



Open Source in IoT Architecture

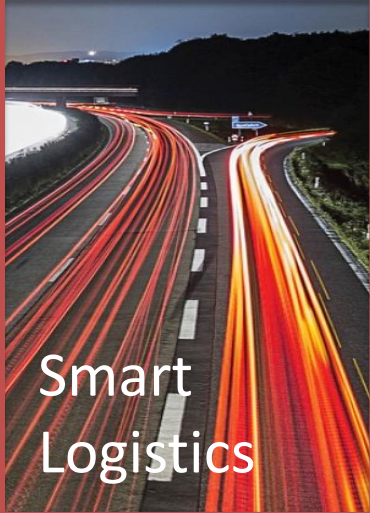
Unlocking the IoT Opportunities through Open Source

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08 Feb 2018

Smart Everything...



Smart
Logistics



Smart
Lighting



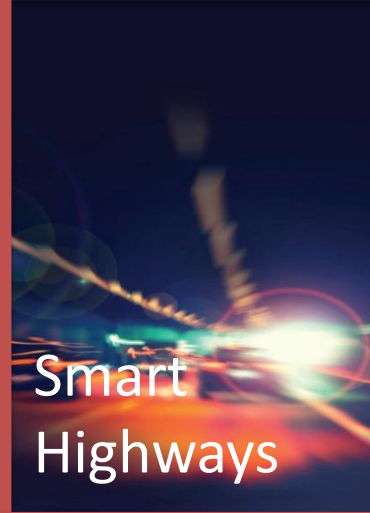
Smart
Parking



Smart
Water



Smart
Buildings



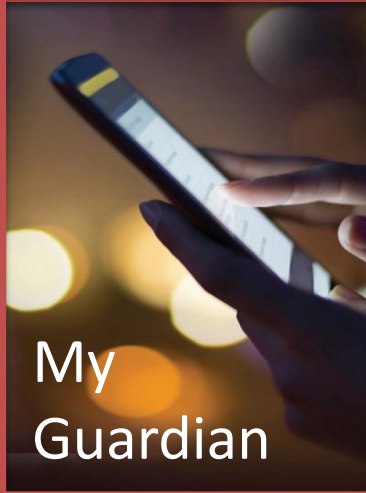
Smart
Highways



Smart Facilities



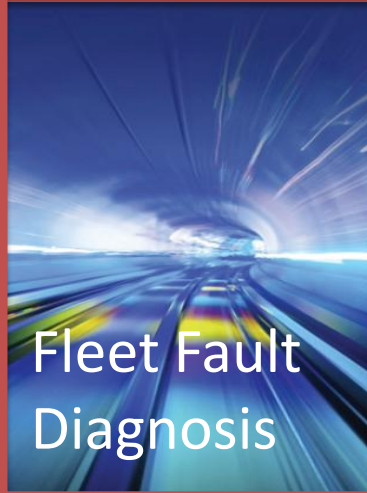
Smart
Food
Safety



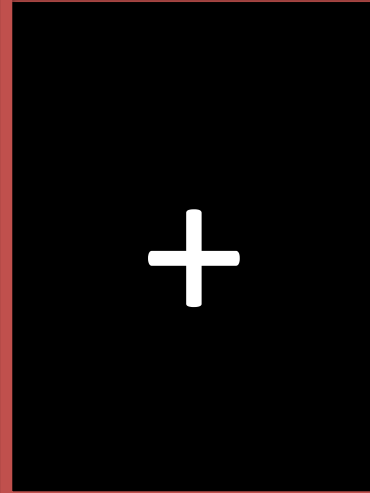
My
Guardian



Smart
Energy



Fleet Fault
Diagnosis



The massive size and growth of IoT

IoT Market Size

(by 2025)

McKinsey&Company

\$6.1T



\$7.1T



\$14.4T

Connected Devices

(by 2020)

Gartner

26B



32B



50B

Data Growth

(2013 vs 2020)



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
2017

\$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

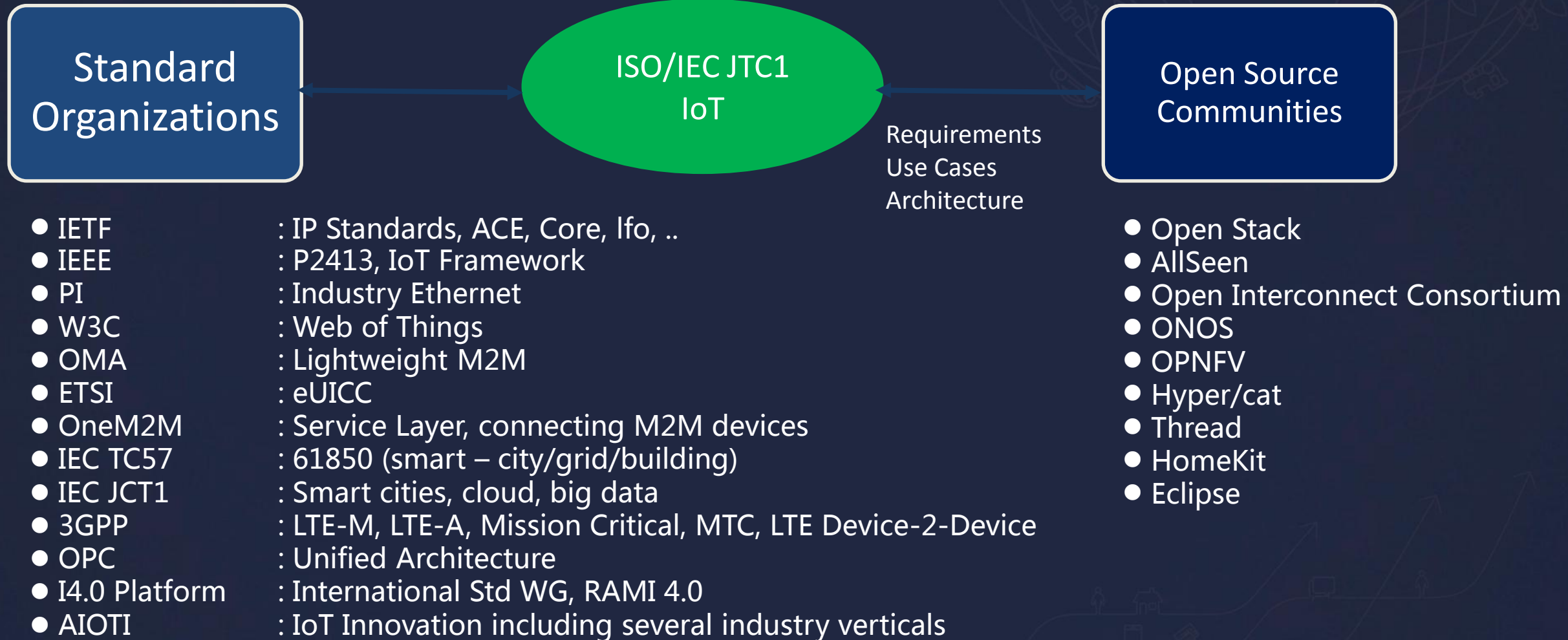
\$2T/y
smart factory

\$100B/y
smart
office

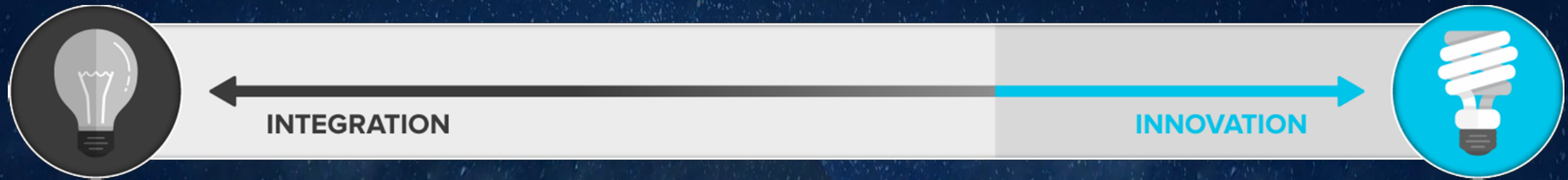
IoT: Battle of Commonality

- 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



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

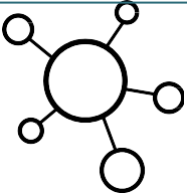


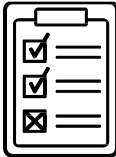

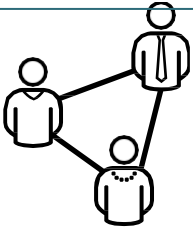
“We believe the best way to support this complex environment is to base our commercial IoT platform, the Bosch IoT Suite, on open source components and open standards. These projects establish a horizontal open technology for IoT and provide the technical breeding grounds for successful business ecosystems.”

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

Why Open Source for IoT?

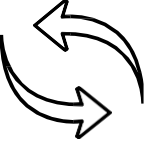


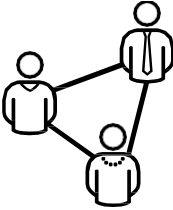


- Use open standards
- Take advantage of community innovation and advances
- Wider integration with platforms and devices
- Accelerate time to market to deliver solutions
- Maintain control of your IoT technology selection and licensing
- Iterate more quickly with less risk
- Lay the foundation for future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

Open Source, Open Standards, Flexible Deployment

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



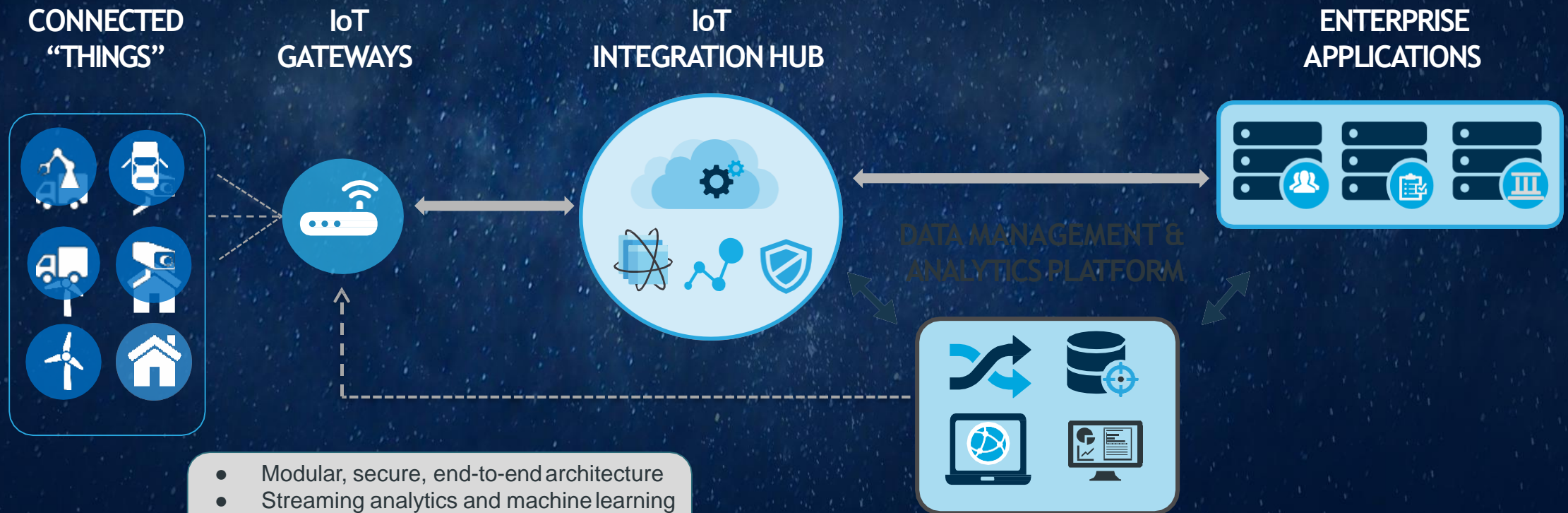
Value Proposition

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



OPEN END-TO-END IoT ARCHITECTURE

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



Open Standards and Open Source to Connect and Manage

IoT STACKS



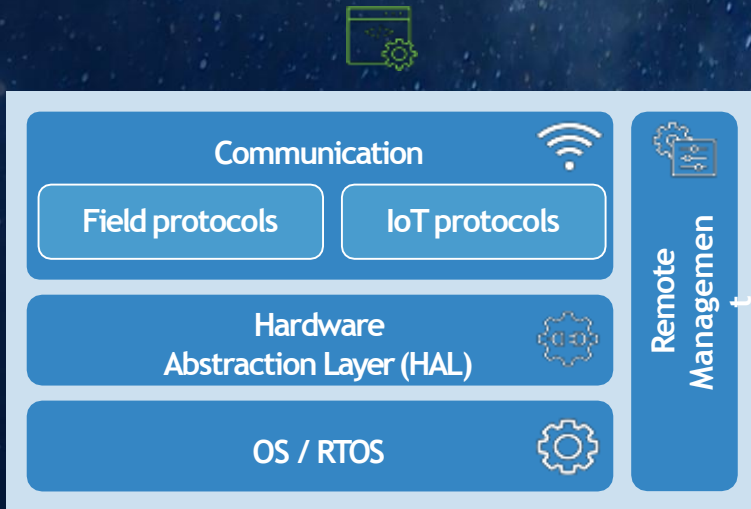
SECURITY



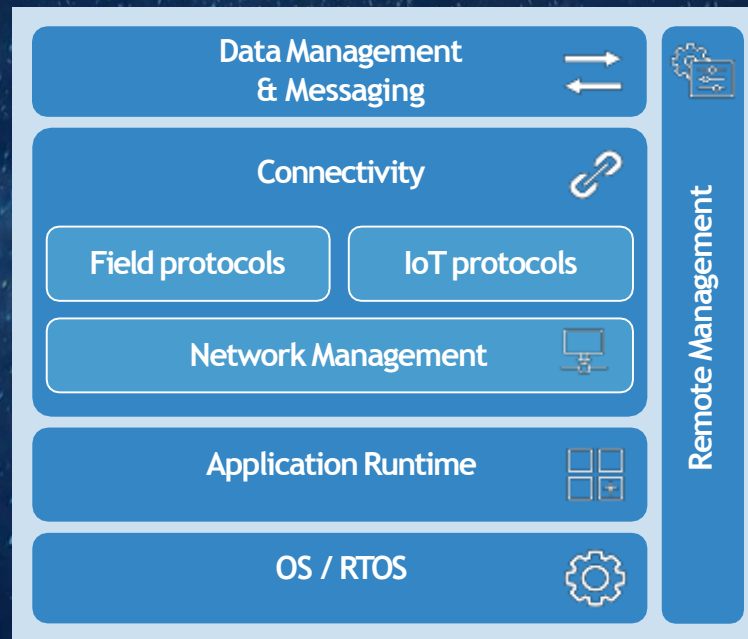
ONTOLOGIES



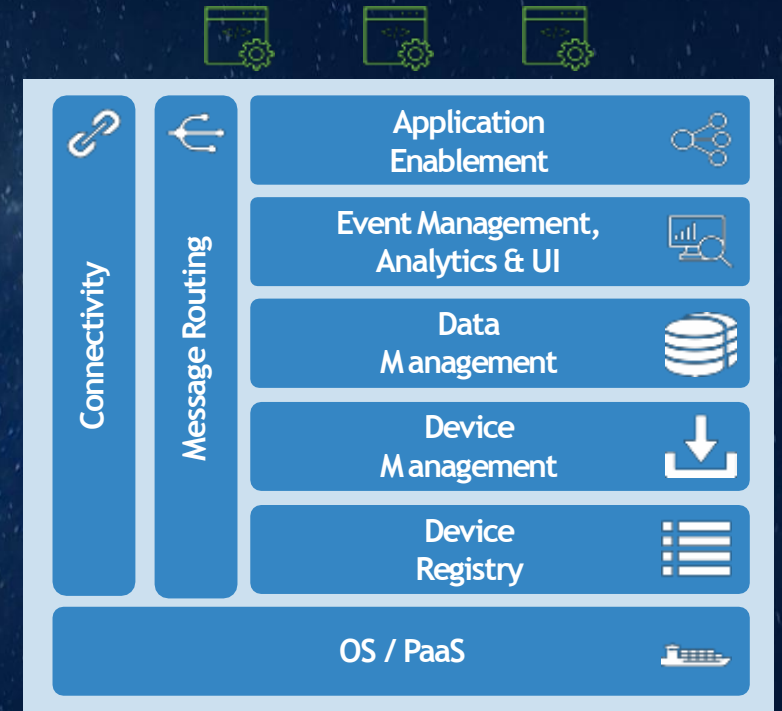
TOOLS & SDKs



CONSTRAINED DEVICES

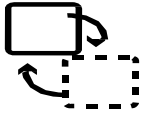


GATEWAYS AND SMART DEVICES

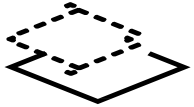


IOT CLOUD PLATFORM

Key Characteristics of IoT Stacks



Loosely coupled - Three IoT stacks have been defined but it is important that each stack can be used independently of the other stacks. It should be possible to use an IoT Cloud Platform from one supplier with an IoT gateway from another supplier and a third supplier for the device stack.



Modular - Each stack should allow for the features to be sourced from different suppliers.



Platform-independent - Each stack should be independent of the host hardware and cloud infrastructure. For instance, the device stack should be available on multiple MCUs and the IoT Cloud Platform should run on different Cloud PaaS.



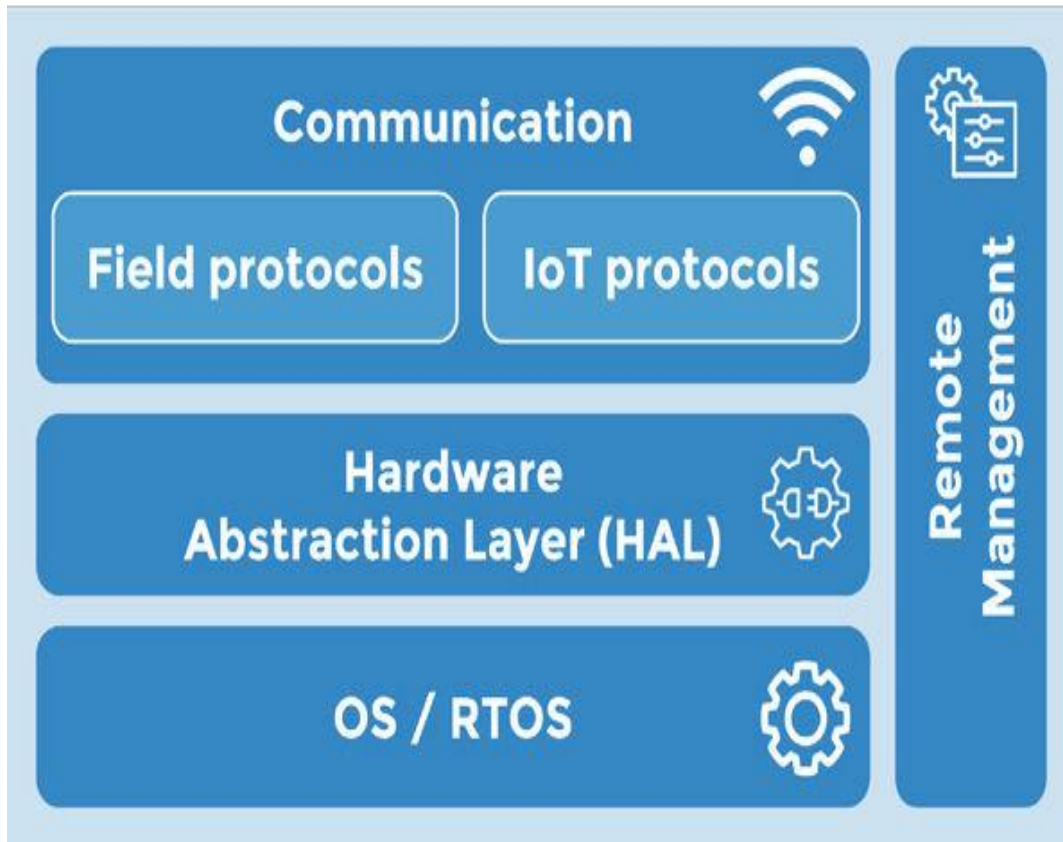
Based on open standards - Communication between the stacks should be based on open standards to ensure interoperability.



Defined APIs - Each stack should have defined APIs that allow for easy integration with existing applications and integration with other IoT solutions.



Software stack for constrained devices

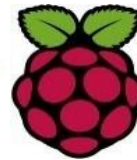


LWM2M

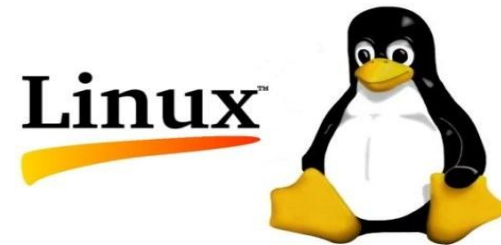
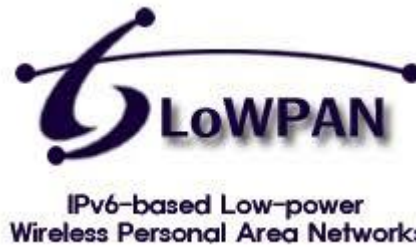
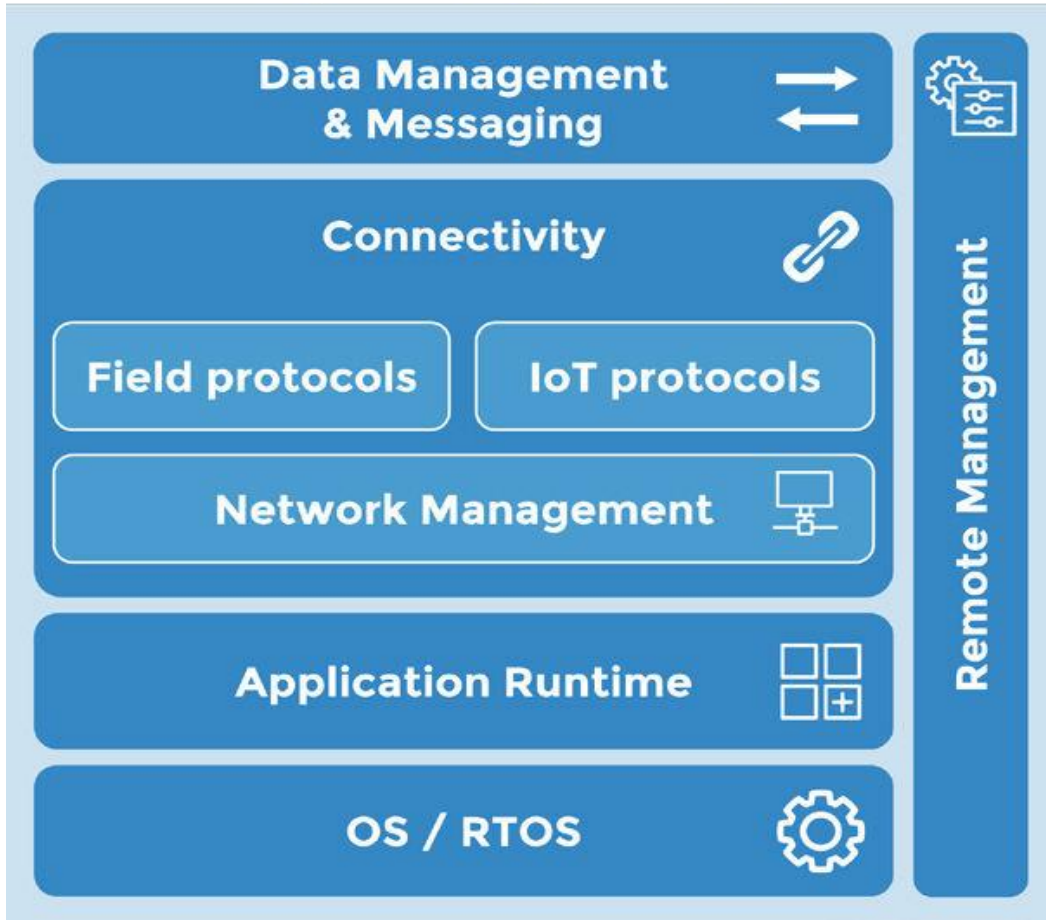


I E T F

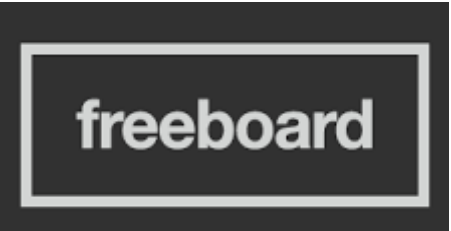
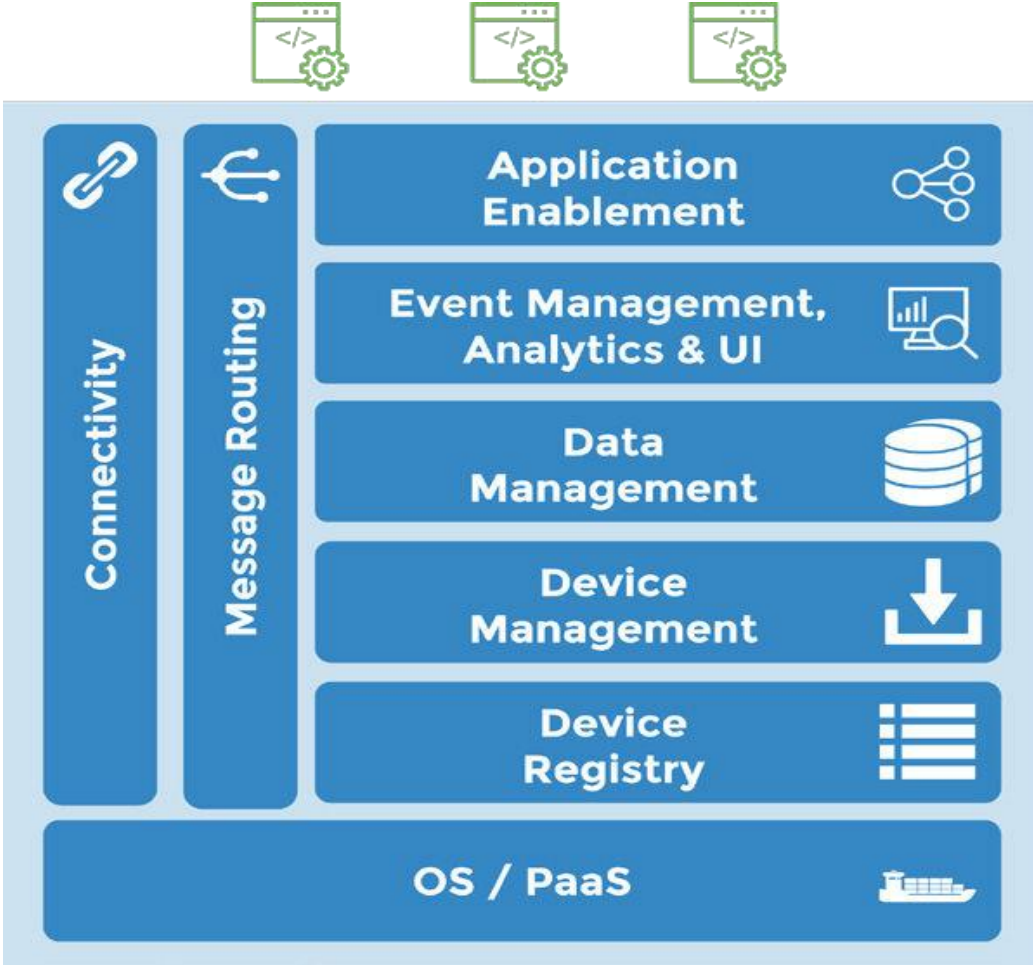
CoAP



Stack for Gateways



Software stack for IoT Cloud Platforms



IoT Sensors / Data Collection

Embedded



Text



Binary



Data Transfer

Wired



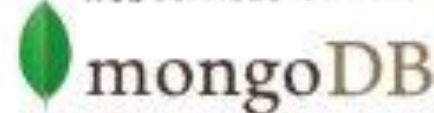
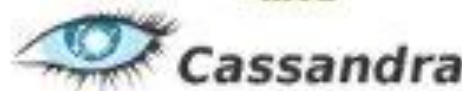
Wireless



S/W Protocols



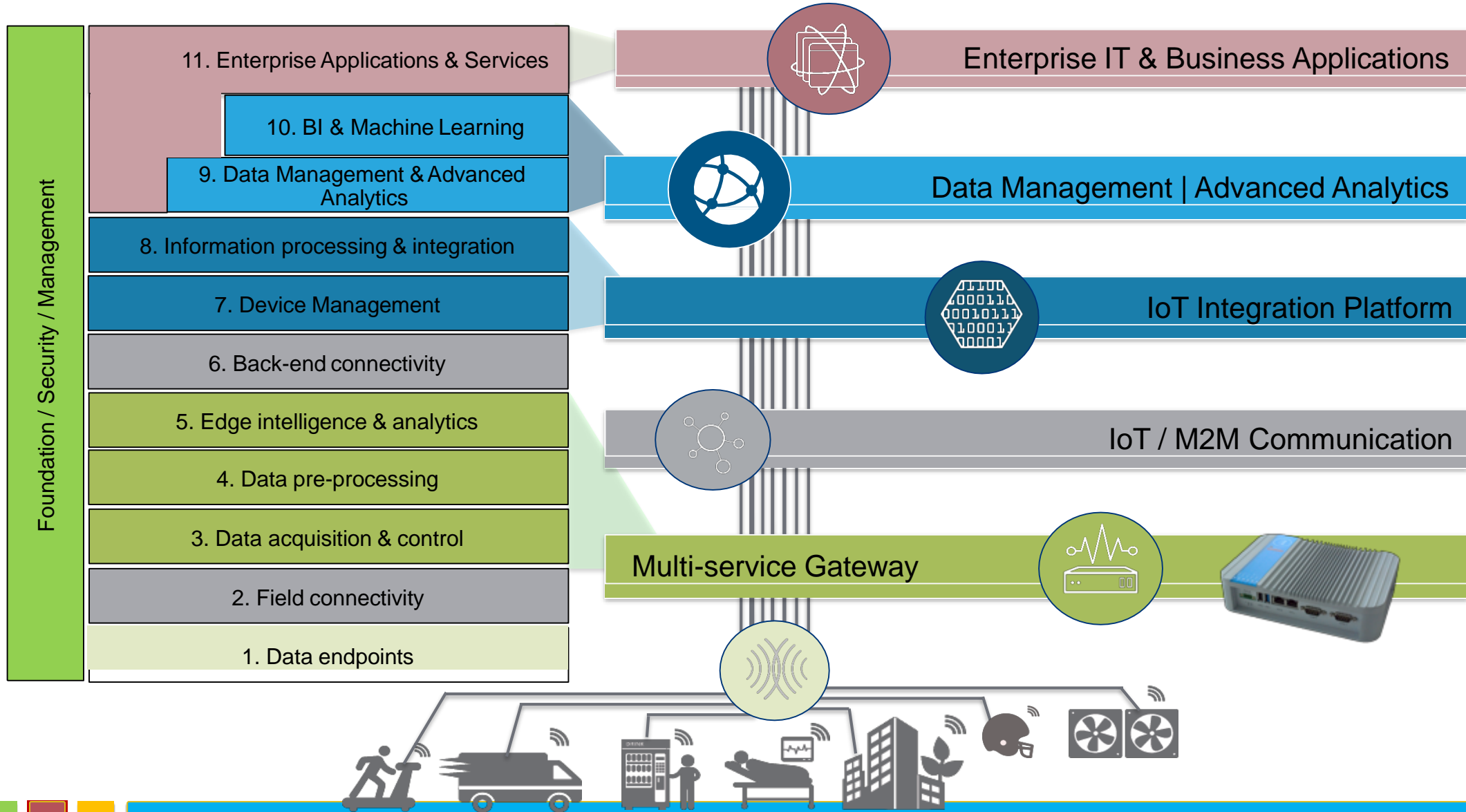
Storage / Analytics



Visualization



Challenge: Pulling Together The Building Blocks For IOT

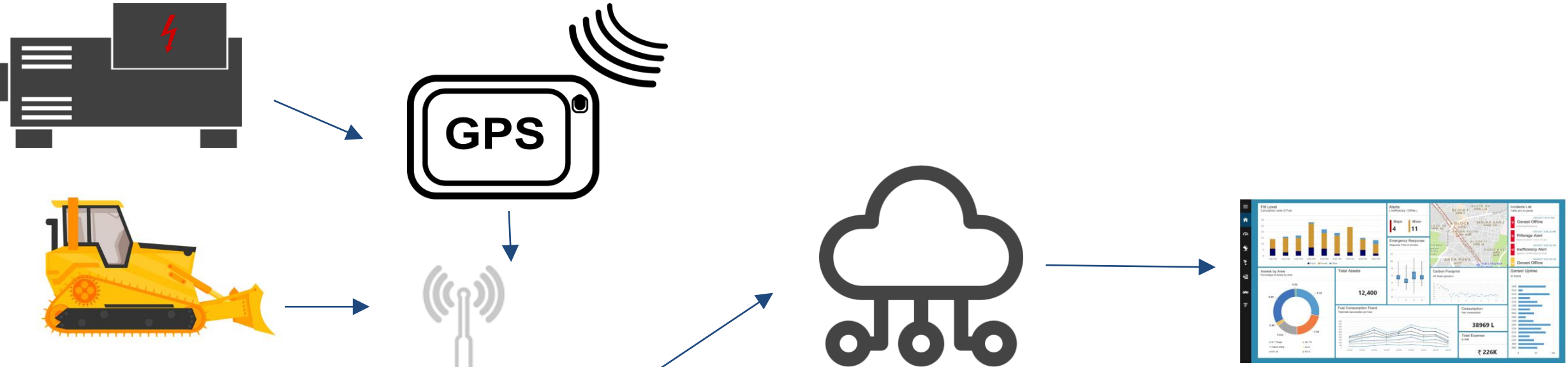


Fuel Scale- Features



- Configurable thermal correction for automatic compensation based on ambient temperature.
- Digital self-diagnostics to control data reliability.
- Length increase with additional sections - upto 1500mm
- Filter for secure protection from water and mud.
- Convenient ready output signal showing fuel level in the tank in mm, fuel volume in litres, percentage of full tank capacity.





Sensors

Gateway

Cloud Engine

Application/Dashboard



Capacitive level sensor



IBM Watson



influxdata



node JS



Chart.js



dreamfactory



Thank You



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