



# Open Source in IoT Architecture

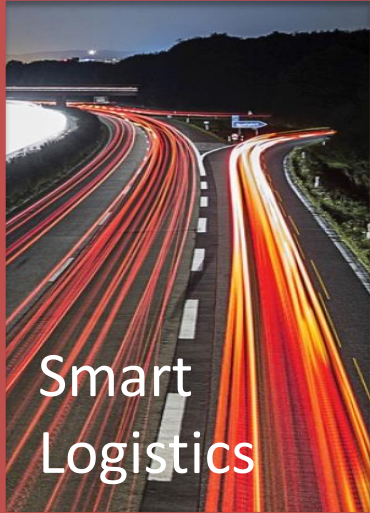
*Unlocking the IoT Opportunities through Open Source*

**Col Inderjeet Singh**

*Chief Cyber Security Officer- Vara Technology Ltd*

*06 Feb 2020*

# Smart Everything...



Smart  
Logistics



Smart  
Lighting



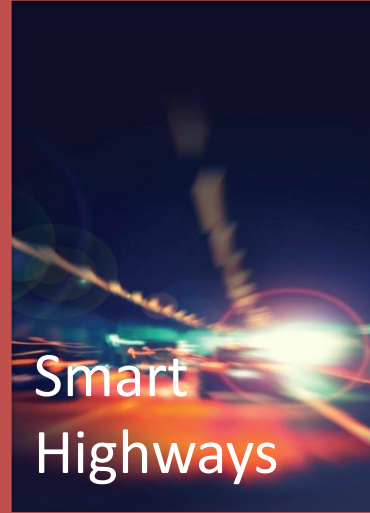
Smart  
Parking



Smart  
Water



Smart  
Buildings



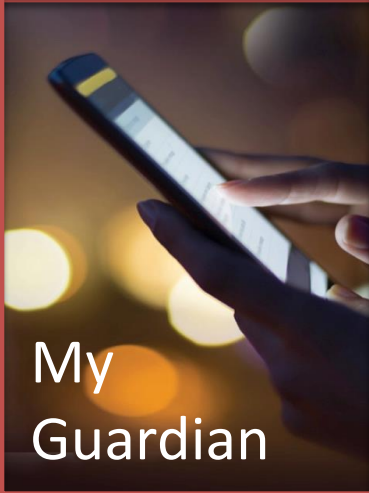
Smart  
Highways



Smart Facilities



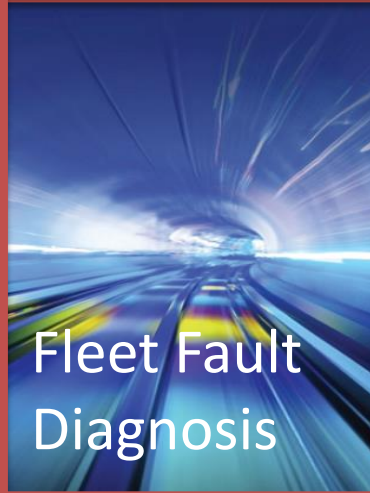
Smart  
Food  
Safety



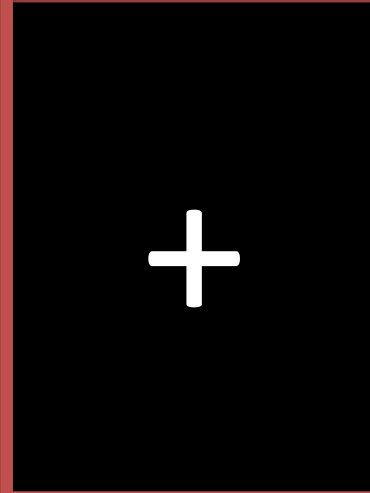
My  
Guardian



Smart  
Energy



Fleet Fault  
Diagnosis



+



# The massive size and growth of IoT

## IoT Market Size

(by 2025)

McKinsey & Company

\$6.1T

IDC

\$7.1T

CISCO

\$14.4T

## Connected Devices

(by 2020)

Gartner

26B

IDC

32B

CISCO

50B

## Data Growth

(2013 vs 2020)

IDC

Total Data  
4.4ZB → 44.4ZB

10x

IoT Data  
.09ZB → 4.4ZB

49x



# How Big Is It?

**20-50**  
billion connected  
devices by  
**2020**

**\$6** trillion  
spent on IoT  
In next 5  
Years

bottom line  
impacts  
  
lowering  
costs increasing  
productivity  
new markets

GOV  
improving  
their citizens'  
**quality  
of life**

**\$ 50**  
Billion spent  
on smart home  
  
**2019**

**\$2** trillion  
Industrial impact  
by 2020

**50-100**  
Connected  
devices  
per smart home

Rides on  
**5G**, the  
next  
generation of  
wireless

**\$500B/y**  
driverless  
Market

**\$1** trillion/y  
Smart city  
Market

**\$2T/y**  
smart factory

**\$100B/y**  
smart  
office



# IoT: Battle of Commonality

- Each vertical industry sector will have their **own applications, use cases, technologies and industry platforms** with its own solution lifecycle and value chain
  - ✓ Isolated IoT solutions within each industry segment will cause a fragmentation in the IoT Market, cause higher entry costs and prevent synergies
- Each Industry Verticals have **IoT solutions specifically designed to match the industry specific requirements**
  - ✓ This will limit the portability, interoperability and cost effective deployments
- Common features for IoT platform shall be documented and validated towards existing standards
  - ✓ IoT shall address at least the following requirements, i.e. Scalability, Security, Dependability (Reliability, Availability, Robustness), High Performarmance



# IoT Standardization Landscape

## Standard Organizations

- IETF : IP Standards, ACE, Core, Ifo, ..
- IEEE : P2413, IoT Framework
- PI : Industry Ethernet
- W3C : Web of Things
- OMA : Lightweight M2M
- ETSI : eUICC
- OneM2M : Service Layer, connecting M2M devices
- IEC TC57 : 61850 (smart – city/grid/building)
- IEC JCT1 : Smart cities, cloud, big data
- 3GPP : LTE-M, LTE-A, Mission Critical, MTC, LTE Device-2-Device
- OPC : Unified Architecture
- I4.0 Platform : International Std WG, RAMI 4.0
- AIOTI : IoT Innovation including several industry verticals

## ISO/IEC JTC1 IoT

Requirements  
Use Cases  
Architecture

## Open Source Communities

- Open Stack
- AllSeen
- Open Interconnect Consortium
- ONOS
- OPNFV
- Hyper/cat
- Thread
- HomeKit
- Eclipse

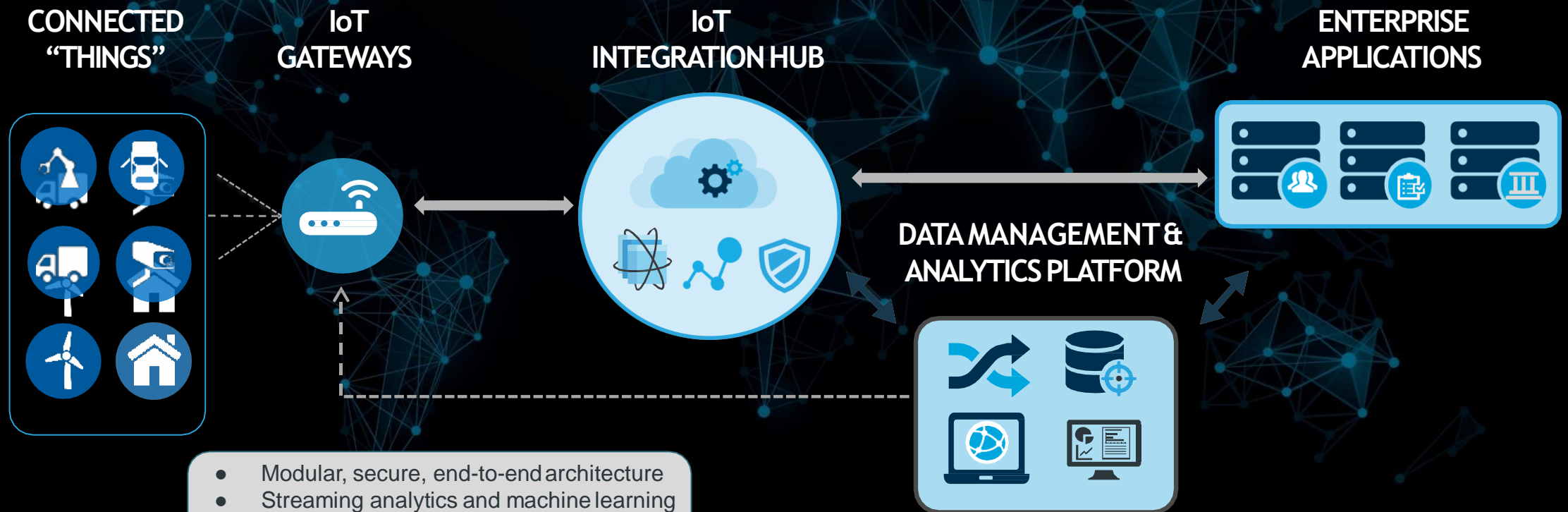


# Why Open Source for IoT?

- Use open standards
- Take advantage of community innovation and advances
- Wider integration with platforms and devices
- Accelerate time to market to deliver solutions
- Maintain control of your IoT technology selection and licensing
- Iterate more quickly with less risk
- Lay the foundation for future system and requirements scaling

# OPEN END-TO-END IoT ARCHITECTURE

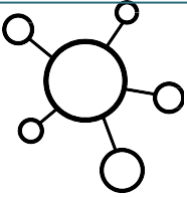

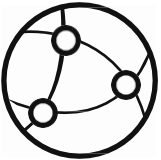
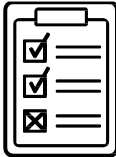

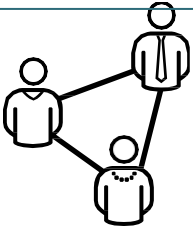
Integrating IoT operating technology, data management, analytics, and applications



Open Standards and Open Source to Connect and Manage

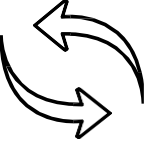


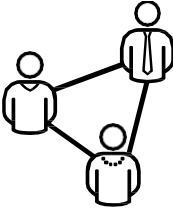




# Open Source, Open Standards, Flexible Deployment

	<b>Device connectivity</b> Open standards – MQTT, AMQP, OPC-UA, CoAP, HTTP(s)		<b>Flexible deployment</b> Any of the leading cloud providers or your data center or hybrid cloud
	<b>Data management &amp; analytics</b> Based on Apache open source ecosystem libraries for machine learning & advanced analytics		<b>Open application interfaces</b> Enterprise visibility   real-time anomaly detection   future-proof
	<b>No vendor lock-in</b> No rigid architectures or proprietary formats & components		<b>Community innovation</b> Collaboration driven by some of the leading enterprises in the IoT space

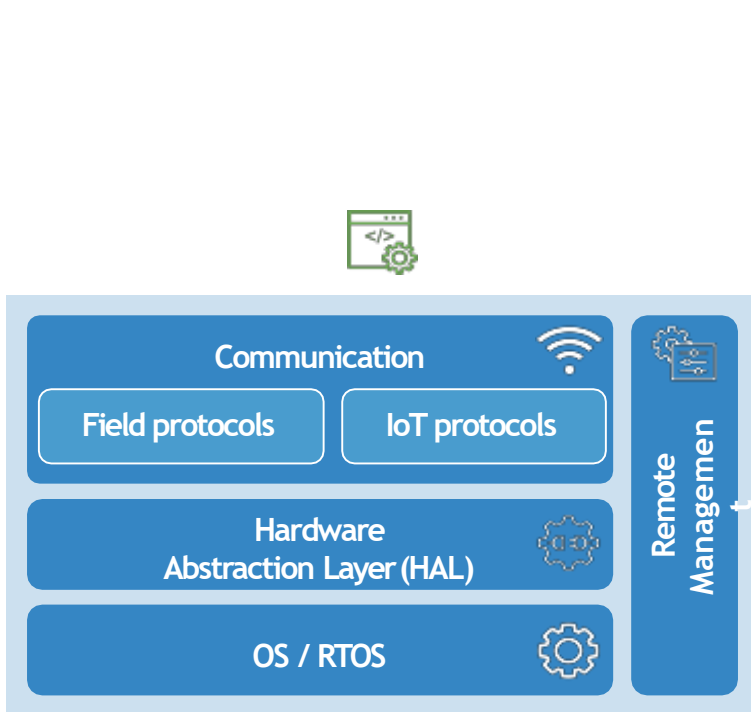


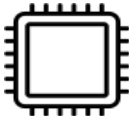
# Value Proposition

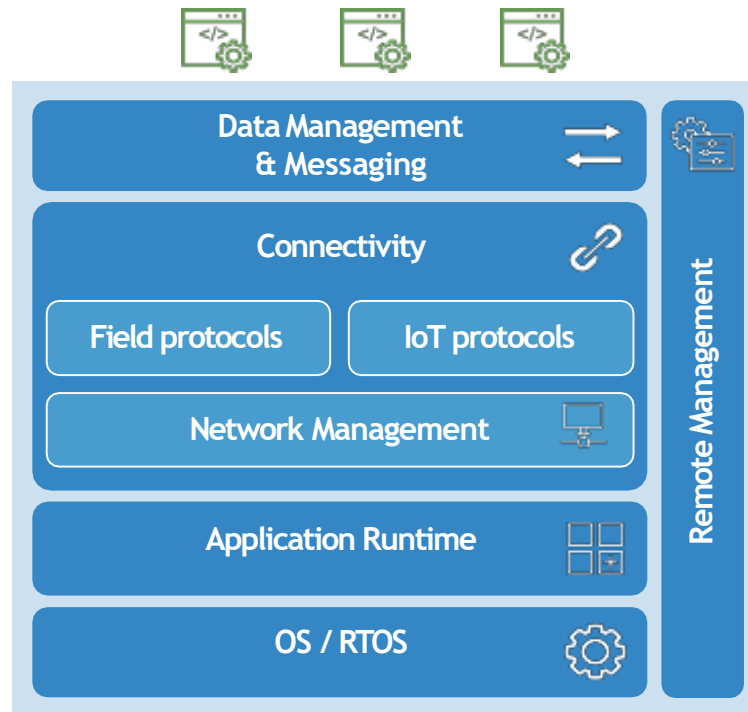
	<b>Open and interoperable</b> Future-proof open source architecture   open standards   deployment flexibility		<b>Modular</b> Avoid lock-in   capitalize on existing investments
	<b>End-to-End Analytics</b> Analytics at the edge   advanced analytics & machine learning   ML model execution at the edge		<b>Reduce risk and complexity</b> Simplify development, deployment, and integration tasks   save costs
	<b>Control your data</b> Privacy   security   regulatory		<b>End-to-end security</b> Security across devices, access, authentication and applications as well as data in motion and at rest




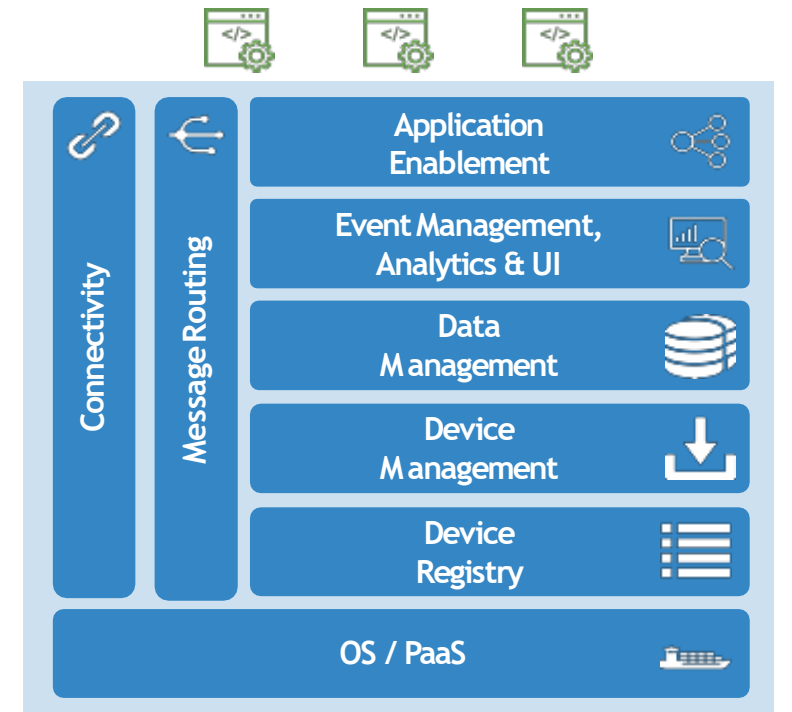
# IoT STACKS



  
**CONSTRAINED DEVICES**



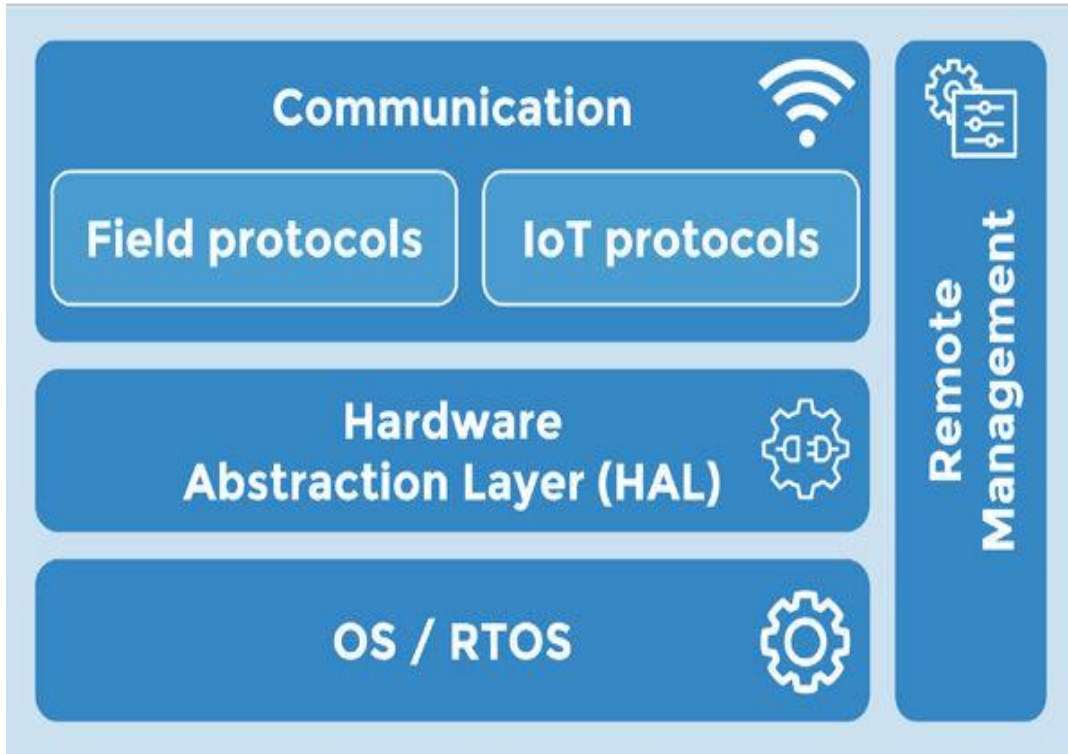
  
**GATEWAYS AND SMART DEVICES**



  
**IOT CLOUD PLATFORM**



# Software stack for constrained devices

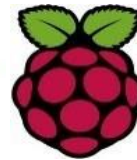


**LWM2M**

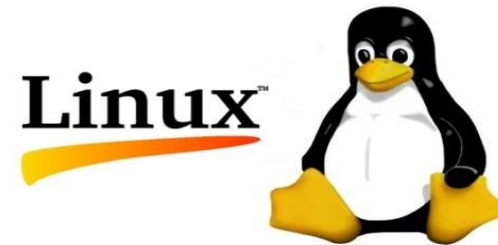
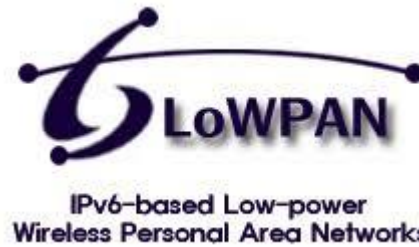
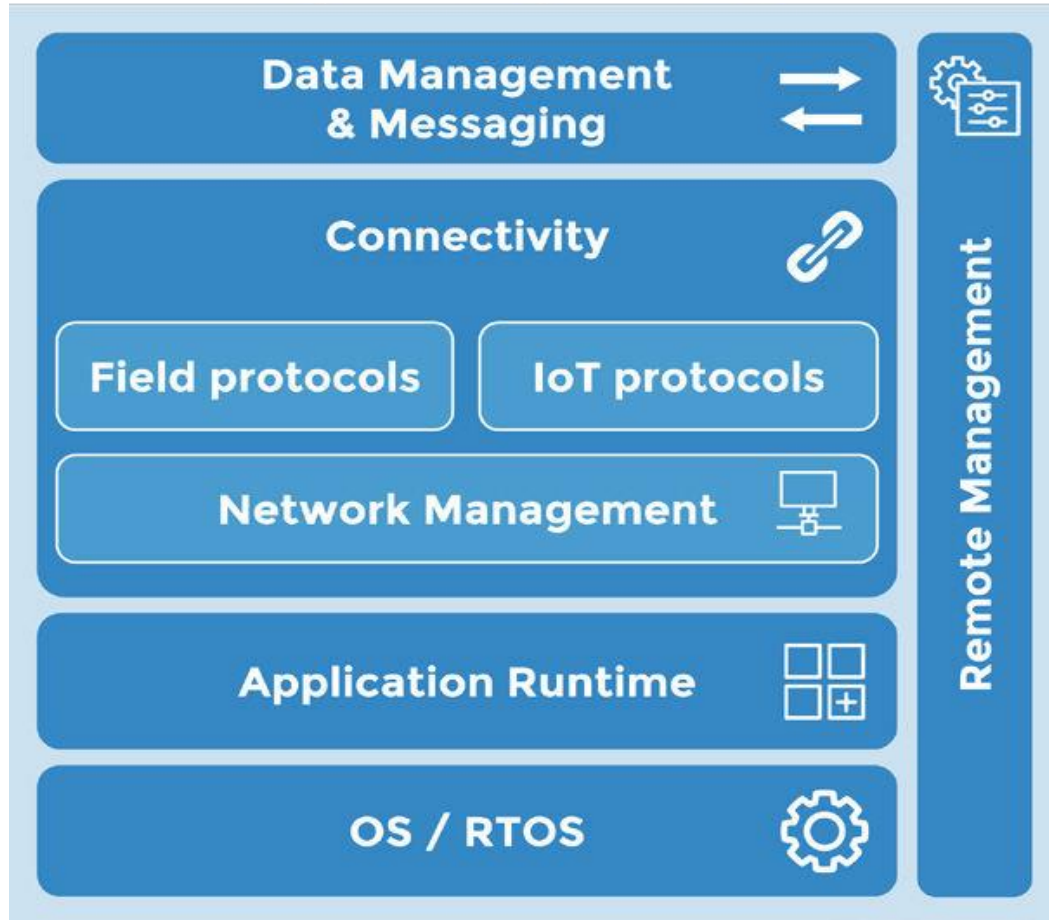


**I E T F**

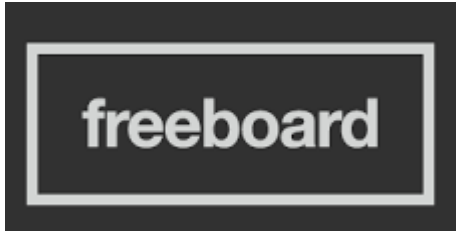
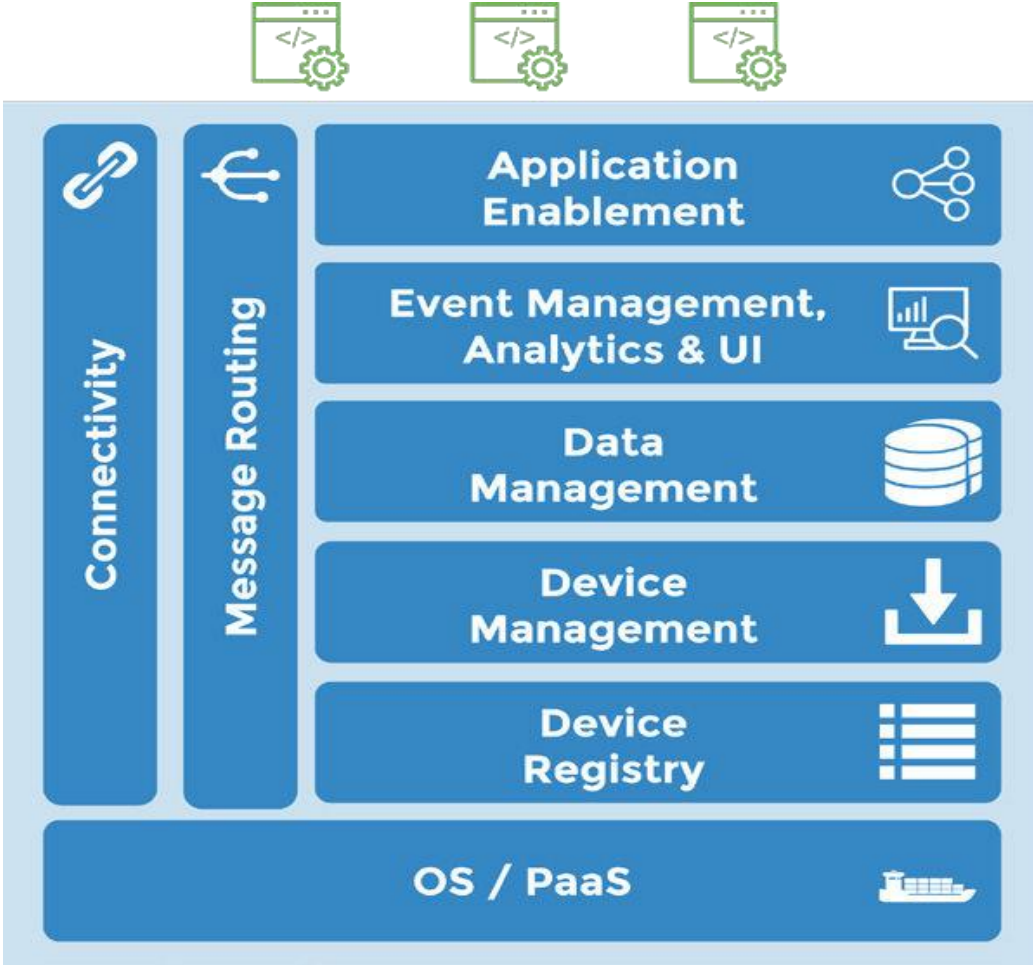
**CoAP**



# Stack for Gateways



# Software stack for IoT Cloud Platforms





## IoT Sensors / Data Collection

### Embedded



### Text



### Binary



## Data Transfer

### Wired



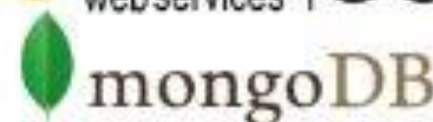
### Wireless



### S/W Protocols



## Storage / Analytics



## Visualization



# Open Source Development Drives Rapid Innovation



64% think open source is very or extremely important in their deployment of IoT

Source: IDC, Global IoT Decision Maker Survey, August 2016

*“We believe the best way to support this complex environment is to base our commercial IoT platform, the Bosch IoT Suite, on open source components and open standards. These projects establish a horizontal open technology for IoT and provide the technical breeding grounds for successful business ecosystems.”*

*- Dr. Stefan Ferber, VP of Engineering, Bosch Software Innovations*



# Thank You



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