Building an open Internet of Things with Java & Eclipse IoT

Benjamin Cabé – Eclipse Foundation
IoT is Big

The Internet Of Everything

BI INTELLIGENCE

Number Of Devices In Use Globally (In Thousands)

Source: BI Intelligence Estimates
THE NUMBER OF IOT DEVELOPERS 2014-2020

Source: VisionMobile estimates, 2014

Report: IoT: Breaking Free From Internet And Things | vmob.me/IoT
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Java for IoT?

- 9+ million Java developers
- Java 8 & embedded are fun
- Lots of IoT devices running on ARM
- Tooling
## Open IoT Stack for Java

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### OSGi Runtime (Concierge)

### Java VM

### Open & Commercial Hardware

- Arduino
- Raspberry Pi
- Eurotech
- Sierra Wireless
- Intel
End-to-end IoT with Java?

Actuators/Sensors
+ Gateway
+ [ Cloud ]
+ User front-end
Sensors / Actuators

- Manipulate **sysfs** directly
- Use **Pi4J** to have full support of GPIO/I2C/SPI
- Device I/O API with Java or Java ME
Sensors / Actuators

• **Pi4J** – [http://pi4j.com](http://pi4j.com)
  - Complete access to GPIOs/I2C/SPI
  - Very mature codebase, based on WiringPi
  - Support for popular shields (PiFace, Gertboard, …)
  - Lots of code samples
Pi4J in action

GpioController gpio = GpioFactory.getInstance();
GpioPinDigitalOutput pin = gpio.provisionDigitalOutputPin(
    RaspiPin.GPIO_01, "MyLED", PinState.HIGH);

Thread.sleep(5000);
pin.low();
Thread.sleep(5000);
pin.toggle();
gpio.shutdown();
Gateway
Gateway

Connect sensors to the world

Manage the hardware and software running at the edge
Connect?

- **CoAP**
  - « HTTP over UDP »
  - Expose your device as a resource to the Internet of Things

- **MQTT**
  - Publish/Subscribe model
  - More room for local processing
CoAP: The web-of-things

- /walk
- /hand/left/raise
- /eye/picture
- /engine/status
- /position
- /fuel
- /on
- /red
- /green
- /blue
- /mtbf
- /buttons
- /buttons/1/push
- /bat-level
- /CO2
- /noise
- /lights/on
Eclipse Californium

- Focus on scalability and usability
- To be used in IoT cloud servers or M2M/IoT devices running Java
- Includes **DTLS** implementation (Scandium), HTTP/CoAP bridge, Plugtests, …

http://eclipse.org/californium
MQTT: Publish & Subscribe
Eclipse Paho

- Open-source MQTT clients
- Pick your language!
  - Java
  - JavaScript
  - C/C++, Objective C
  - Go, Lua, Python, .NET, WinRT, …

http://eclipse.org/paho
MQTT brokers

- **Eclipse Mosquitto**
  - C implementation
  - Scalable (1000 clients == 3MB RAM)

- **Eclipse Moquette**
  - Java implementation
  - Based on Netty and LMAX disruptor
Manage?

- **Gateway itself**
  - wireless modem, firewall, …
- **Applications**
  - Install/Uninstall software packages
  - Start/Stop applications
- **Sensors**
  - H/W abstractions layer
Installing Kura

cd ~

sudo apt-get update

wget https://s3.amazonaws.com/kura_downloads/raspbian/release/1.1.0/kura_1.1.0_raspberry-pi_armv6.deb

sudo dpkg -i kura_1.1.0_raspberry-pi_armv6.deb

sudo apt-get install -f

sudo reboot
First steps with Kura

● Network management
  ○ Cellular Modem, WiFi
  ○ Firewall
  ○ NAT

● OSGi and system administration

● IoT server communication settings
Kura API

- OSGi services that you can re-use in your own components
  - ClockService
  - DataService, CloudService
  - CryptoService (AES, base64, SHA-1)
  - PositionService (geolocation)
  - ... and many others

- And of course you can leverage a huge ecosystem of Java and OSGi libraries
Demo time!
End-user interaction

- JavaFX Charts
- Eclipse BIRT
- Smartphone app (e.g. Android)
  - https://www.eclipse.org/paho/clients/android
- MQTT + WebSockets = 💕
  - https://www.eclipse.org/paho/clients/js
If you had to remember only 3 things...

#1

Kura is awesome!
Go download it now!

http://eclipse.org/kura
Build your own greenhouse & follow the tutorial
http://iot.eclipse.org/java/tutorial
If you had to remember only 3 things...

#3  Eclipse Open IoT Stack for Java is much more than Kura

http://iot.eclipse.org/java
Get Involved!

WE WANT YOU!!

War Production Co-ordinating Committee
Thank you! Questions?

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http://iot.eclipse.org