at the edge of the IoT for sensor hubs and devices

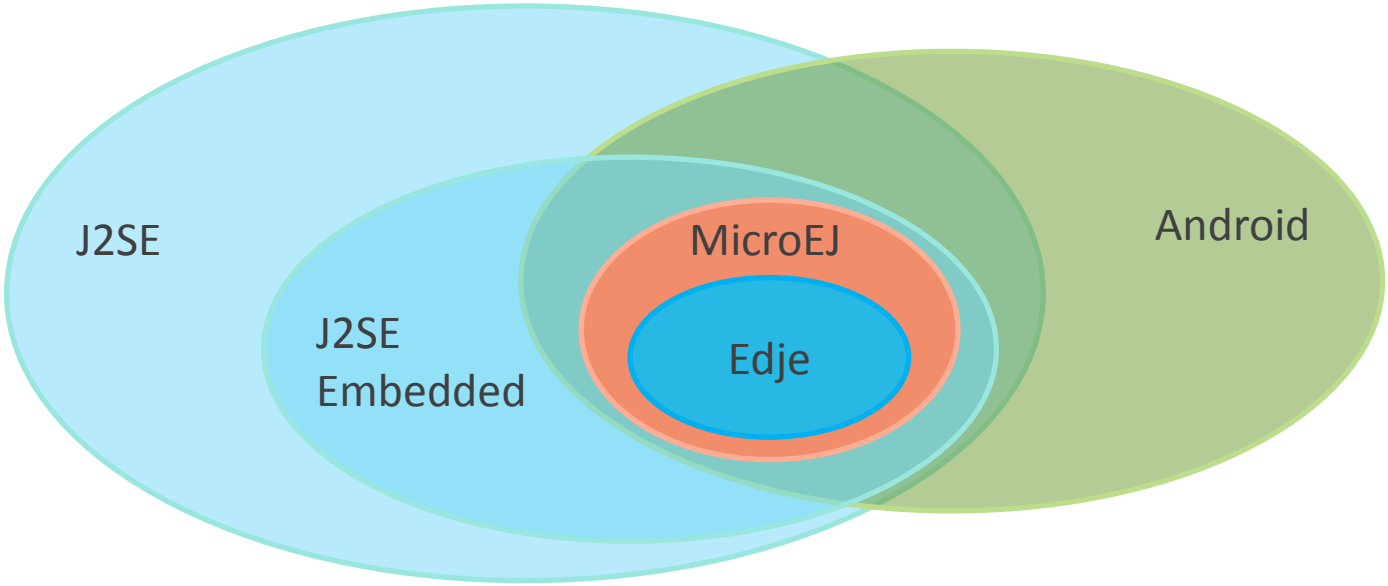


EDJE REQUIREMENTS

EDJE DEVICE CONFIGURATION

List of Java API

- The minimum execution environment provided by an Edje compatible device
- Intersection between Java SE, Java SE Embedded, MicroEJ and Android
- Includes java.lang, java.util, java.io, …



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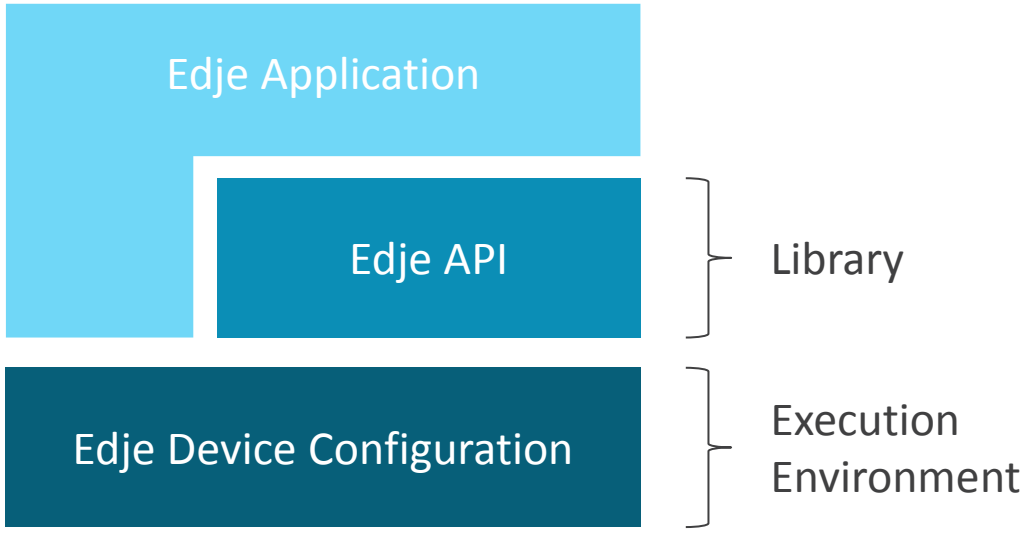


HARDWARE REQUIREMENTS

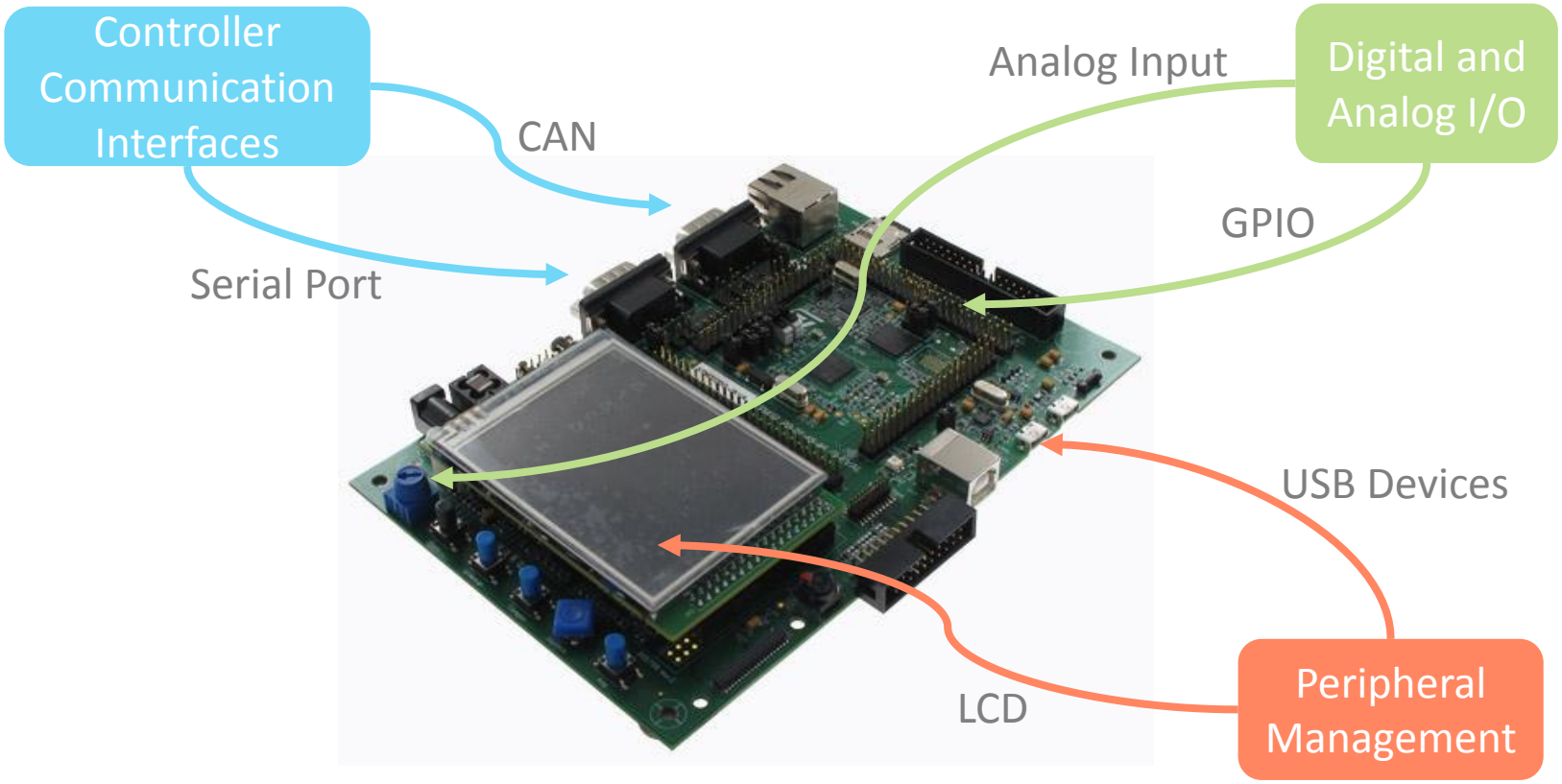
Minimal targeted Hardware

- Processor: 32-bits (e.g. Cortex-M0)
- Frequency: 16 MHz
- RAM: 32 KB
- Flash: 128 KB

EDJE API

EDJE API

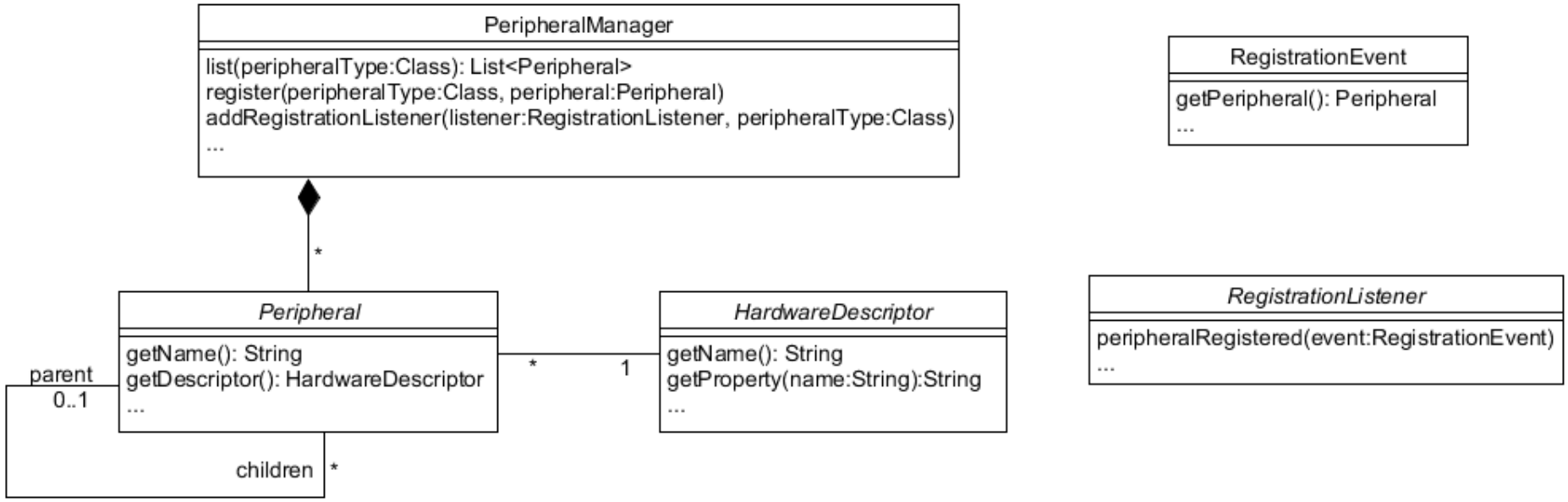
Edje comes with the following services



EDJE API

Peripheral Management

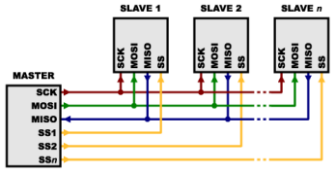
- List the peripherals of a platform
  - MCU peripherals (UART, timer, USB controller, …)
  - Board peripherals (screen, button, LED, sensors, …)
  - External peripherals (USB devices, bluetooth devices, …)
- Peripheral plug/unplug notification system



EDJE API

Controller Communication Interfaces

- Some peripherals can establish a connection to external devices
  - Serial Connection (UART)
  - Serial Peripheral Interface (SPI)
  - Inter-Integrated Circuit (I^2C)
  - Controller Area Network (CAN)
- The peripheral implements Connectable interface
- Connection is described by a String
- Example with serial ports:




```
List<SerialPort> serialPorts = PeripheralManager.list(SerialPort.class);

for(SerialPort serialPort : serialPorts){
  Connection connection = serialPort.openConnection("baudrate=115200;bitsperchar=8");
  …
  connection.close();
}
```

EDJE API

Digital and Analog I/O

- Manage controller pins
- API inspired from Arduino C API

- General Purpose Input/Output (GPIO)
  - LED, Buzzer, Button

- Analog to Digital Converter (ADC)
  - Potentiometer, Temperature Sensor, Light Sensor

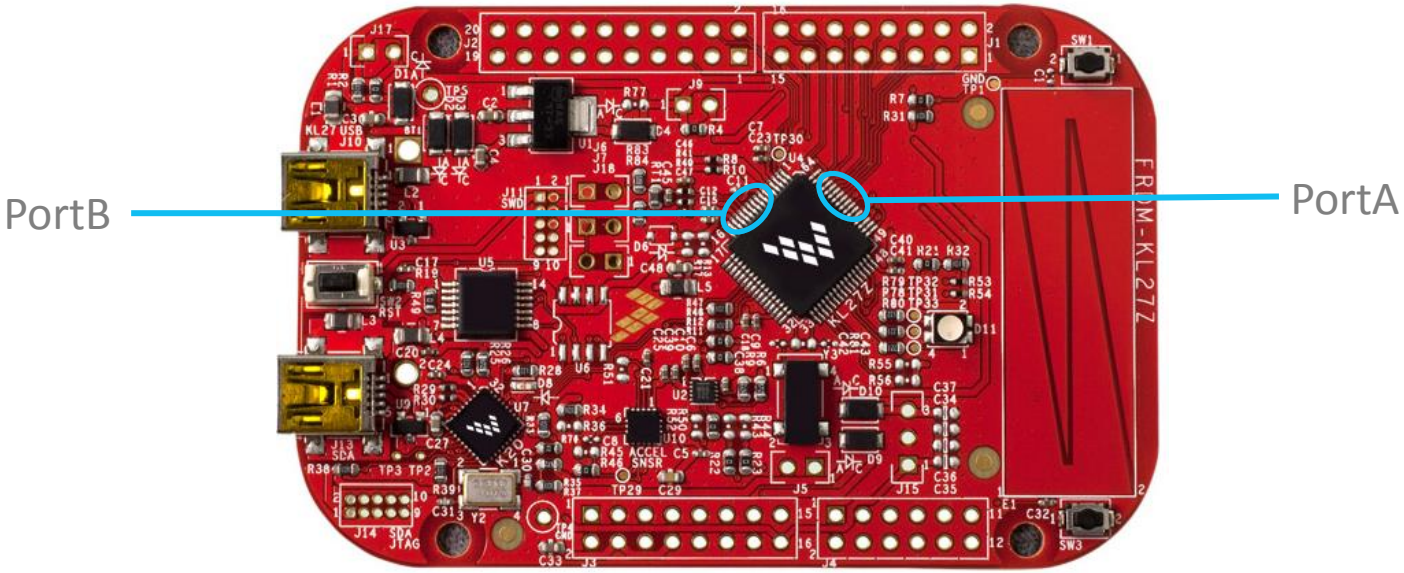
- Digital to Analog Converter (DAC)
  - Speaker, Light Dimmer

- Pulse Width Modulation (PWM)
  - Motor

EDJE API

Digital and Analog I/O

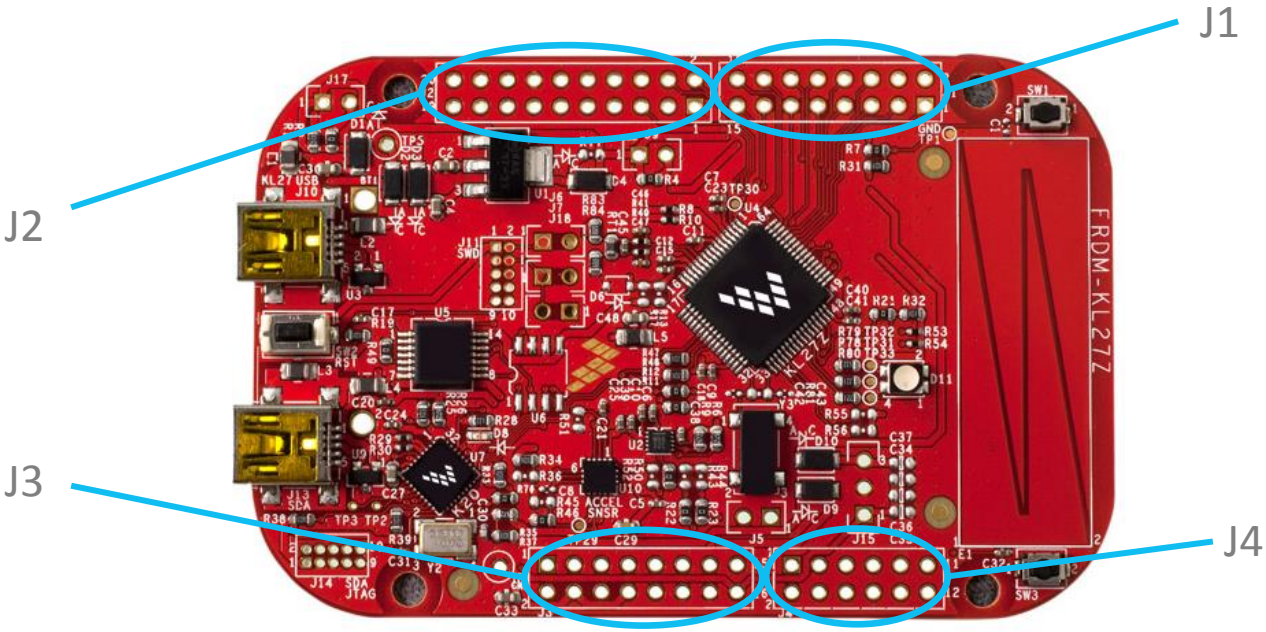
- A pin is identified by the port and an ID
- Port name can be
  - MCU specific



EDJE API

Digital and Analog I/O

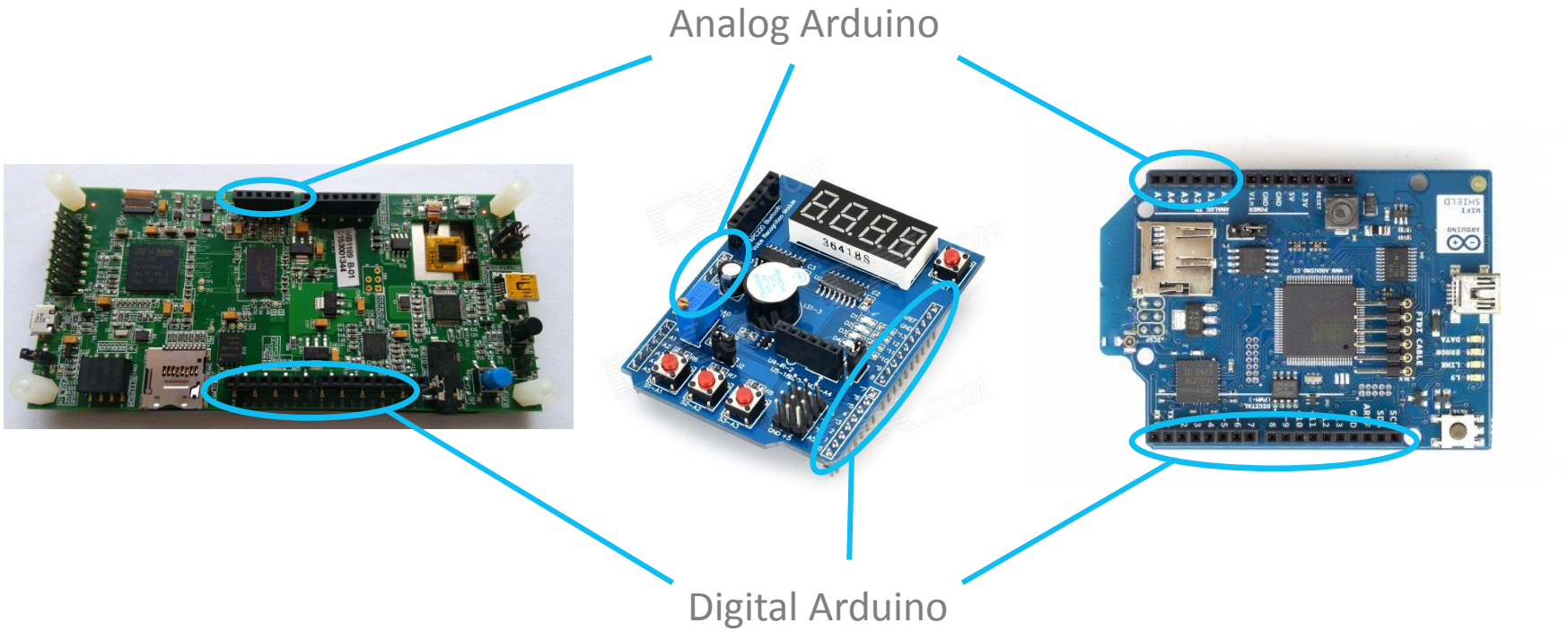
- A pin is identified by the port and an ID
- Port name can be
  - Board specific



EDJE API

Digital and Analog I/O

- A pin is identified by the port and an ID
- Port name can be
  - Standard



REFERENCE IMPLEMENTATIONS

REFERENCE IMPLEMENTATIONS

Features

- Peripheral Management
- UART, USB CDC, GPIO, DAC, ADC

Hardware

- Raspberry-Pi 2
- Quad-Cortex-A7 @ 900 MHz
- RAM: 1 GB RAM

Platform

- Kura
- OpenJDK
- Linux

REFERENCE IMPLEMENTATIONS

Features

- Peripheral Management
- UART, USB CDC, GPIO, DAC, ADC

Hardware

- STM32F746G-DISCO
- Cortex-M7 @ 200 MHz
- RAM: 8 MB
- Flash: 16 MB

Platform

- MicroEJ OS
- FreeRTOS
- STM32Cube

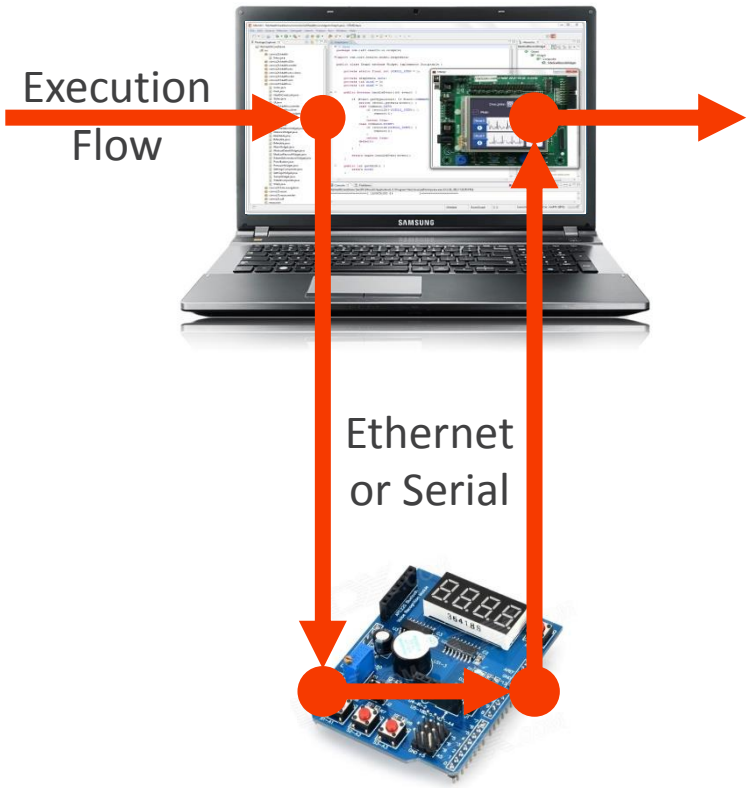
REFERENCE IMPLEMENTATIONS

Features

- Peripheral Management
- UART, USB CDC, GPIO, DAC, ADC

PC Simulation

- Java® SE
- Hardware In the Loop Simulation (HIL)



EDJE ROADMAP

POTENTIAL ROADMAP

Features

- I^2C, SPI
- Controller Area Network (CAN)
- Power Management
- Sensor

Reference Implementations

- MicroEJ Renesas Synergy Cortex-M4
- MicroEJ NXP Kinetis Cortex-M0+

CALL TO ACTION

DEMO

STM32F746G-DISCO

+

Arduino Multi-function Shield

+

over MicroEJ

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