Building an open Internet of Things with Eclipse IoT

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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

**IoT Applications**

- IoT Solution Frameworks
  - Home Automation
  - SCADA
  - OM2M

**Connectivity**

- MQTT
- CoAP
- LWM2M

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**IoT Gateway Services**

- Remote management
- Application management

**OSGi Runtime (Concierge)**

**Java VM**

**Open & Commercial Hardware**

**Reporting**

**Developer Tools (IDE, etc.)**
End-to-end IoT with Java?

Actuators/Sensors

+ Gateway

[ Cloud ]

+ User front-end
Gateway
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

- /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

Pub KETTLE232/temp
Payload: 21°C

BROKER

Pub KETTLE232/temp
Payload: 21°C

Sub KETTLE232/*

Teapot

Phone
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 abstraction layer
Eclipse Kura

- Operation & Management
  - Connectivity and Delivery
  - Network Management
  - Gateway Basic Services
- Applications
  - App 1
  - App 2
  - . . . .
  - App n
- Administration GUI
- Device Abstraction
- OSGi Application Container
- Java VM
- Linux
- Hardware

- Field Protocols
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
If you had to remember only 3 things...

#2 Build your own greenhouse & follow the tutorial

http://iot.eclipse.org/java/tutorial
If you had to remember only 3 things...

#3

Eclipse IoT is much more than Kura and Java!

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

- Open bugs / fix bugs
- Request new features
- Write articles, tutorials
- Participate on the mailing lists
- Propose your project!
Coming next?
Coming next?

● **Device Management**
  ○ LwM2M, LwM2M over MQTT, IPSO Smart Objects

● **Security**
  ○ TinyDTLS

● **Open-source IoT server?**
  ○ Several members interested in defining and implementing the OpenStack for IoT
Thank you! Questions?

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http://iot.eclipse.org