IoT 시대의 Open H/W Platform을 위한 임베디드 플랫폼 전략

김홍일 (hong-il.kim@oracle.com)
Java Embedded GSU, Oracle

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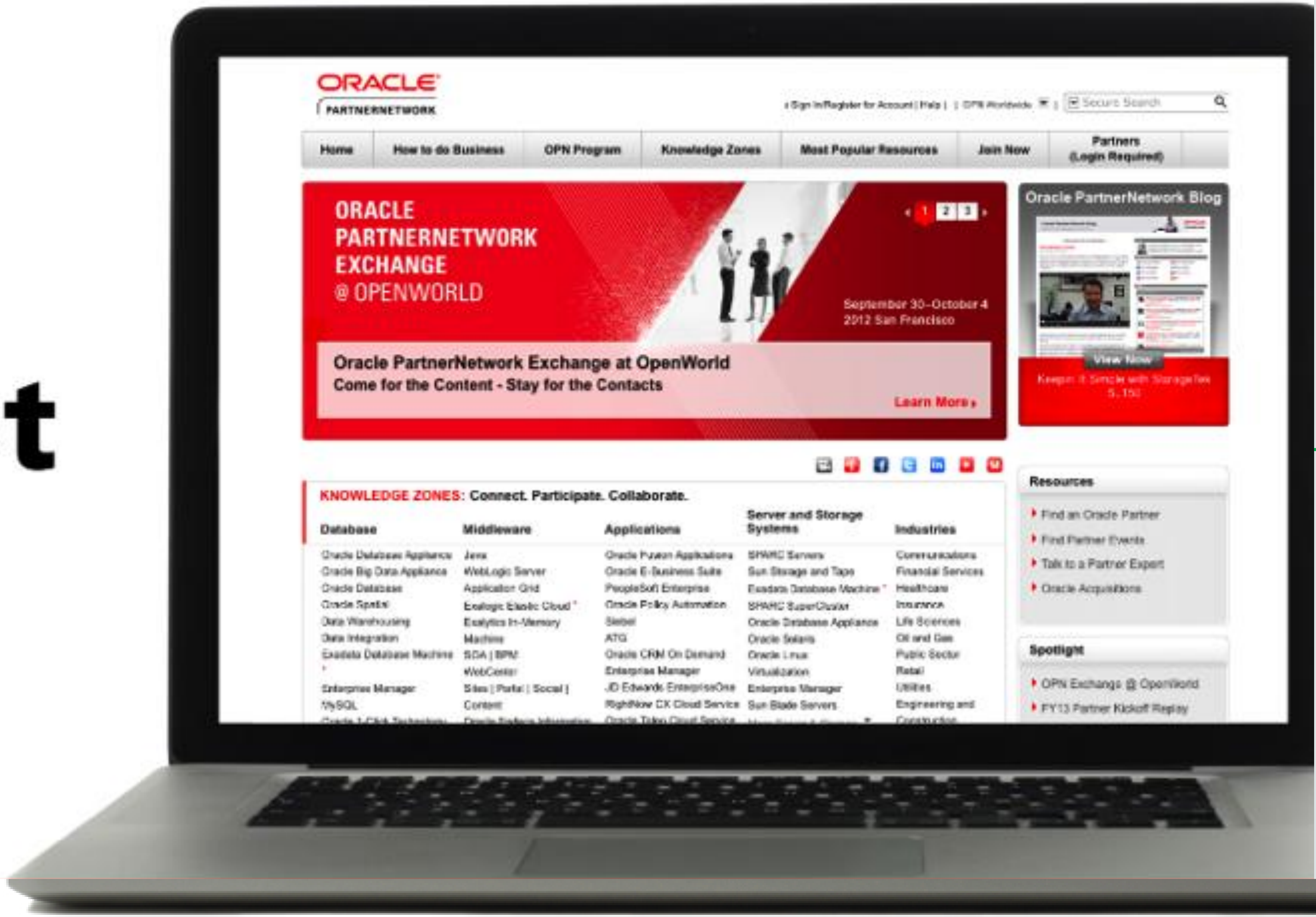
ORACLE®

2.3B Internet Users

Source: IDC



ORACLE PARTNERNETWORK

Sign In/Register for Account | Help | | OPN Worldwide | Secure Search

Home | How to do Business | OPN Program | Knowledge Zones | Most Popular Resources | Join Now | Partners (Login Required)

ORACLE PARTNERNETWORK EXCHANGE @ OPENWORLD

September 30–October 4 2012 San Francisco

Oracle PartnerNetwork Exchange at OpenWorld

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Learn More

Oracle PartnerNetwork Blog

View Now

KNOWLEDGE ZONES: Connect. Participate. Collaborate.

Database
- Oracle Database Appliance
- Oracle Big Data Appliance
- Oracle Database
- Oracle Spatial
- Data Warehousing
- Data Integration
- Exadata Database Machine *
- Enterprise Manager
- MySQL

Middleware
- Java
- WebLogic Server
- Application Grid
- Exalogic Elastic Cloud *
- Exalytics In-Memory Machine
- SOA | BPM
- WebCenter
- Sites | Portal | Social | Content

Applications
- Oracle Fusion Applications
- Oracle E-Business Suite
- PeopleSoft Enterprise
- Oracle Policy Automation
- Siebel
- ATG
- Oracle CRM On Demand
- Enterprise Manager
- JD Edwards EnterpriseOne
- RightNow CX Cloud Service

Server and Storage Systems
- SPARC Servers
- Sun Storage and Tape
- Exadata Database Machine *
- SPARC SuperCluster
- Oracle Database Appliance
- Oracle Solaris
- Oracle Linux
- Virtualization
- Enterprise Manager
- Sun Blade Servers

Industries
- Communications
- Financial Services
- Healthcare
- Insurance
- Life Sciences
- Oil and Gas
- Public Sector
- Retail
- Utilities
- Engineering and Construction

Resources
- Find an Oracle Partner
- Find Partner Events
- Talk to a Partner Expert
- Oracle Acquisitions

Spotlight
- OPN Exchange @ OpenWorld
- FY13 Partner Kickoff Replay

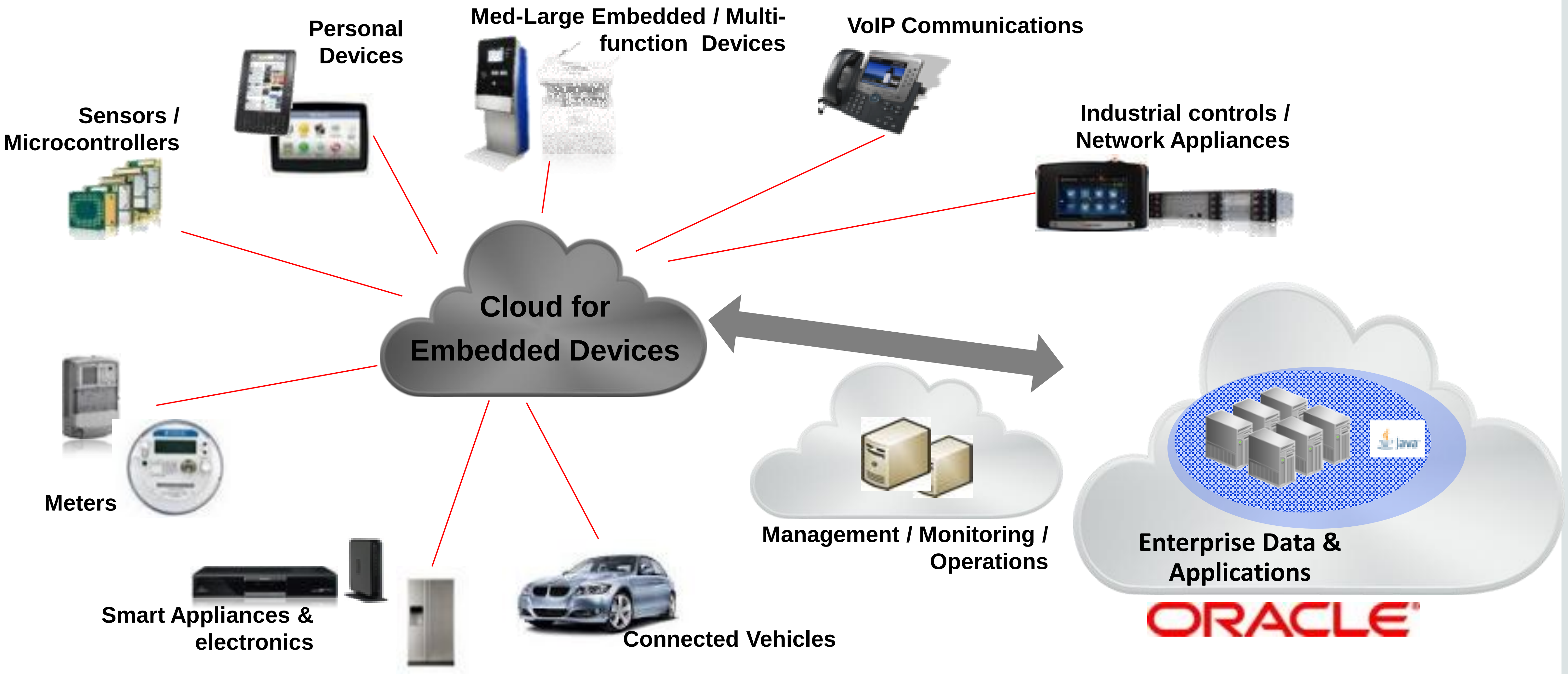
1.1B Global

3G mobile subscribers

Source: Mobithink

3B to 50B Devices

Internet of Things Meets Big Data



Sensors / Microcontrollers

Personal Devices

Med-Large Embedded / Multi-function Devices

VoIP Communications

Industrial controls / Network Appliances

Cloud for Embedded Devices

Meters

Smart Appliances & electronics

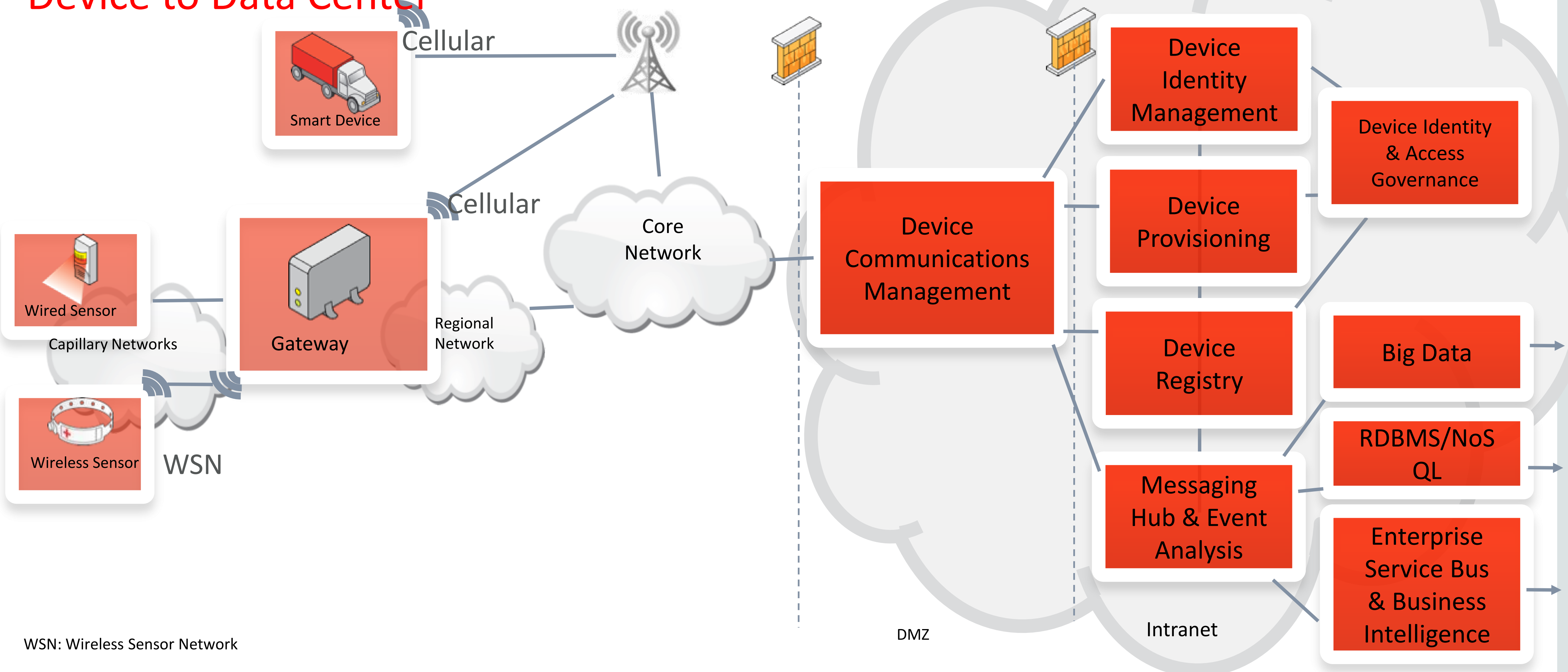
Connected Vehicles

Management / Monitoring / Operations

Enterprise Data & Applications

IoT Conceptual Architecture

Device to Data Center


Smart Device
Cellular
Cellular
Wired Sensor
Capillary Networks
Gateway
Regional Network
Core Network
Wireless Sensor
WSN
Device Communications Management
Device Identity Management
Device Provisioning
Device Registry
Messaging Hub & Event Analysis
Device Identity & Access Governance
Big Data
RDBMS/NoSQL
Enterprise Service Bus & Business Intelligence
DMZ
Intranet

WSN: Wireless Sensor Network

IoT Consideration

SERVICES

Open S/W Platform

Reusability

END-to-END
Service Model

Time To & In Market

Security

Remote
Update/Management

Real Time Analysis

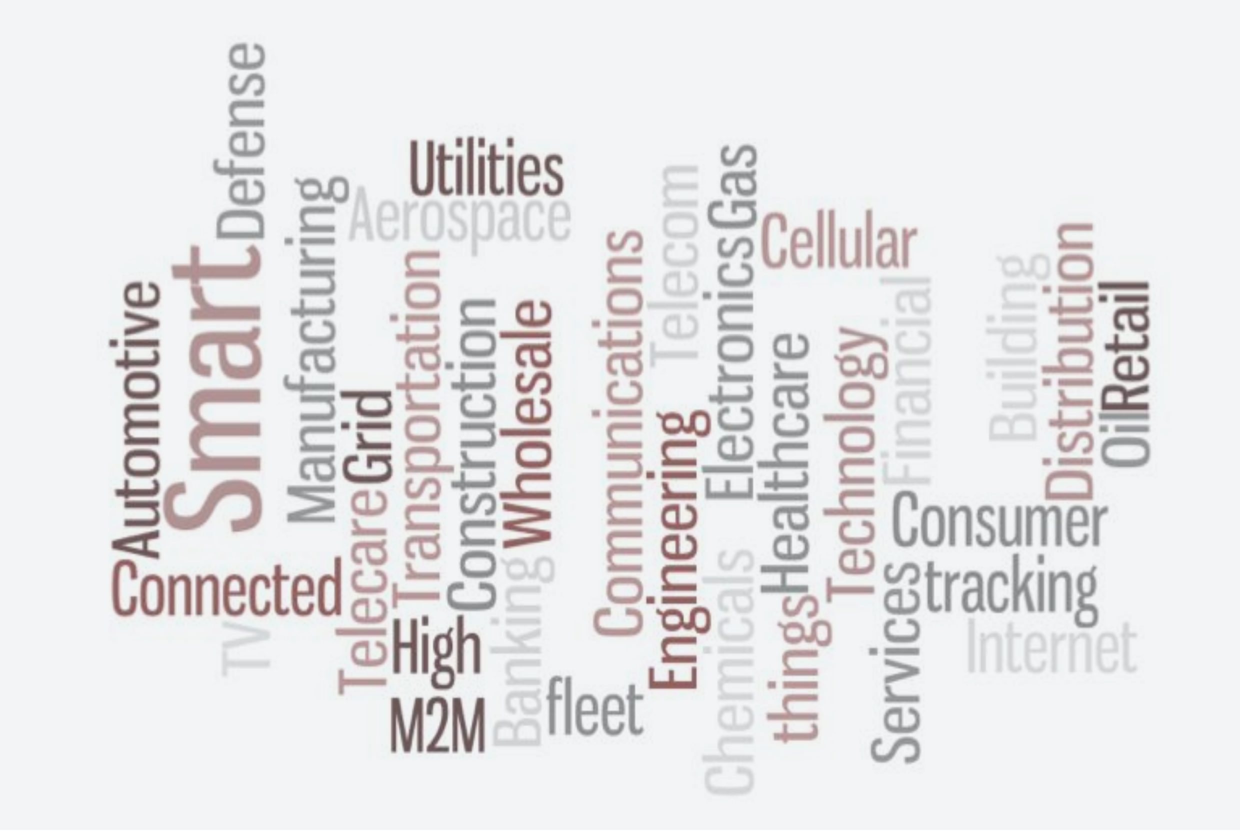
Ecosystem

IoT needs an Open Platform

Developers can focus on Application Logic

Moving from proprietary point solutions to **horizontal platforms and infrastructure**:

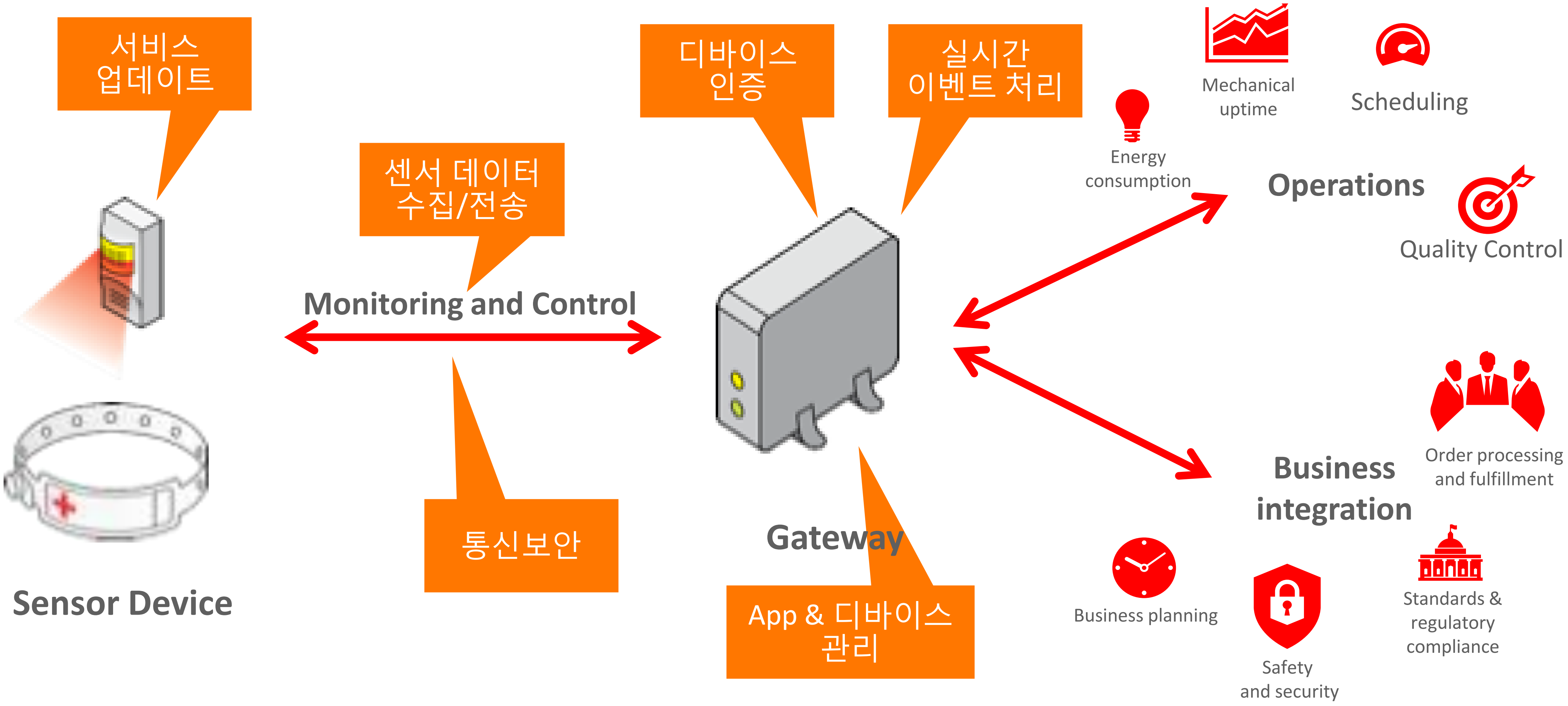
- Application platform
- Security
- Connectivity
- Manageability
- Interoperability
- Back-end integration
- Tooling


Automotive
Connected
Smart
Defense
TV
Manufacturing
Telecare
Grid
Utilities
Aerospace
Transportation
High
M2M
Construction
Banking
Wholesale
fleet
Communications
Engineering
Telecom
Chemicals
Electronics
Gas
Cellular
things
Healthcare
Technology
Financial
Services
Consumer
tracking
Internet
Building
Distribution
Oil
Retail

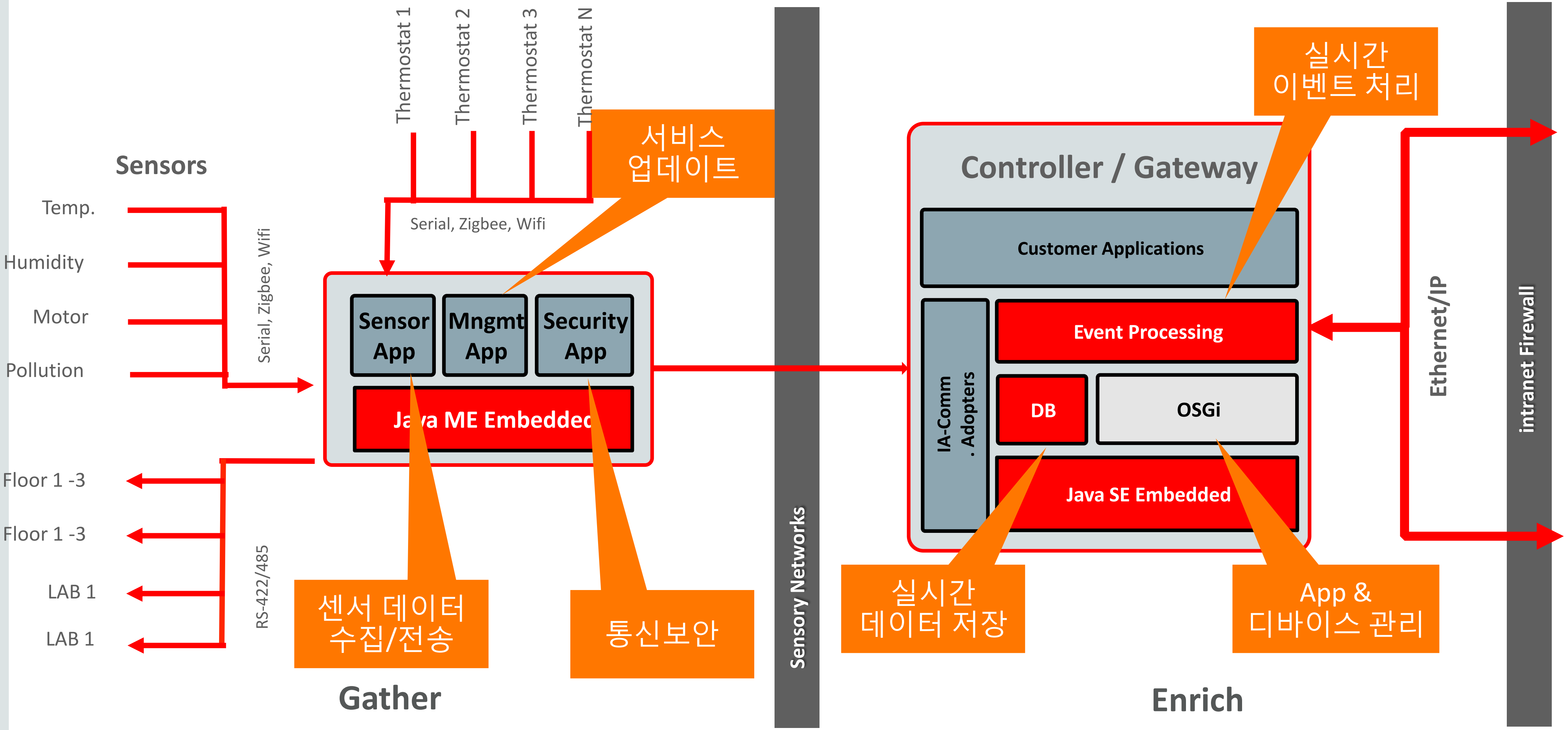
IoT Platform

Open Platform for IoT

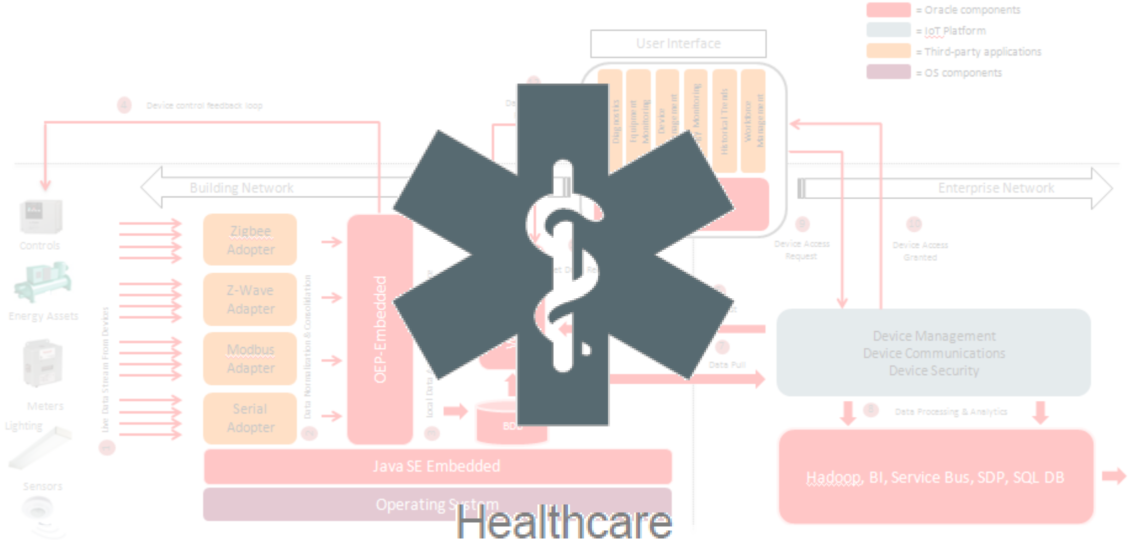
IoT Generic Architecture


서비스
업데이트
센서 데이터
수집/전송
디바이스
인증
실시간
이벤트 처리
Monitoring and Control
통신보안
Sensor Device
Gateway
App & 디바이스
관리
Energy
consumption
Mechanical
uptime
Scheduling
Operations
Quality Control
Business
integration
Order processing
and fulfillment
Business planning
Safety
and security
Standards &
regulatory
compliance

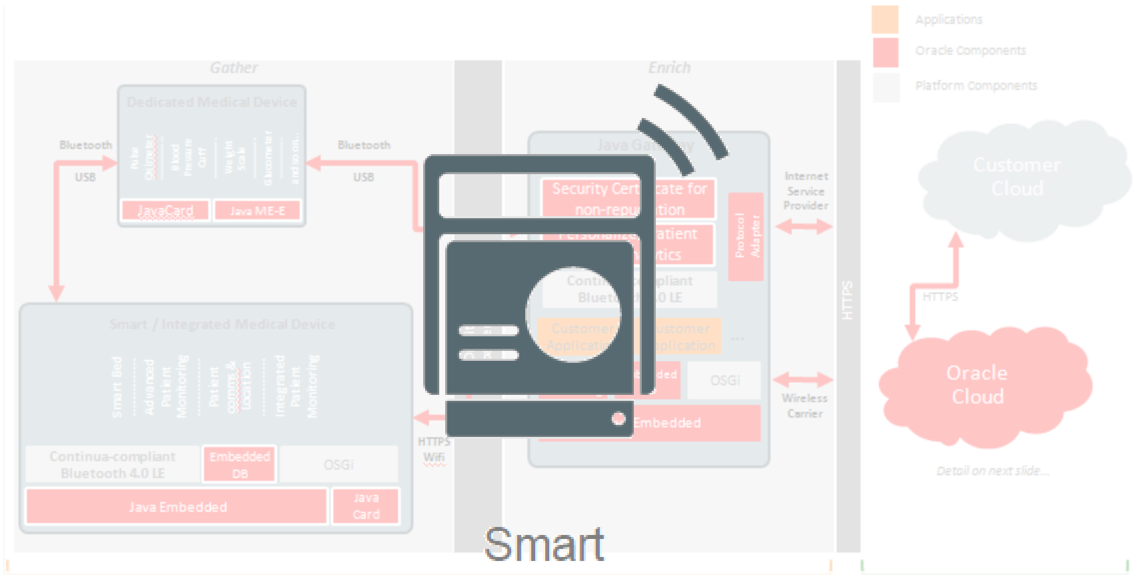
Reference Architecture


Thermostat 1
Thermostat 2
Thermostat 3
Thermostat N
서비스 업데이트
실시간 이벤트 처리
Sensors
Temp.
Humidity
Motor
Pollution
Serial, Zigbee, Wifi
Serial, Zigbee, Wifi
Sensor App
Mngmt App
Security App
Java ME Embedded
Floor 1 -3
Floor 1 -3
LAB 1
LAB 1
RS-422/485
센서 데이터 수집/전송
통신보안
Gather
Sensory Networks
Controller / Gateway
Customer Applications
Event Processing
IA-Comm . Adopters
DB
OSGi
Java SE Embedded
실시간 데이터 저장
App & 디바이스 관리
Enrich
Ethernet/IP
intranet Firewall

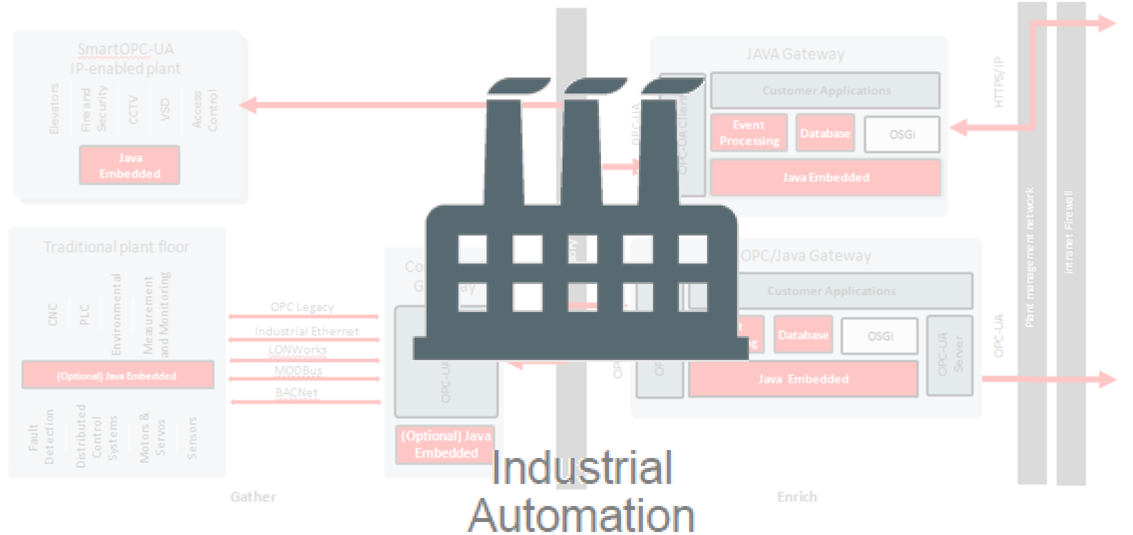
Reference Architectures


= Oracle components
= IoT Platform
= Third-party applications
= OS components
User Interface
Device control feedback loop
Building Network
Enterprise Network
Controls
Energy Assets
Meters
Lighting
Sensors
Zigbee Adapter
Z-Wave Adapter
Modbus Adapter
Serial Adapter
OEP-Embedded
Device Management
Device Communications
Device Security
Data Processing & Analytics
Hadoop, BI, Service Bus, SDP, SQL DB
Java SE Embedded
Operating System

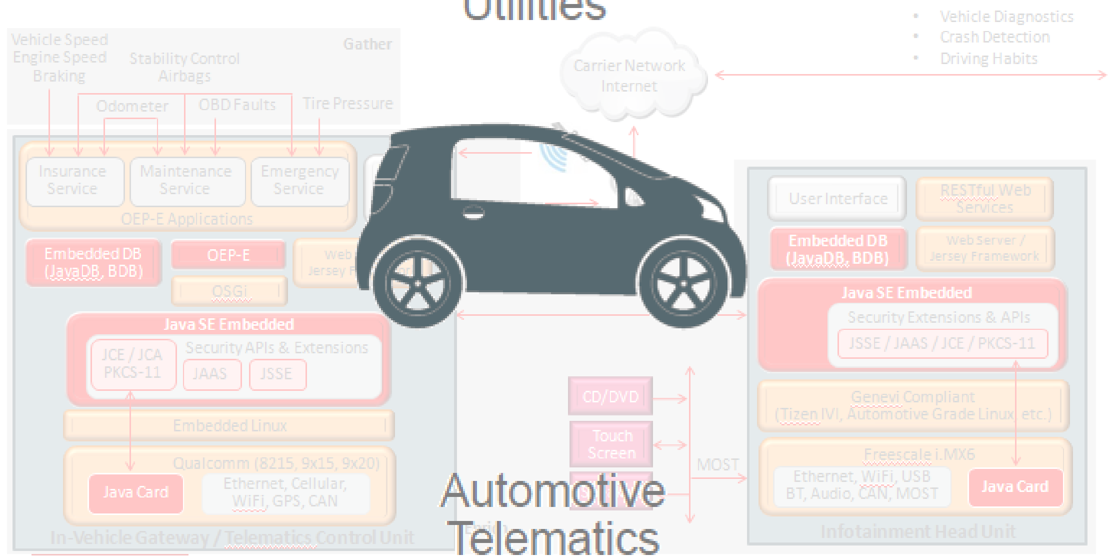
Healthcare


Applications
Oracle Components
Platform Components
Gather
Enrich
Dedicated Medical Device
Bluetooth
USB
JavaCard
Java ME-E
Smart / Integrated Medical Device
Continua-compliant Bluetooth 4.0 LE
Embedded DB
OSGi
Java Embedded
Java Card
HTTPS
Wifi
Internet Service Provider
Wireless Carrier
Customer Cloud
Oracle Cloud
Detail on next slide...

Smart Utilities


SmartOPC-UA IP-enabled plant
Java Embedded
Traditional plant floor
(Optional) Java Embedded
OPC Legacy
Industrial Ethernet
LONWorks
MODBus
BACNet
JAVA Gateway
Customer Applications
Event Processing
Database
OSGi
Java Embedded
OPC/Java Gateway
(Optional) Java Embedded
HTTPS/IP
OPC-UA
Gather
Enrich

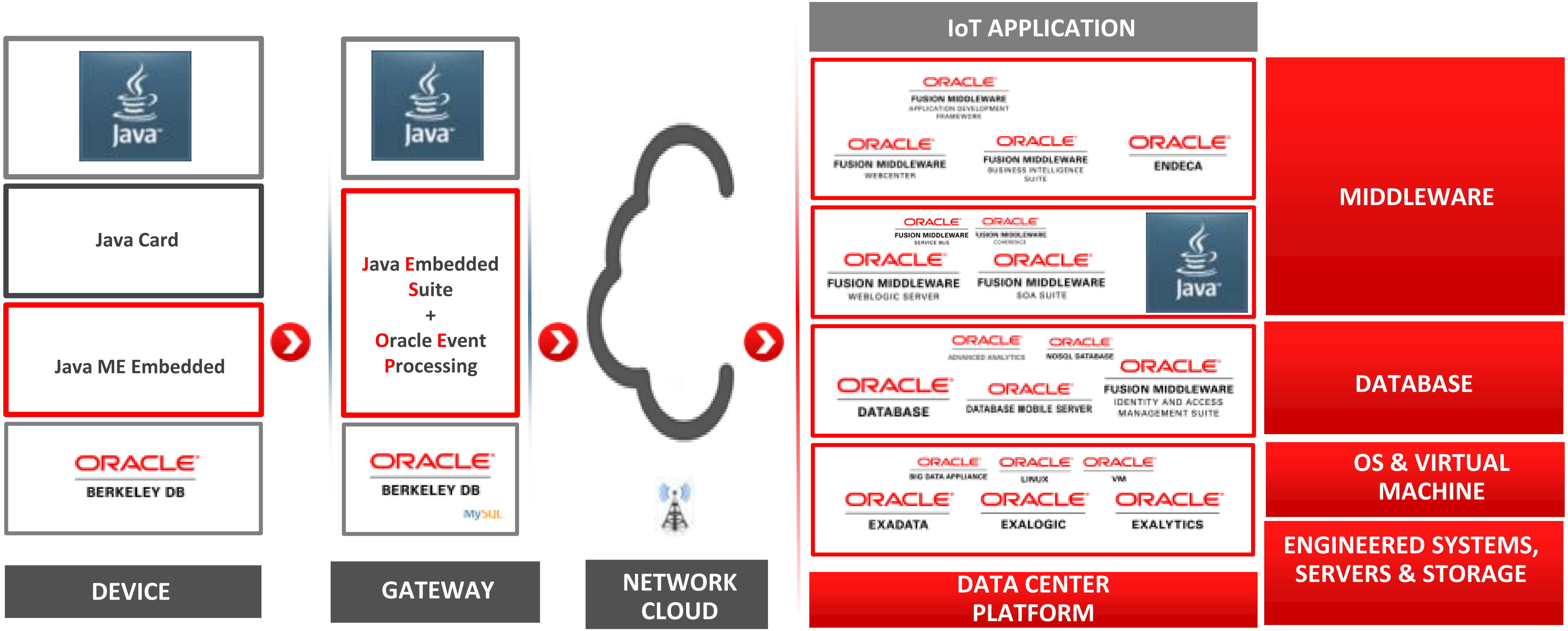
Industrial Automation


Vehicle Speed
Engine Speed
Braking
Stability Control
Airbags
Gather
Odometer
OBD Faults
Tire Pressure
Carrier Network Internet
Vehicle Diagnostics
Crash Detection
Driving Habits
Insurance Service
Maintenance Service
Emergency Service
OEP-E Applications
Embedded DB (JavaDB, BDB)
OEP-E
OSGi
Java SE Embedded
JCE / JCA PKCS-11
Security APIs & Extensions
JAAS
JSSE
Embedded Linux
Qualcomm (8215, 9x15, 9x20)
Java Card
Ethernet, Cellular, WiFi, GPS, CAN
In-Vehicle Gateway / Telematics Control Unit
CD/DVD
Touch Screen
MOST
User Interface
RESTful Web Services
Embedded DB (JavaDB, BDB)
Web Server / Jersey Framework
Java SE Embedded
Security Extensions & APIs
JSSE / JAAS / JCE / PKCS-11
Genevi Compliant (Tizen IVI, Automotive Grade Linux, etc.)
Freescale i.MX6
Ethernet, WiFi, USB BT, Audio, CAN, MOST
Java Card
Infotainment Head Unit

Automotive Telematics

Open Platform for IoT

Based on Java


Java
ORACLE BERKELEY DB
MySQL
ORACLE FUSION MIDDLEWARE APPLICATION DEVELOPMENT FRAMEWORK
ORACLE FUSION MIDDLEWARE WEBCENTER
ORACLE FUSION MIDDLEWARE BUSINESS INTELLIGENCE SUITE
ORACLE ENDECA
ORACLE FUSION MIDDLEWARE SERVICE BUS
ORACLE FUSION MIDDLEWARE COHERENCE
ORACLE FUSION MIDDLEWARE WEBLOGIC SERVER
ORACLE FUSION MIDDLEWARE SOA SUITE
ORACLE ADVANCED ANALYTICS
ORACLE NOSQL DATABASE
ORACLE DATABASE
ORACLE DATABASE MOBILE SERVER
ORACLE FUSION MIDDLEWARE IDENTITY AND ACCESS MANAGEMENT SUITE
ORACLE BIG DATA APPLIANCE
ORACLE LINUX
ORACLE VM
ORACLE EXADATA
ORACLE EXALOGIC
ORACLE EXALYTICS

Java Card

Java ME Embedded

DEVICE

Java **E**mbedded **S**uite
+
Oracle **E**vent **P**rocessing

GATEWAY

NETWORK CLOUD

IoT APPLICATION

DATA CENTER PLATFORM

MIDDLEWARE

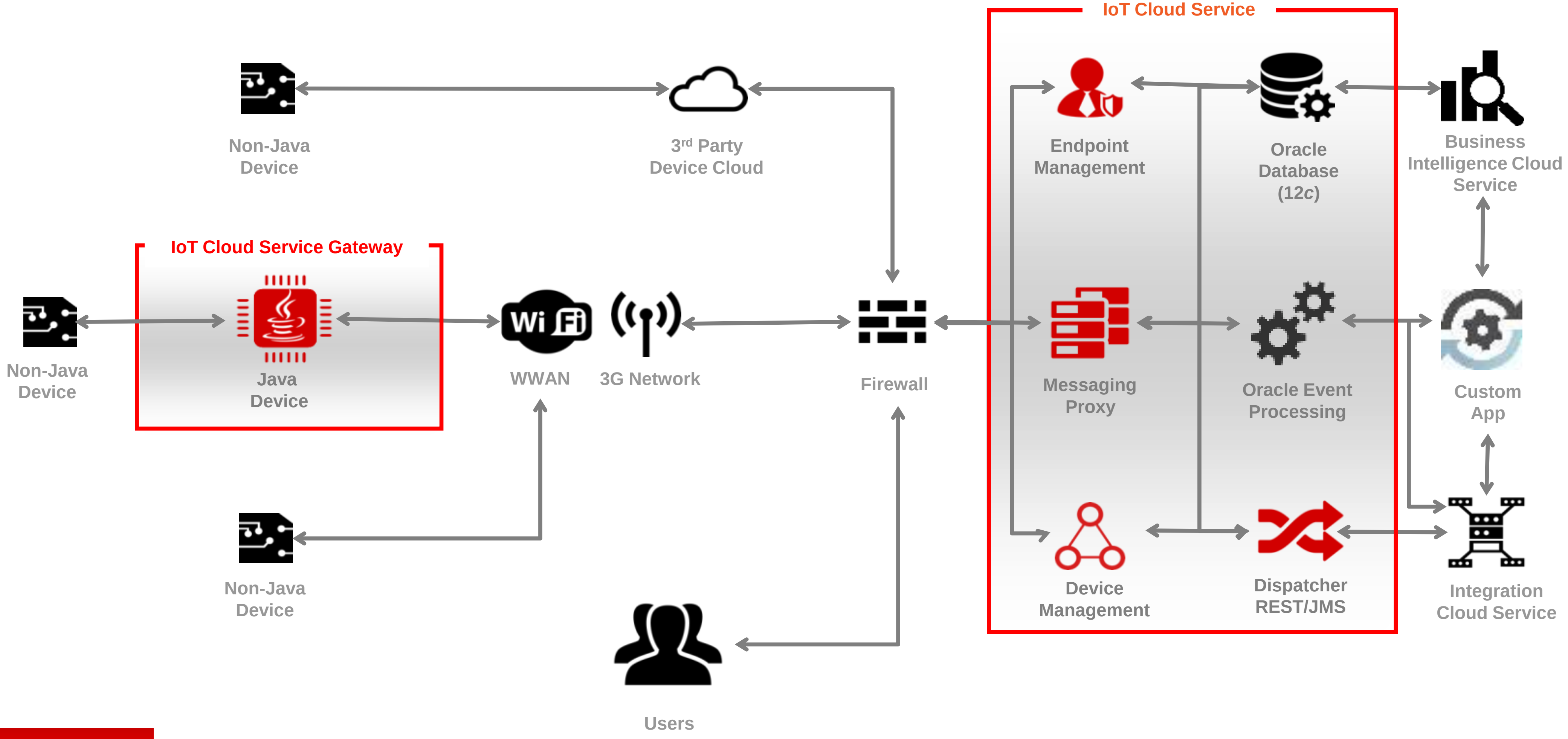
DATABASE

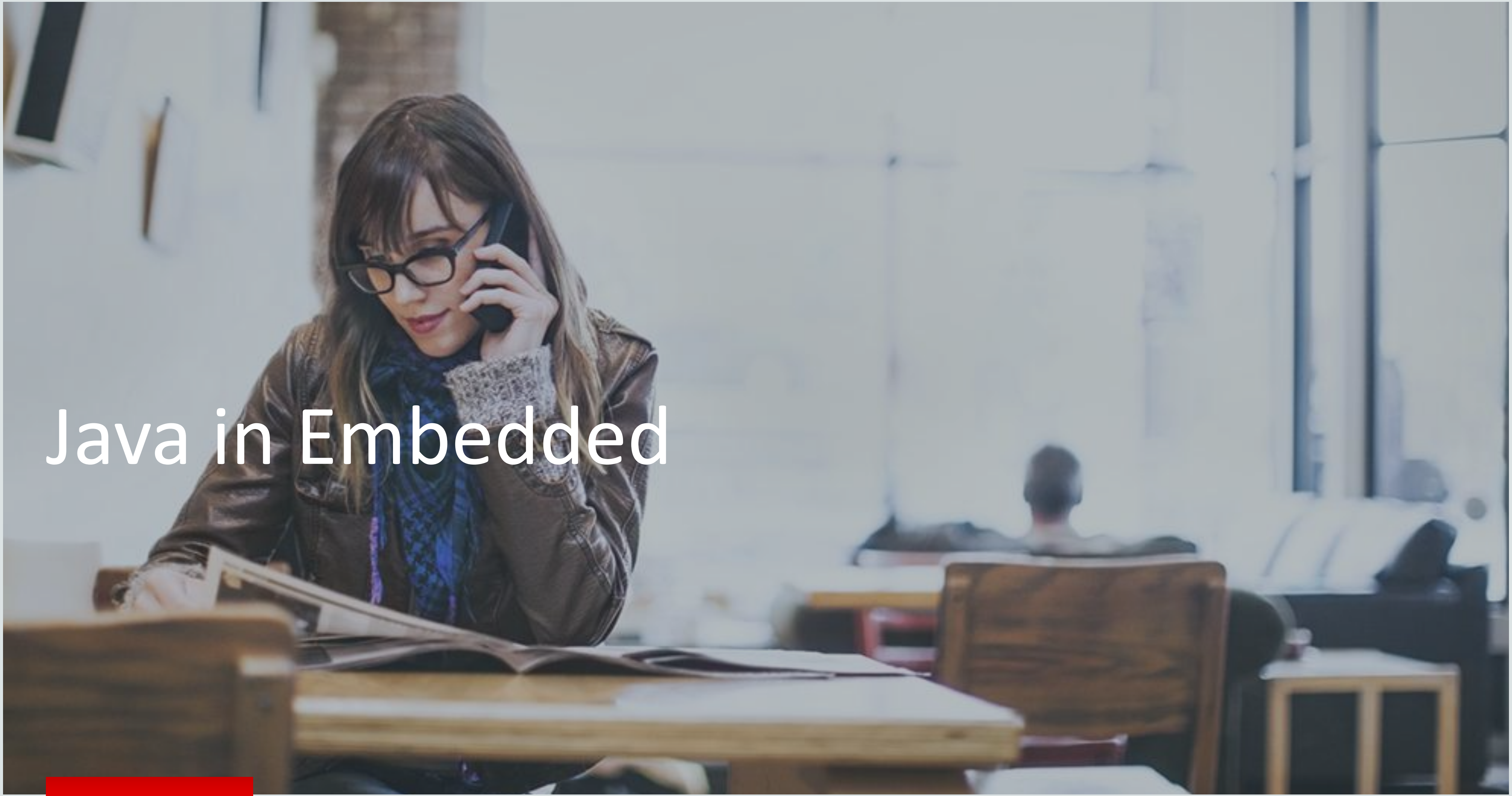
OS & VIRTUAL MACHINE

ENGINEERED SYSTEMS, SERVERS & STORAGE

Oralce IoT Cloud Service

Overall Architecture


IoT Cloud Service
Non-Java Device
3rd Party Device Cloud
Endpoint Management
Oracle Database (12c)
Business Intelligence Cloud Service
IoT Cloud Service Gateway
Non-Java Device
Java Device
WWAN
3G Network
Firewall
Messaging Proxy
Oracle Event Processing
Custom App
Non-Java Device
Device Management
Dispatcher REST/JMS
Integration Cloud Service
Users



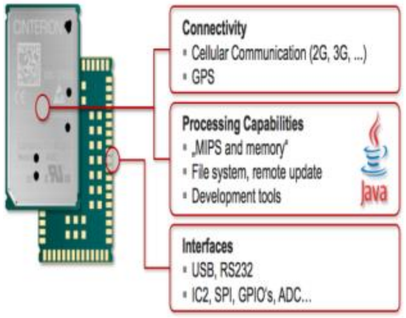
Java in Embedded

Java References

Use Cases

x10
Fuel Score
Safety Score
%
Insurance Discount

- Automotive / Telematics


CINTERION
Connectivity
Cellular Communication (2G, 3G, ...)
GPS
Processing Capabilities
„MIPS and memory"
File system, remote update
Development tools
Java
Interfaces
USB, RS232
IC2, SPI, GPIO's, ADC...

- M2M Modules

- Healthcare

- Industry Automation
- Smart Grid
- Gateway

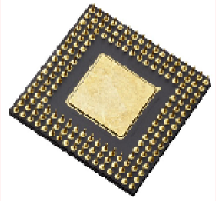
Java References

Automotive / Telematics

	Volkswagen Car diagnostic S/W(ODIS) JavaSE-E on portable testing device		**Audi** Unmanned Automobile - Research of Audi and Stanford University Autonomous Audi w/ Java RTS
	Volvo Telematics MX-1 VB GSM/GPRS modem integrated JavaME MIDP 2.0		**Toyota** Car Blue-ray System JavaME CDC
	Siemens VDO Automotive BMW TLA(Top Level Architecture) structure mounted on BMW7, 6, 5 UI JavaME CDC	JEODE	**Insignia Solutions** Automotive Telematics Gateway JavaME
	Thorcom VLR200 Vehicle Tracking Unit JavaME-E on Cinterion module	eCall	**Europe Major Car Maker** OCU(On-Board Communication Unit) w/ JavaME-E 8 for eCall service

Java References

M2M Wireless Modules

	Qualcomm (AT&T, Deutsche Telekom) QSC6270 T Gobi JavaME-E	UE 910 V2 Telit	**Telit (M2M Module, Car)** UE 910 V2 HSPA 3.6 Mbps module for 3.5G JavaME-E
	Gemalto Cinterion M2M Wireless Module 2G/3G Remote Provisioning Management JavaME-E		**SIMCom** GSM/GPRS Wireless Module SIM800 for Automotive, Healthcare, Metering JavaME-E
SIERRA WIRELESS AirPrime	**Sierra Wireless** Embedded Application Framework based on Java for M2M Application Development tool JavaME-E		**Spreadtrum (CMCC)** Common M2M module for Gas Meter, ODB Box, Driving Recorder, POS, Healthcare device JavaME-E

Java References

Healthcare

HITACHI Inspire the Next ALOKA illuminate the change	**Hitachi Aloka Medical** Diagnostic Ultrasound System JavaSE-E	healthimo 	**Healthimo** GlucoMon Wireless Diabetes Management System JavaME-E
	Philips Respironics Sleep Therapy System Cinterion Java module JavaME		**Europe IT Provider** Broadband-enabled care management platform combines daily tele-monitoring and personalized healthcare information
	Austria E-Health System Austria’s healthcare platform (card and gateway reader) for secure ID, storage and processing of health records JavaCard		**Mortara Instrument** Surveyor S12/S19 Bedside Patient Monitoring System JavaSE-E
	Philips DXR Imaging System JavaSE and JavaFX		**Imprivata** Electronic Record Management System w/ secure single sign-on and massaging functions / JavaSE-E

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Java References

Healthcare Device Standard

Continua®

Continua Health Alliance

International non-profit, open industry group of nearly 240 healthcare providers, communications, medical and fitness device companies.
Members aim to develop a system to deliver personal and individual healthcare.
Currently 220 member companies

Oracle as a member of Continua's Board of Director

Making efforts on Java as requirements of Continua standard

ORACLE®

Java References

Industry / Home Automation

	Honeywell Alerton Control Module / Building Automation JavaSE-E	BUILDING EFFICIENCY STARTS HERE. METASYS BY JOHNSON CONTROLS	**Johnson Controls** Metasys Building Management System Control System – Building Automation JavaSE
	Sumitomo Electric Networks Home Gateway for Deutsche Telekom JavaME on OSGi		**Rockwell Automation** Logix controller infrastructure (HMI product) JavaSE-E
QIVICON ProSyst	**Deutsche Telekom AG/Quivicon** OSGi based home gateway	www (WLAN-) Router	**Miele@Home** Networked Home Appliance
	Siemens Serve@Home Networked Home Appliance		**Robustel** Industrial Modem M1000 JavaME-E

Java References

Open Source Projects

iot
eclipse.org

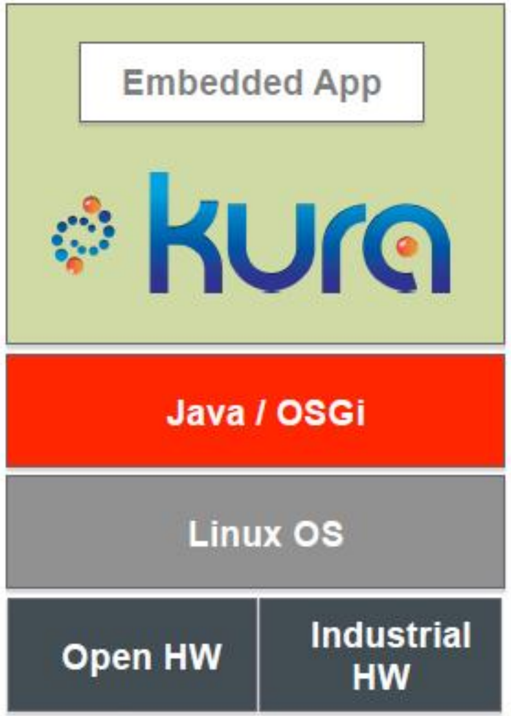
openHAB
empowering the smart home

Californium (Cf)
Cf

eclipse

paho

eclipse smarthome


Embedded App
kura
Java / OSGi
Linux OS
Open HW
Industrial HW

Open Hardware

Open HW Platform

mbed
Enabled

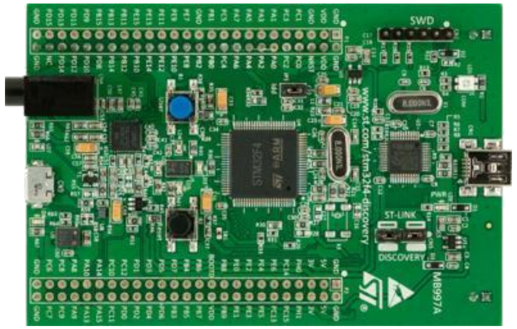
ARM

freescale™

QUALCOMM

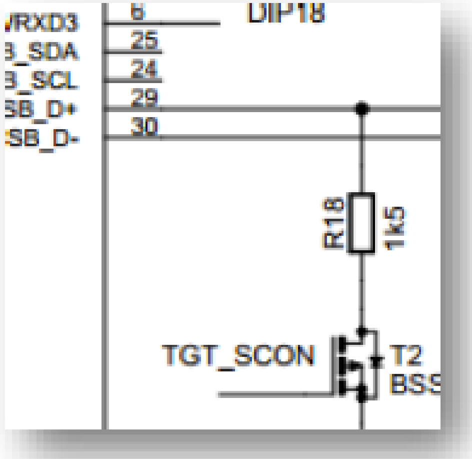
gemalto

security to be free



ARM mbed^{TM} Platform

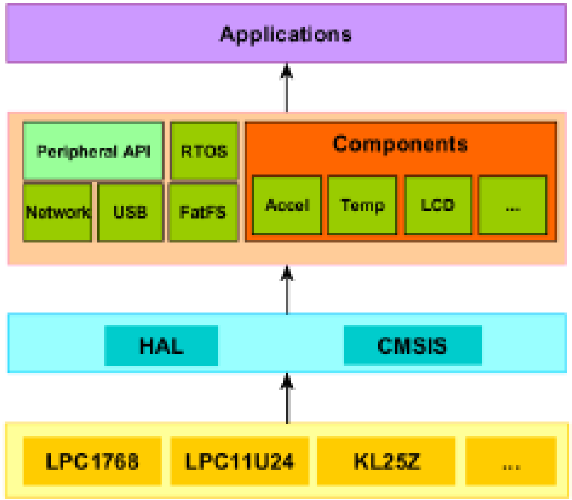
HDK



RXD3
SDA
SCL
SB_D+
SB_D-
6
25
24
29
30
DIP18
R18
1k5
TGT_SCON
T2
BSS

open hardware

SDK


Applications

Peripheral API
RTOS
Components
Network
USB
FatFS
Accel
Temp
LCD
...

HAL
CMSIS

LPC1768
LPC11U24
KL25Z
...

GCC

mbed Compiler

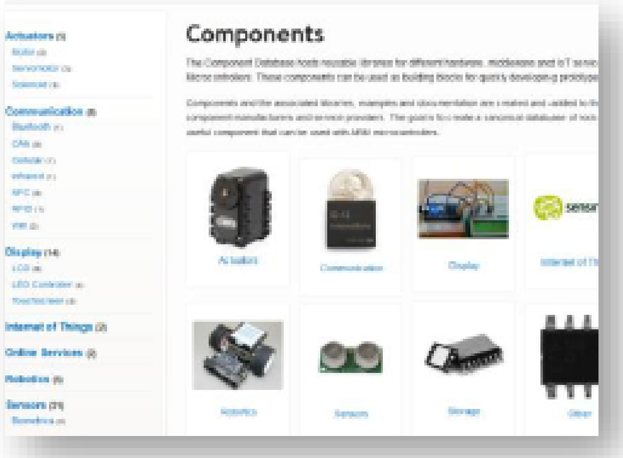
LPCXPRESSO

KEIL Tools by ARM

IAR SYSTEMS

CODESOURCERY now part of Mentor Embedded

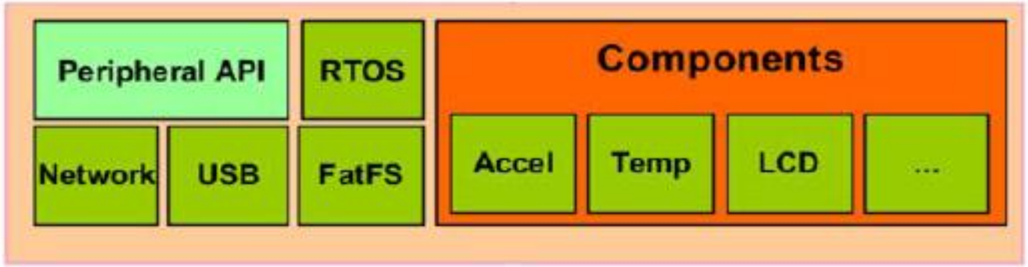
Component Database


Components

open source

Java on ARM mbed^{TM}

Java ORACLE



Peripheral API

RTOS

Components

Network

USB

FatFS

Accel

Temp

LCD

…

ARM MBED

IoT Device Development

FRDM K64F
mbed
Enabled

Freescale Freedom Development Platform

- Freescale K64F Kinetis K64 MCU
- 120MHz, Cortex-M4
- 1MB Flash, 256KB RAM
- Arduino Headers
- SPI, I2C, I2S, UART,
- USB OTG / Host / Device
- PWM, ADC/DAC,
- GPIO, Comparator, CAN

Java on Qualcomm

Internet of Everything

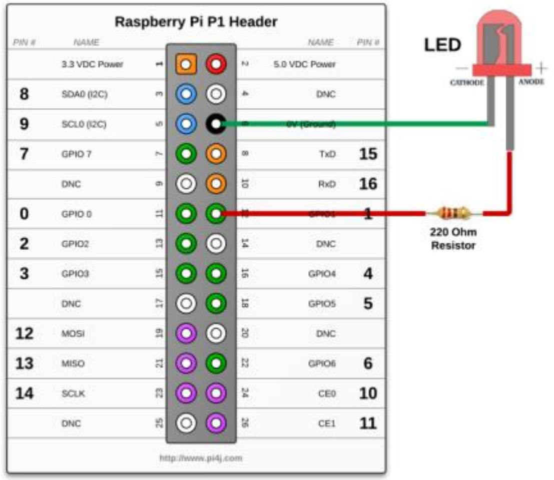
Brew Mobile Platform

Qualcomm Platform

Qualcomm IoE Platform (Orion Board)

- QSC6270T
- ARM926EJ-S 400MHz
- RAM: 64MB DDR RAM
- ROM: 128MB NAND Flash
- Multiband Cellular
- HSDPA, GSM/GPRS
- GPS/WLAN/Accelerometer/Light/Temp./ SPI/I2C/ADC/GPIO/microSD/USIM/JTAG …

Java on Raspberry Pi



Raspberry Pi P1 Header

PIN #	NAME			NAME	PIN #
	3.3 VDC Power	1	2	5.0 VDC Power	
8	SDA0 (I2C)	3	4	DNC	
9	SCL0 (I2C)	5	6	0V (Ground)	
7	GPIO 7	7	8	TxD	15
	DNC	9	10	RxD	16
0	GPIO 0	11	12	GPIO1	1
2	GPIO2	13	14	DNC	
3	GPIO3	15	16	GPIO4	4
	DNC	17	18	GPIO5	5
12	MOSI	19	20	DNC	
13	MISO	21	22	GPIO6	6
14	SCLK	23	24	CE0	10
	DNC	25	26	CE1	11

http://www.pi4j.com

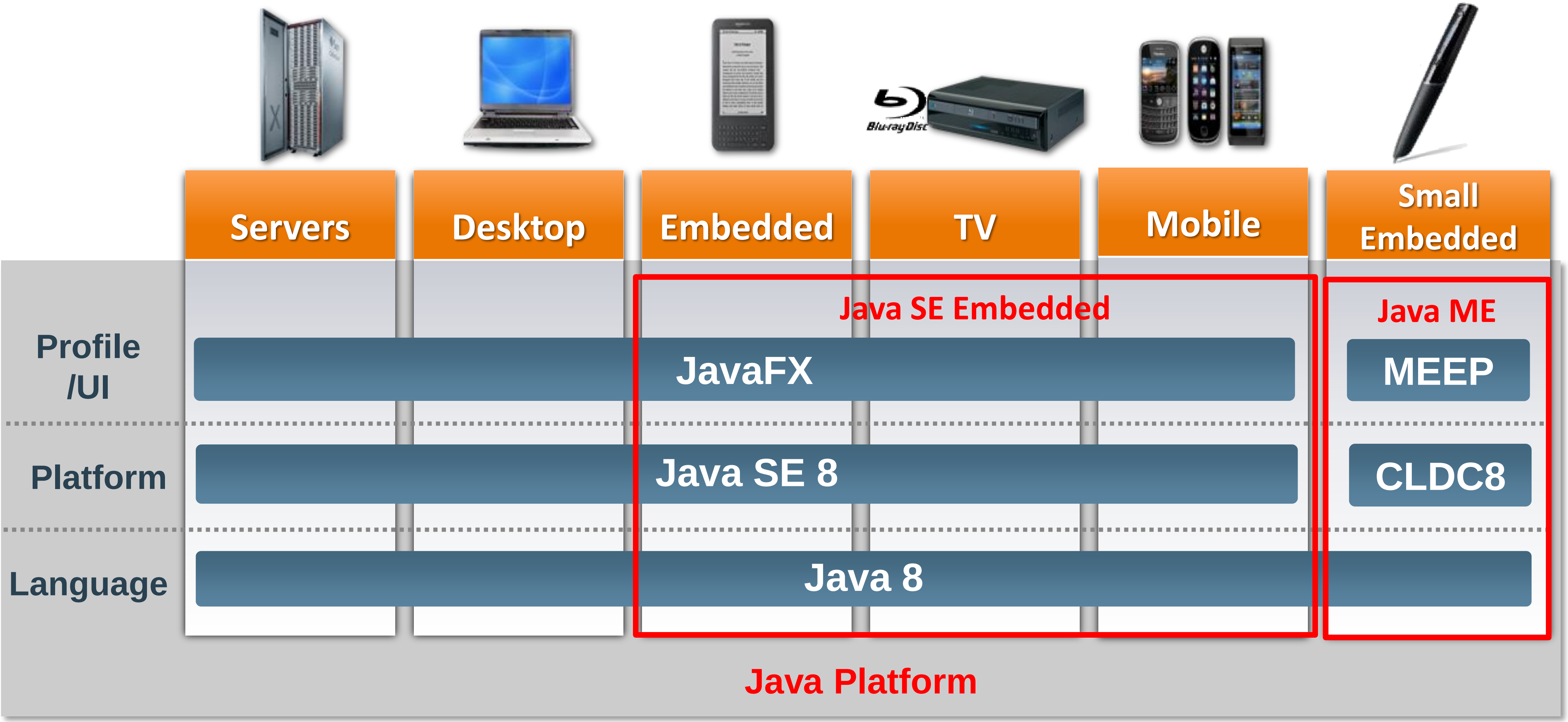
RaspbianOS

Raspberry Pi

- Broadcom BCM2835
- ARM1176JZF-S 700MHz
- OpenGL ES 2.0
- RAM: 512MB
- ROM: microSD
- Composite Video/HDMI/Audio/Ethernet/GPIO/UART /I2C/SPI/microUSB …

Java Embedded

Java Embedded



Servers

Desktop

Embedded

TV

Mobile

Small Embedded

Profile /UI

Platform

Language

Java SE Embedded

Java ME

JavaFX

MEEP

Java SE 8

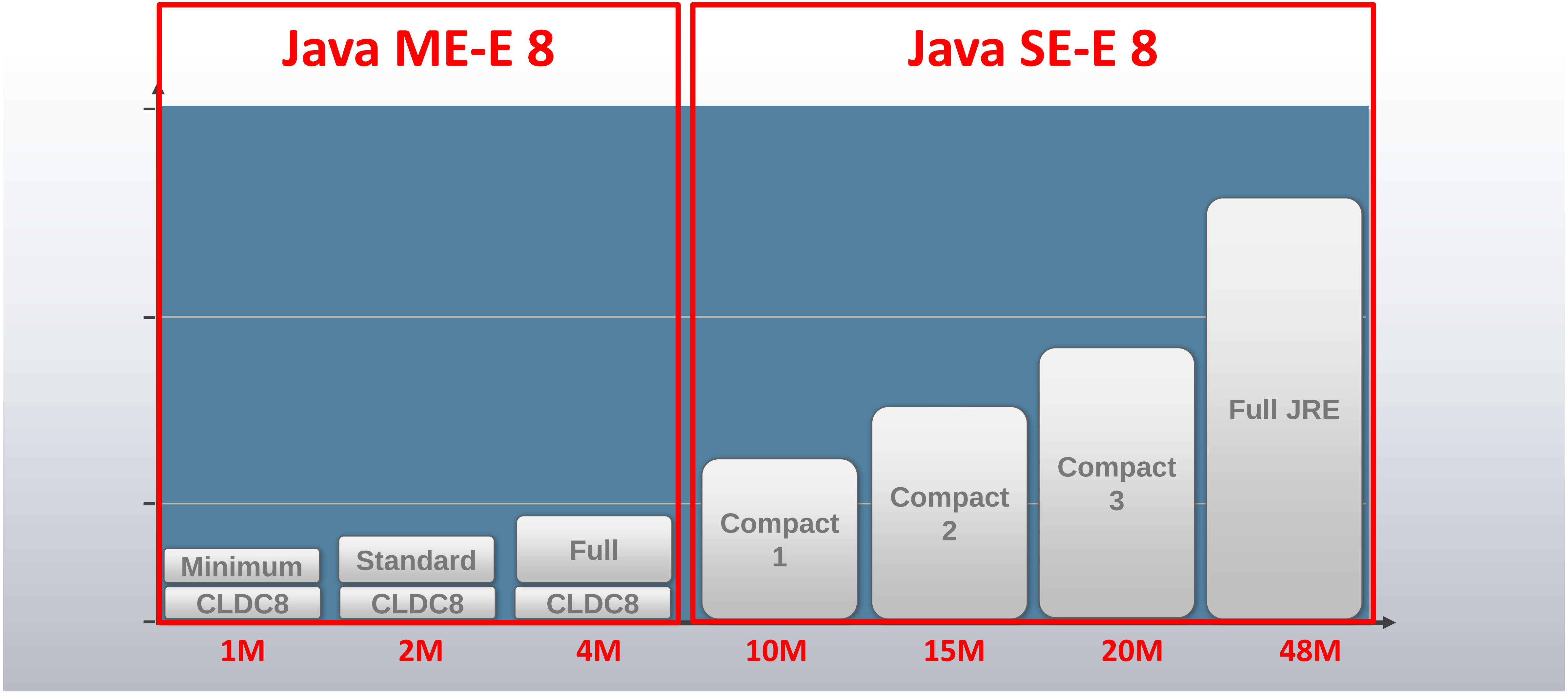
CLDC8

Java 8

Java Platform

ORACLE

ROM Requirement



ORACLE

Java ME Platform

IoT APIs

Use Case Software
(e.g. smart pen)

Use Case Software
(e.g. wireless module)

Use Case Software
(e.g. asset tracking)

Use Case Software
(e.g. smart meter)

Additional APIs (Examples)

- Messaging
- Wireless Communication
- Protocols and Data Conversion
- Security and Management
- Additional Optional APIs
- Location
- Web Services
- Sensors
- Additional Optional JSRs
- Vertical Specific APIs

On-Device I/O Access

- Device I/O API

Generic Connection Framework

- GCF 8

Application Platform

- Java ME Embedded Profile (MEEP) 8 (JSR 361)

Security and Trust Services

- SATSA

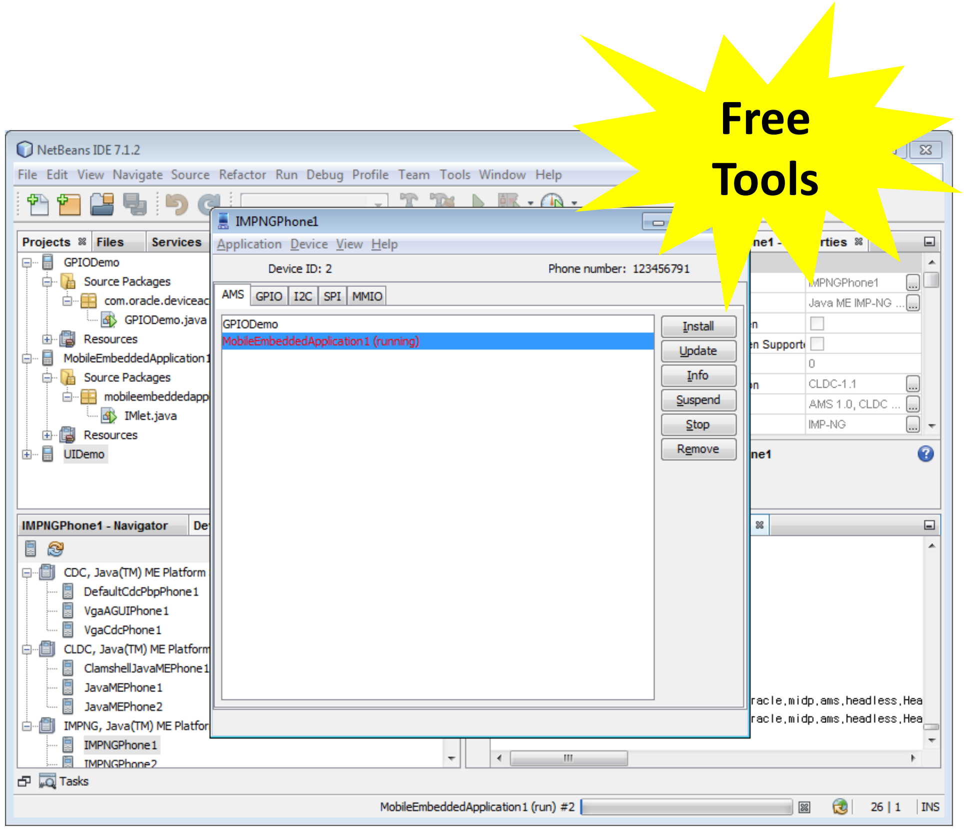
Java VM

- Java ME Connected Limited Device Configuration (CLDC) 8 (JSR 360)

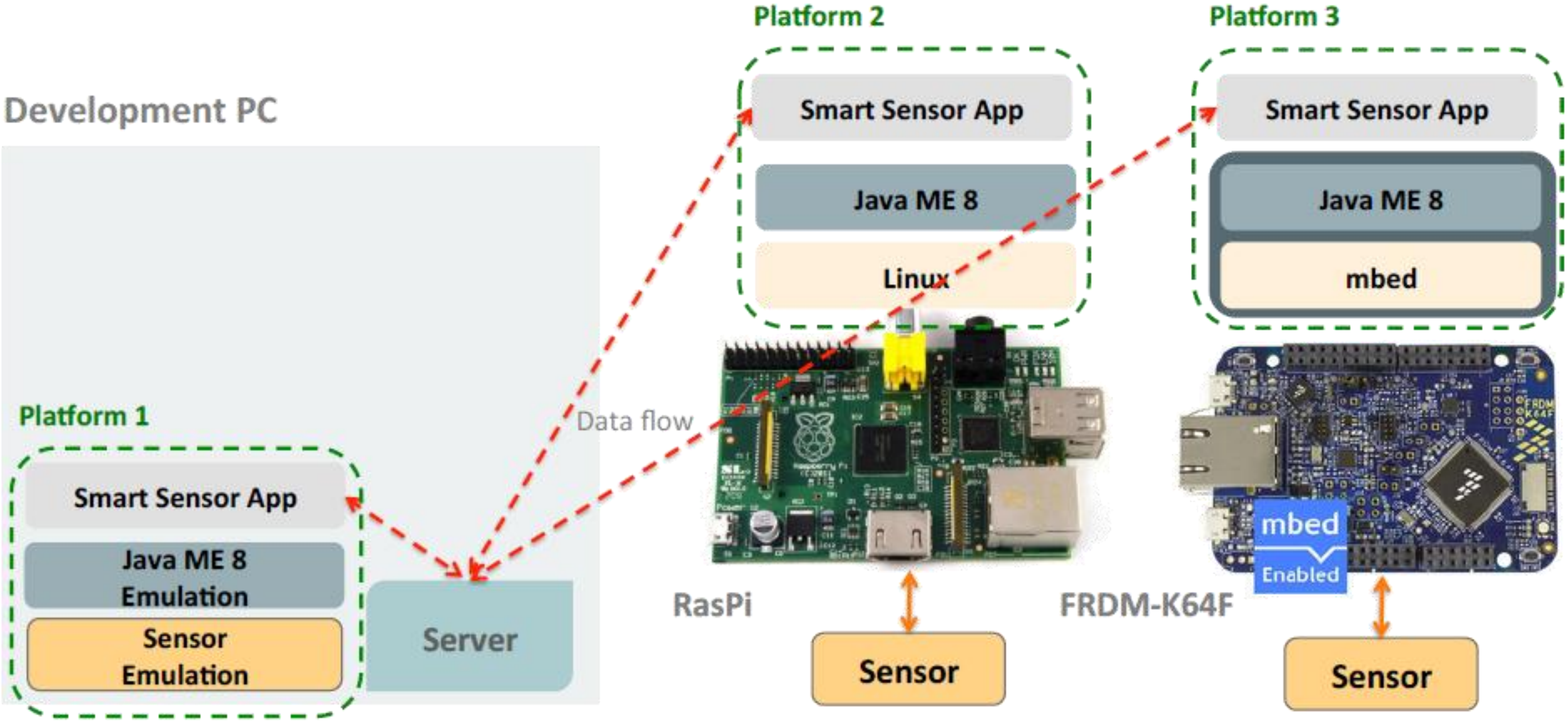
Tooling – Developing Efficiently

Java ME SDK, IDEs

- Java ME 8 SDK
  - Tools and emulation for rapid development of embedded Java ME applications
  - Includes device emulator, application management interface, memory monitor, network monitor, and more
  - Live code deployment and debugging on devices
- Eclipse/NetBeans Plug-ins
  - Integration with Java ME SDK
  - Full-featured, integrated development environment for embedded


Device ID: 2
Phone number: 123456791
Free Tools
NetBeans IDE 7.1.2
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
Projects Files Services
GPIODemo
Source Packages
com.oracle.deviceac
GPIODemo.java
Resources
MobileEmbeddedApplication1
Source Packages
mobileembeddedapp
IMlet.java
Resources
UIDemo
IMPNGPhone1
Application Device View Help
AMS GPIO I2C SPI MMIO
GPIODemo
MobileEmbeddedApplication1 (running)
Install
Update
Info
Suspend
Stop
Remove
IMPNGPhone1 - Navigator
CDC, Java(TM) ME Platform
DefaultCdcPbpPhone1
VgaAGUIPhone1
VgaCdcPhone1
CLDC, Java(TM) ME Platform
ClamshellJavaMEPhone1
JavaMEPhone1
JavaMEPhone2
IMPNG, Java(TM) ME Platform
IMPNGPhone1
IMPNGPhone2
Tasks
MobileEmbeddedApplication1 (run) #2
26 | 1
INS

Write Once Run Anywhere



Development PC

Platform 1

Smart Sensor App

Java ME 8 Emulation

Sensor Emulation

Server

Data flow

Platform 2

Smart Sensor App

Java ME 8

Linux

RasPi

Sensor

Platform 3

Smart Sensor App

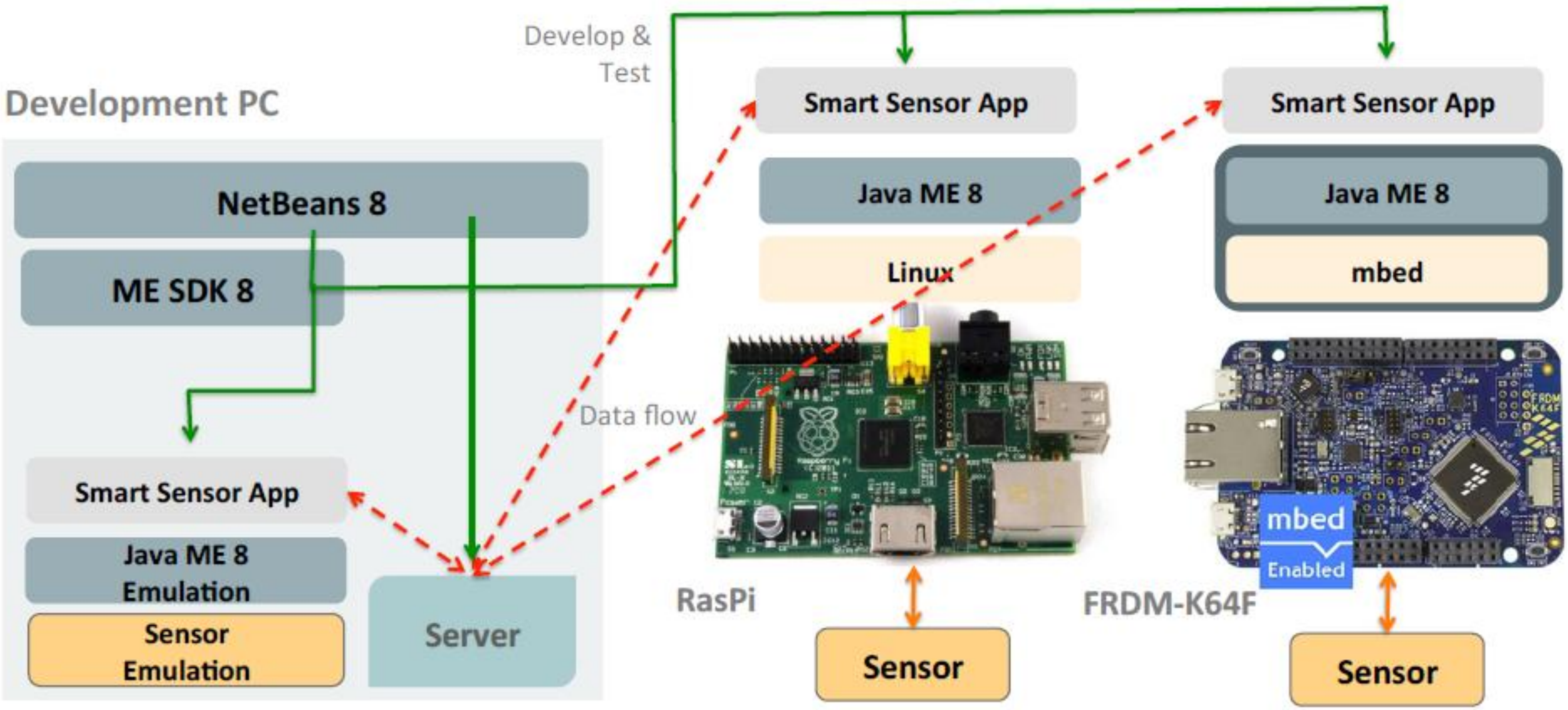
Java ME 8

mbed

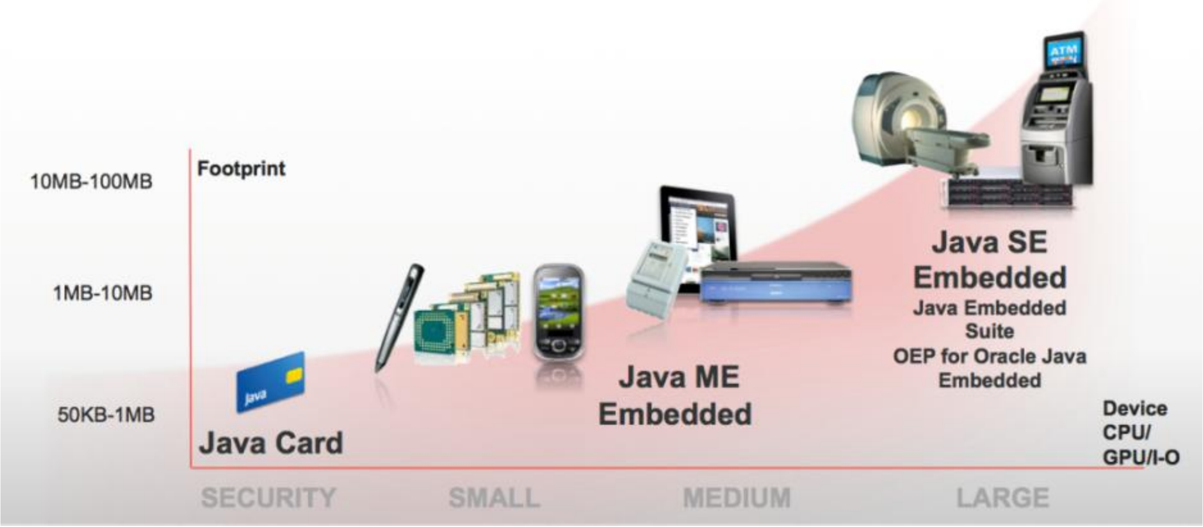
FRDM-K64F

Sensor

Development Environment


Develop & Test
Development PC
NetBeans 8
ME SDK 8
Smart Sensor App
Java ME 8 Emulation
Sensor Emulation
Server
Data flow
Smart Sensor App
Java ME 8
Linux
RasPi
Sensor
Smart Sensor App
Java ME 8
mbed
mbed Enabled
FRDM-K64F
Sensor

Oracle Java Ecosystem


10MB-100MB
1MB-10MB
50KB-1MB
Footprint
Java Card
Java ME
Embedded
Java SE
Embedded
Java Embedded
Suite
OEP for Oracle Java
Embedded
Device
CPU/
GPU/I-O
SECURITY
SMALL
MEDIUM
LARGE

Products

COMMUNITY DRIVEN
PROVEN TECHNOLOGY
ORACLE LEADERSHIP

Stewardship & Innovation

Partnership

Increase your market reach

Increase the value of your proposition

Developer expertise and education

World's largest community of developers, admins and architects

More Information

- Oracle Embedded Java Products
  - http://www.oracle.com/goto/javaembedded
- Java SE Home
  - http://oracle.com/technetwork/java/javase
- The Java Spotlight Podcast
  - http://thejavaspotlight.org
- Java Magazine
  - http://www.oraclejavamagazine-digital.com/javamagazine/current