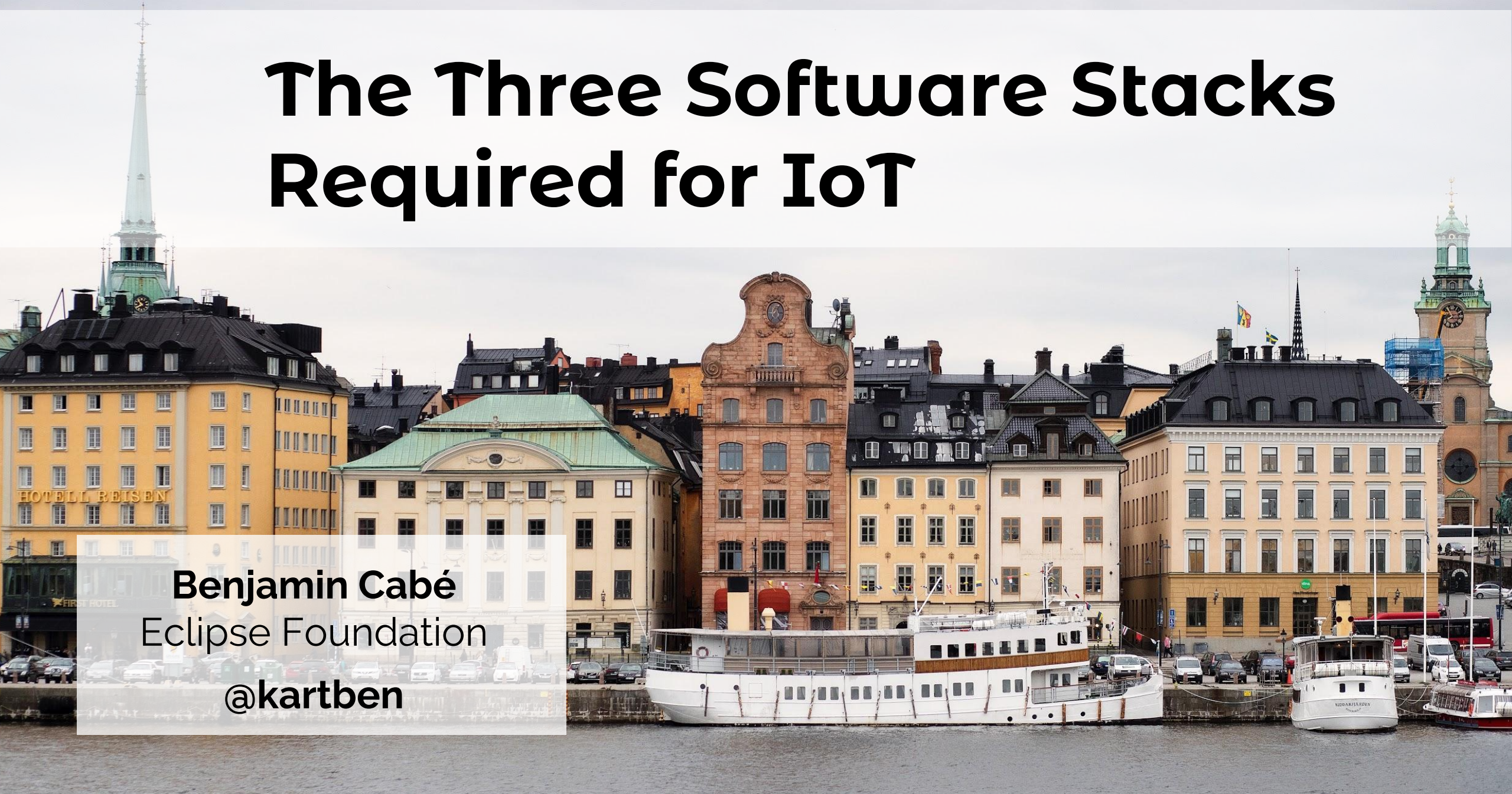
The Three Software Stacks Required for IoT



Benjamin Cabé
Eclipse Foundation
@kartben

IoT?

Applications

Collect, exchange
& analyze data

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IoT?

Applications

Collect, exchange & analyze data

Sensing / Actuating

Interact with the physical world

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IoT?

Applications

Networking & Data Communications

Sensing / Actuating

Collect, exchange & analyze data

Bridge the physical world to the Internet

Interact with the physical world

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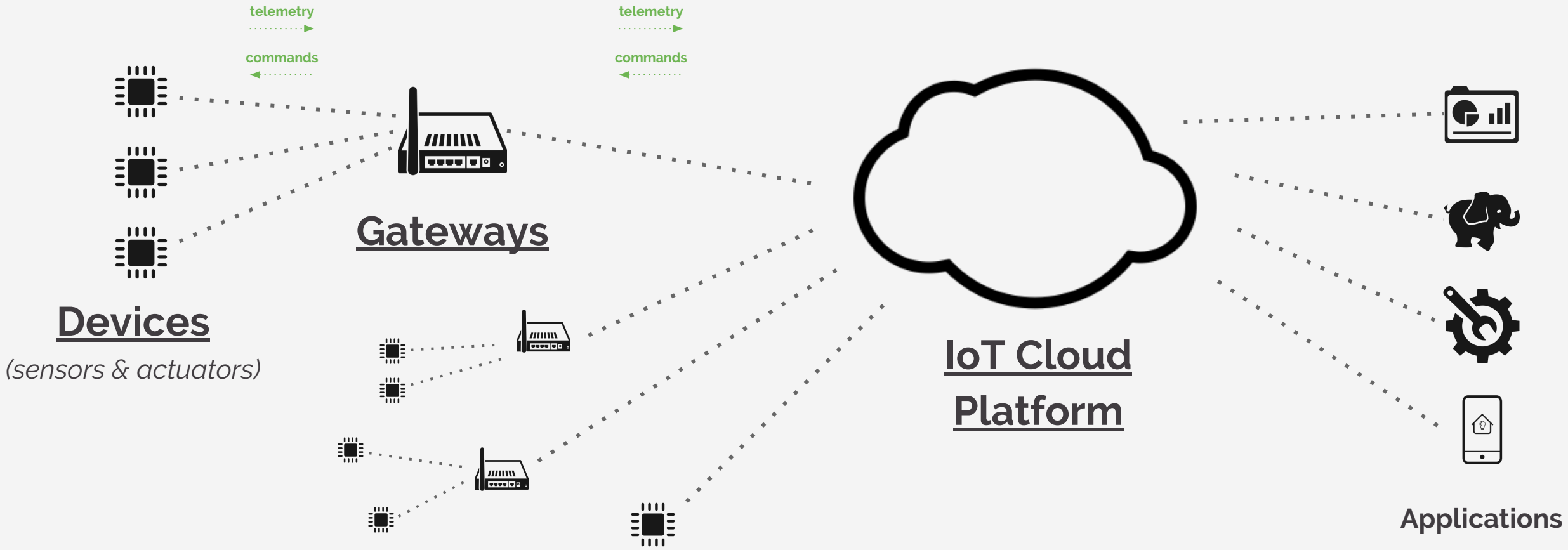
Typical IoT Architecture



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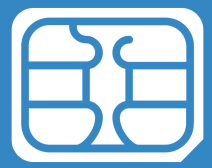
Role & Characteristics

DEVICE



constrained

low-power

specialized

GATEWAY / SMART OBJECT

connectivity

messaging

edge computing

CLOUD PLATFORM

scale out

integration

data analytics

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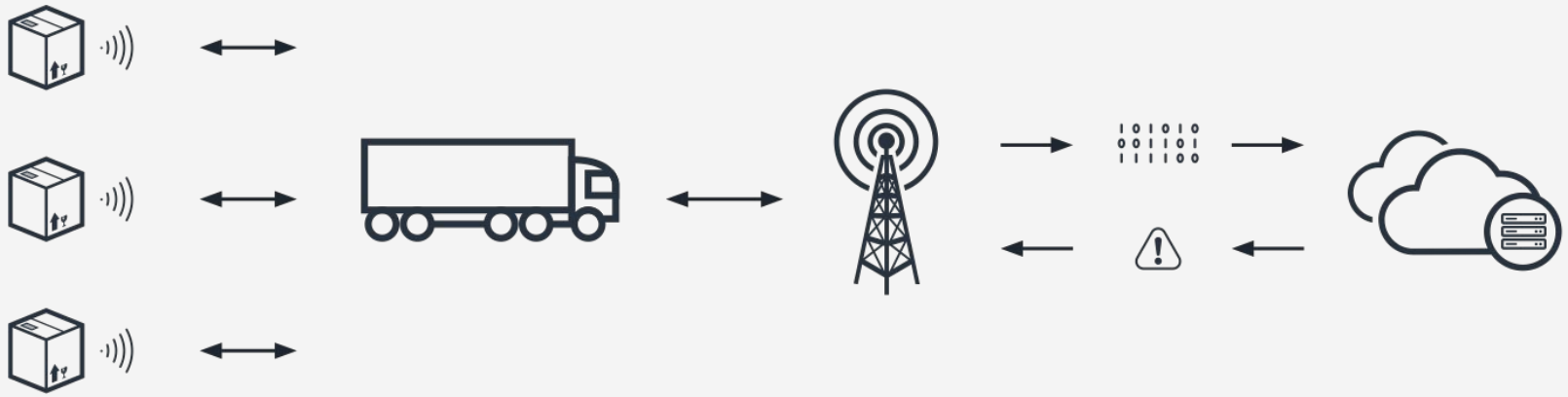
Asset Tracking



Track condition and location of cargo and goods in real time

Optimize the transport and delivery of inventory and goods

Reduce product spoilage, damage, delay, and theft

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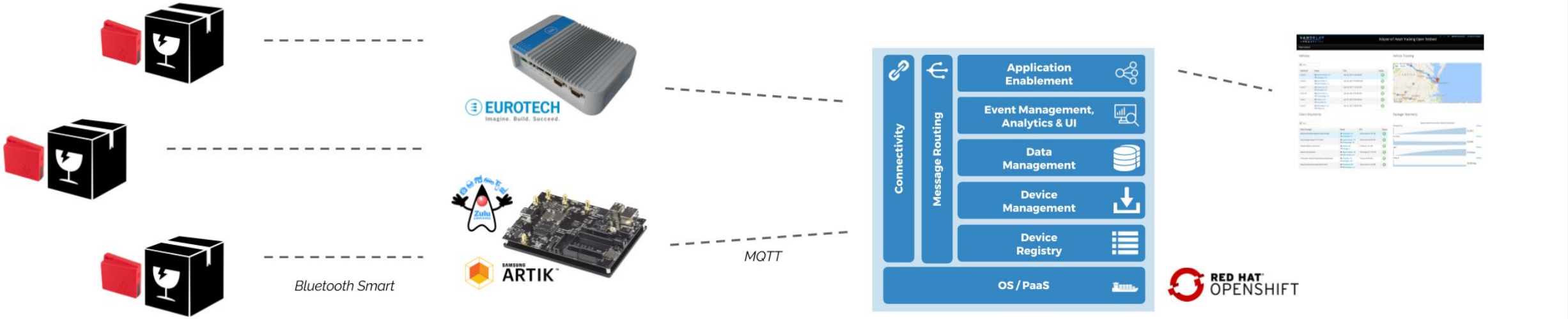
The solution



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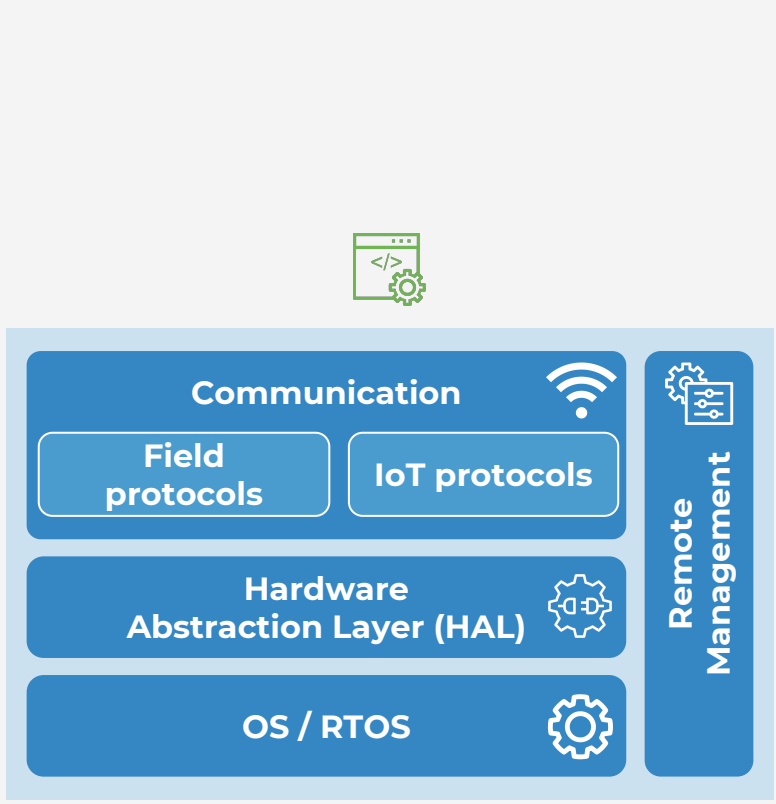
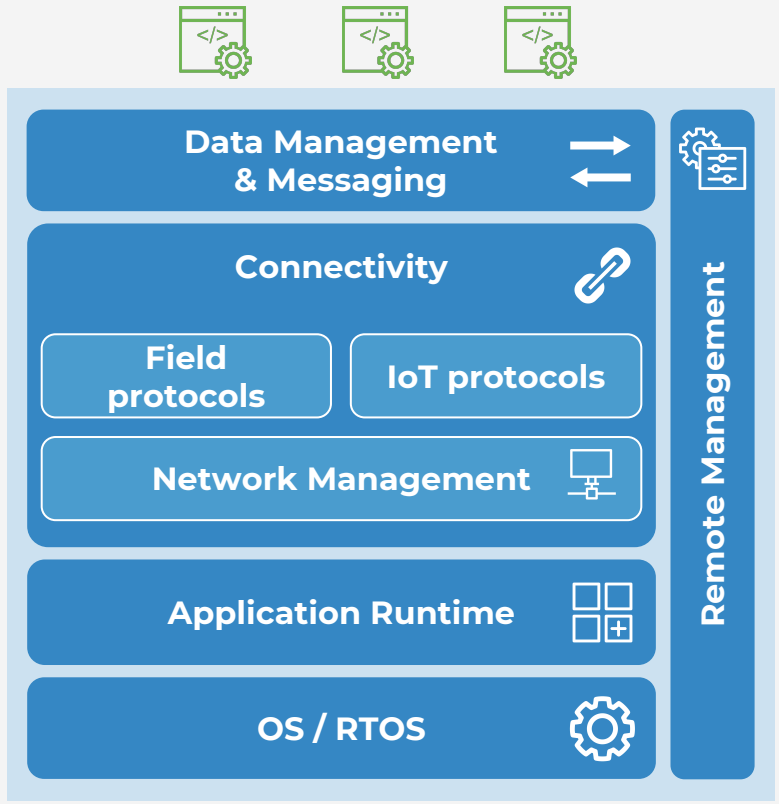
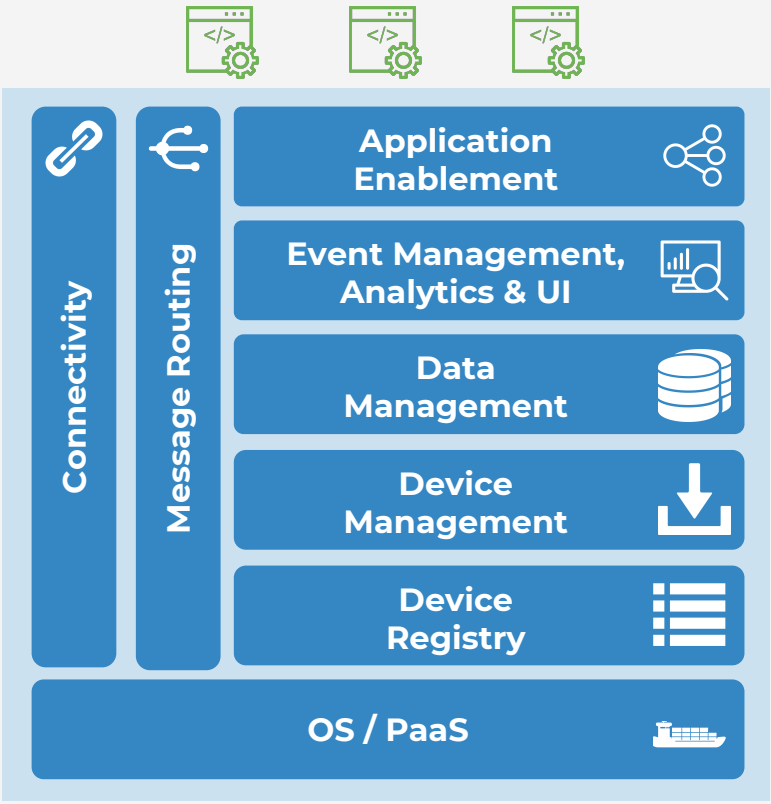
The 3 IoT Software Stacks

iot eclipse.org

SECURITY | ONTOLOGIES | TOOLS & SDKs







CONSTRAINED DEVICES

GATEWAYS AND SMART DEVICES

IOT CLOUD PLATFORM

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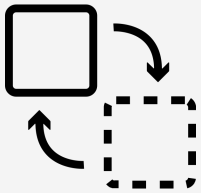
Characteristics of Open IoT Stacks

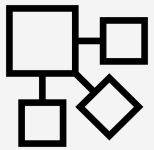


loosely coupled

modular

platform-independant

based on open standards



API

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Eclipse IoT

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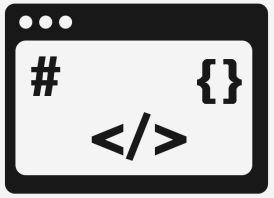
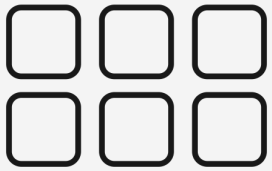
Eclipse IoT Community



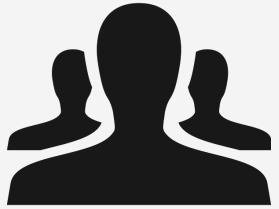
2.4

million
lines of code



30

projects



280+

developers

140K

monthly
visitors

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Eclipse IoT...

from building blocks ... to stacks

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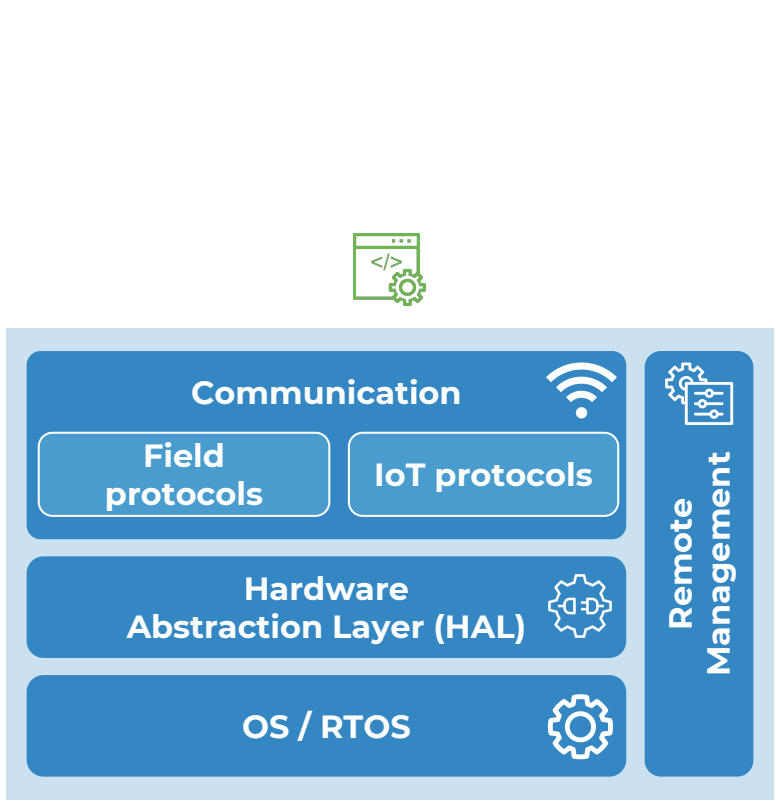
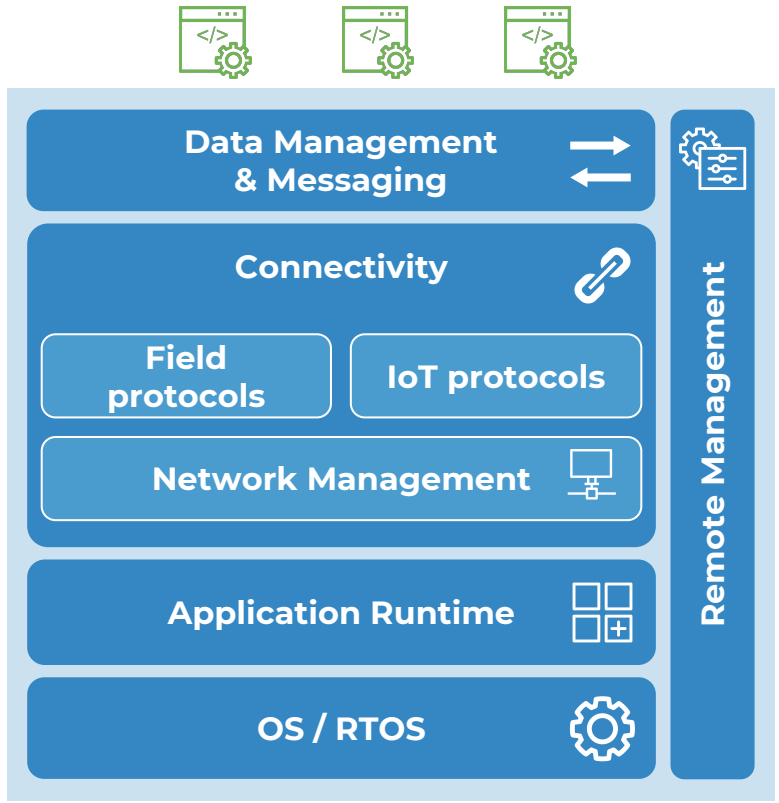
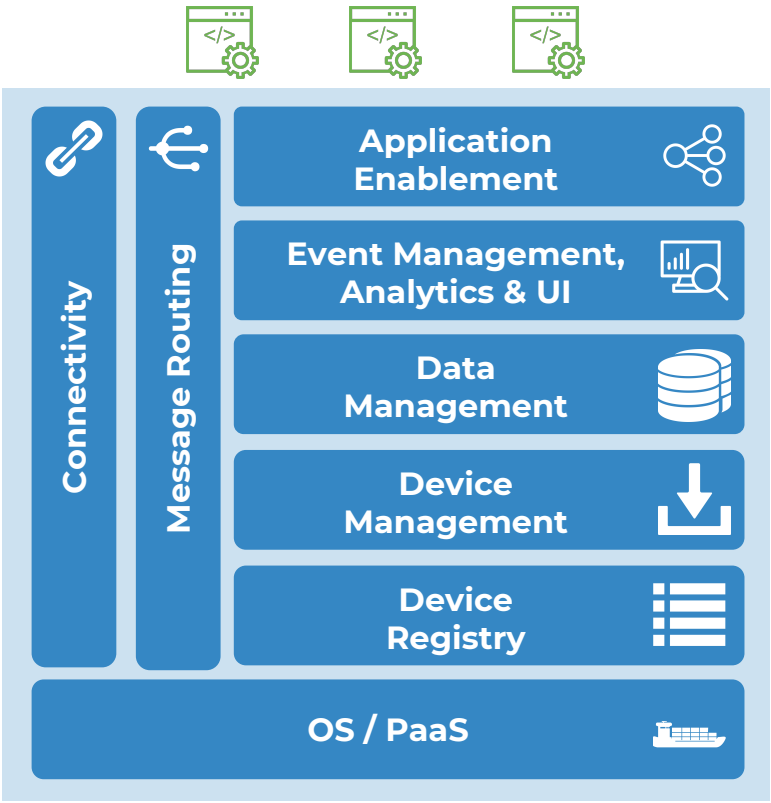
The 3 IoT Software Stacks

iot eclipse.org

SECURITY | ONTOLOGIES | TOOLS & SDKs







CONSTRAINED DEVICES

GATEWAYS AND SMART DEVICES

IOT CLOUD PLATFORM

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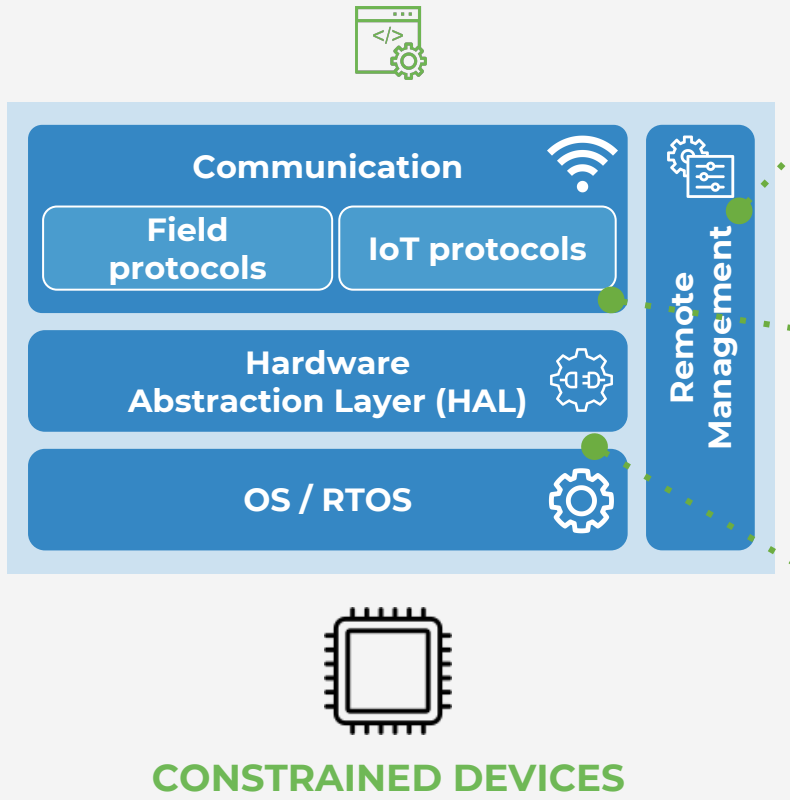
OS Stack for IoT Devices



C implementation of OMA LWM2M

Portable on any POSIX-compliant system

C implementation of MQTT 3.1.1

< 2,000 lines of C ANSI code

JAVA API for MCUs

“Android for IoT”

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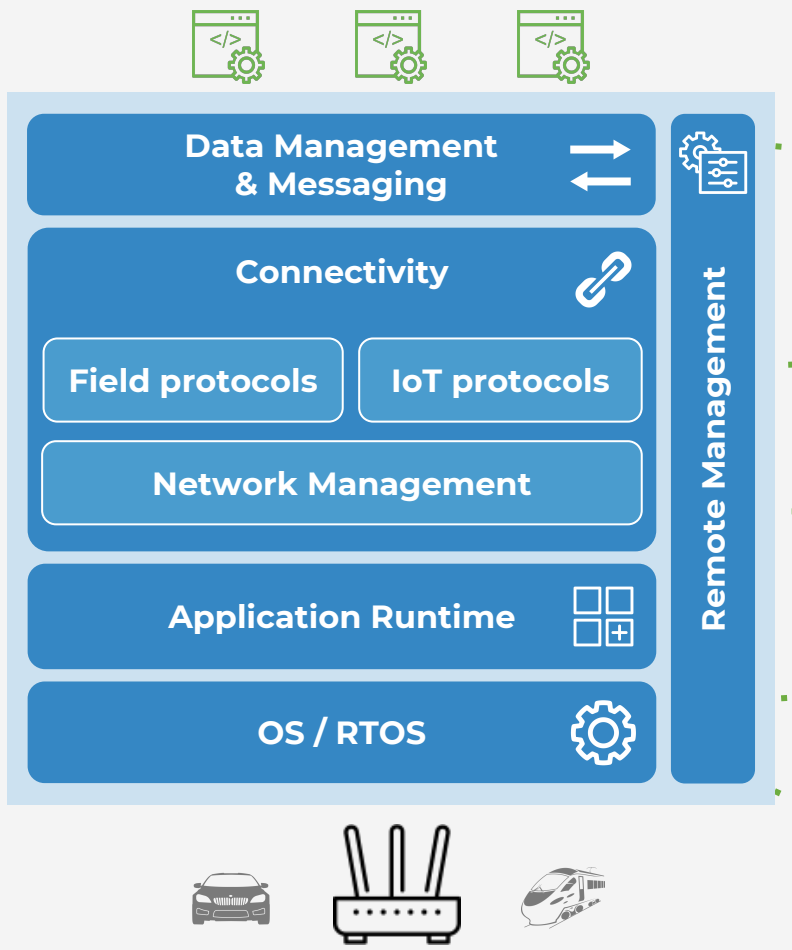
OS Stack for IoT Gateways



kura

Native support for MQTT paho

Serial, RS-485, BLE, MODBUS, OPC-UA, CAN Bus, … milo

NAT, firewall, modem configuration, …

Remote Management over MQTT

equinox OSGi

concierge

OSGi implementation

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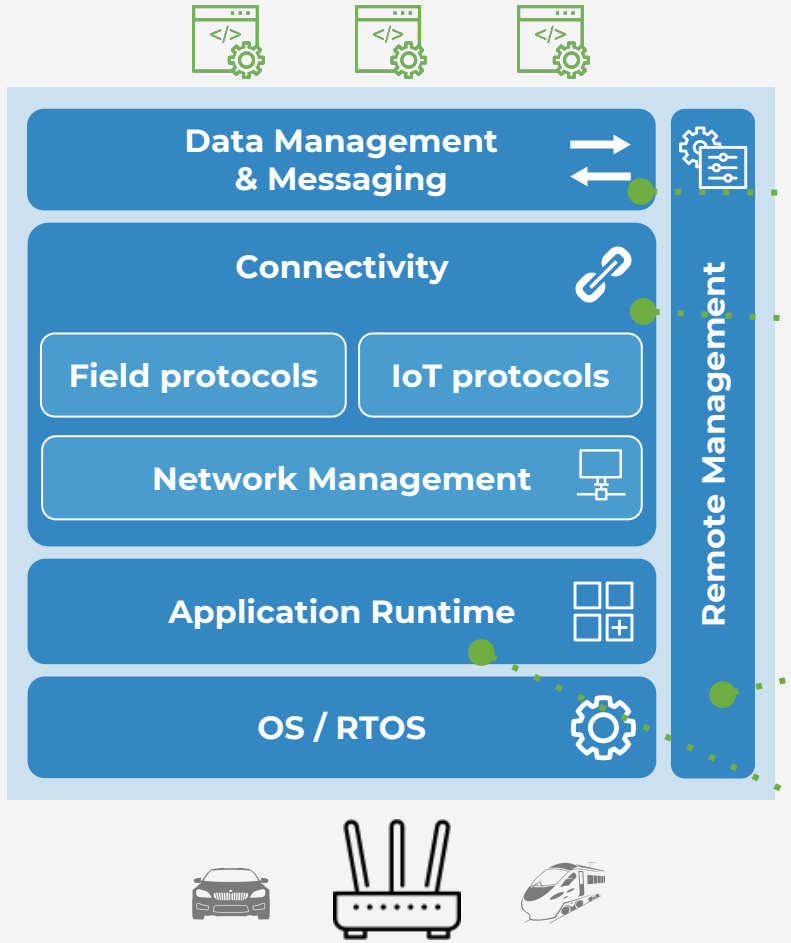
OS Stack for Home Automation



eclipse smarthome

Rule engine to orchestrate “things”

Home automation protocols such as Belkin WeMo, LIFX, Philips Hue, …

Remote firmware update through the GW

Web UI and API for remote control

equinox OSGi

concierge

OSGi implementation

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OS Stack for IoT Cloud

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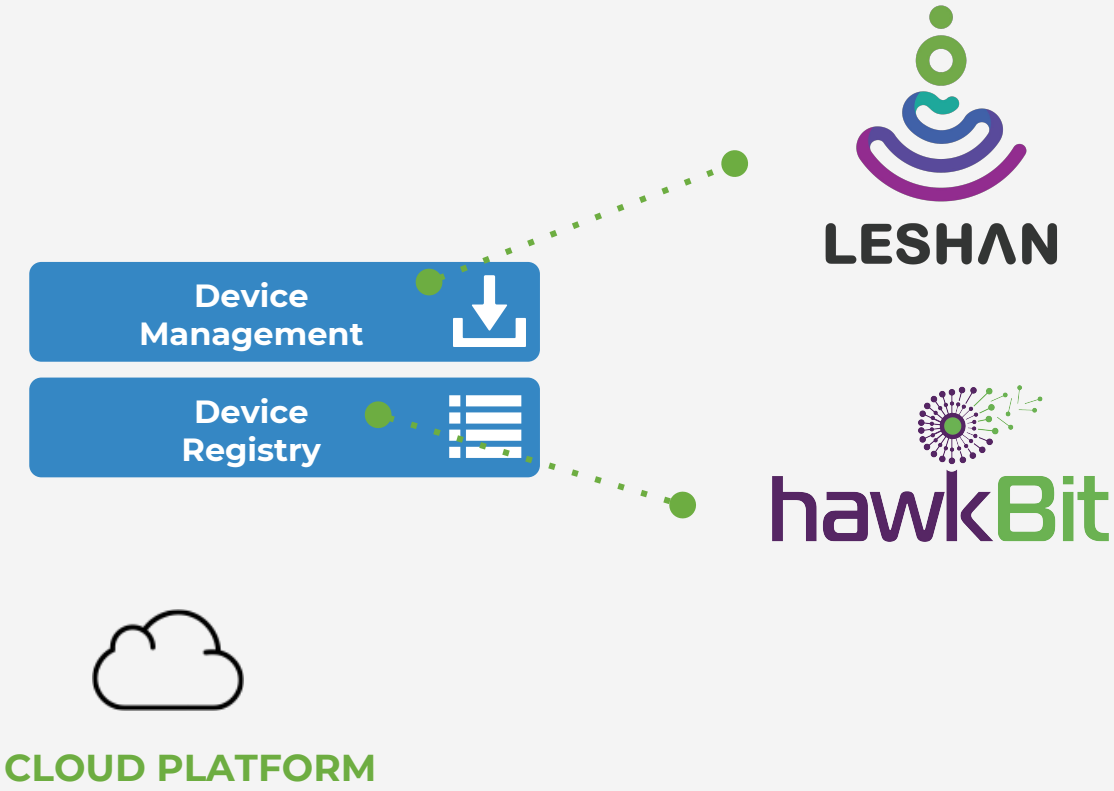
OS Stack for IoT Cloud



OMA LWM2M implementation in Java built on top of Eclipse Californium (CoAP)

Manage software upgrade campaigns independently of the actual DM protocol

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Eclipse hawkBit

IoT Business Solutions

Graphical User Interface

Management API

hawkBit – Update Server

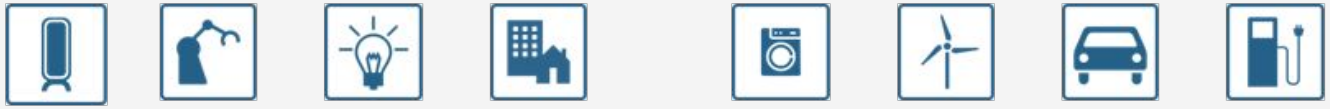
- Device and Software Repository
- Artifact Content Delivery
- Software Update and Roll out Management

Direct Device Integration API

Device Management Federation API

Device Managements

OMA-DM | LWM2M | *Custom*



hawkBit

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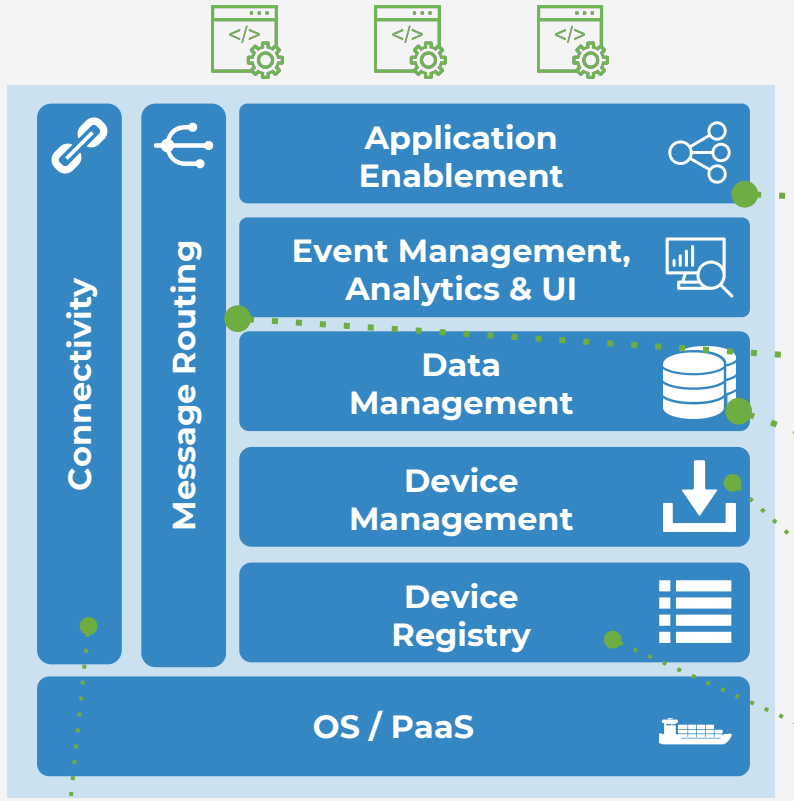
OS Stack for IoT Cloud Platform



Kapua

An Integration Platform for IoT Services

REST API / Digital Twin — ditto

HONO

Abstract the actual communication protocols via “protocol adapters”

LESHAN

NoSQL data store

hawkBit

Deploy on:

OPENSHIFT

CLOUD FOUNDRY

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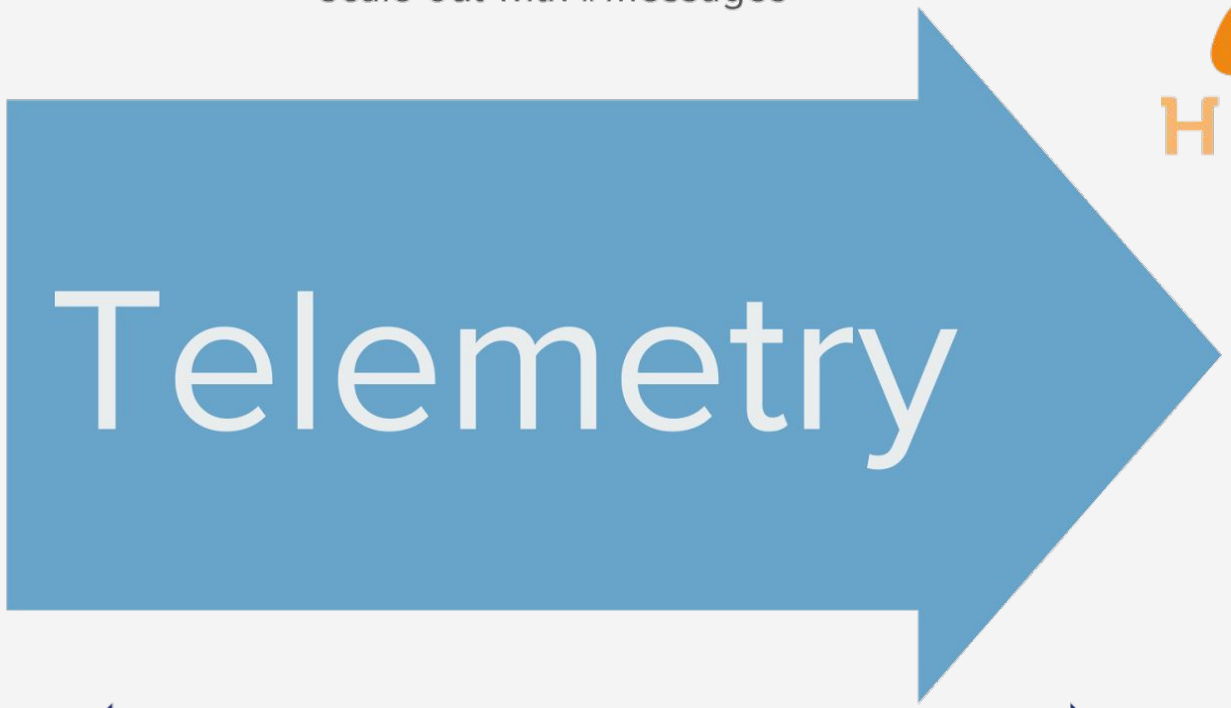
Eclipse hono

optimized for throughput
scale-out with #messages



HONO

Things

many existing protocols
HTTP, MQTT, CoAP
etc

Cloud

arbitrary providers &
deployment options

optimized for reliability
scale-out with #devices

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Eclipse IoT Adoption

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Eclipse IoT Programs

Virtual IoT

Open
IoT Challenge

IoT
Marketplace

Testbeds

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One more thing...

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Eclipse Enterprise for Java (EE4J)

Moving Java EE to Eclipse Foundation

Technology

IBM

ORACLE

redhat

Community and Vendors

Sponsorship

eclipse

Enterprise for Java

- ✓ Agile
- ✓ Flexible
- ✓ Open
- ✓ Compatible

Join the discussion at ee4j-community@eclipse.org

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Eclipse Enterprise for Java (EE4J)

Project Overview

- Open process
- Collaboration: community, vendors, Eclipse
- Transition to EE4J in CY2018
  - GlassFish 5.0/Java EE 8 RIs, TCKs, product docs
  - Process for existing and new specs
  - Compatibility process
- Technology evolution, MicroProfile integration
- Oracle Java EE Support through Java EE 8
  - Continuity for Java EE community

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Eclipse Deeplearning4j

- Java-based Machine Learning Framework
  - Toolkit for building, training and deploying Neural Networks
- Distributed training
  - GPU or Hadoop/Spark
- Use cases:
  - network intrusion detection, predictive maintenance, recommender systems in e-commerce, image recognition, …

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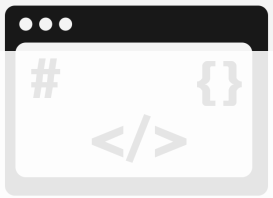
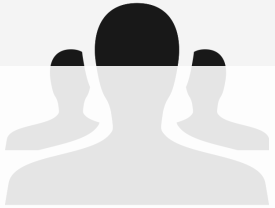
Join us!





https://iot.eclipse.org

2.4 million lines of code

30* projects

280+ developers

140K monthly visitors

* and counting!

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Join us!

- **Check out the projects**
  - Contribute ideas, bug fixes, use cases…
- **Participate on the mailing lists**
- **Virtual IoT Meetup**
  - https://www.meetup.com/virtual-iot
- **Propose your project!**

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IoT Developer Survey

https://goo.gl/zidHso

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Thank you!

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https://blog.benjamin-cabe.com