

Big Data

Internet of Things (IoT)

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September 1st, 2019

s³Lab

Smart Software System Laboratory

A photograph of a railway track receding into a landscape under a dramatic, cloudy sky. A blue circular graphic is overlaid on the upper right.

“Big data is at the foundation of all the megatrends that are happening today, from social to mobile to cloud to gaming.”

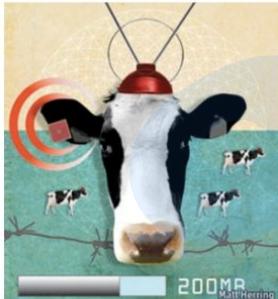
– Chris Lynch, Vertica Systems



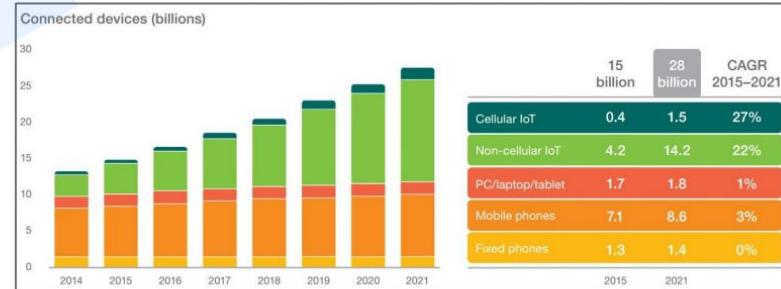
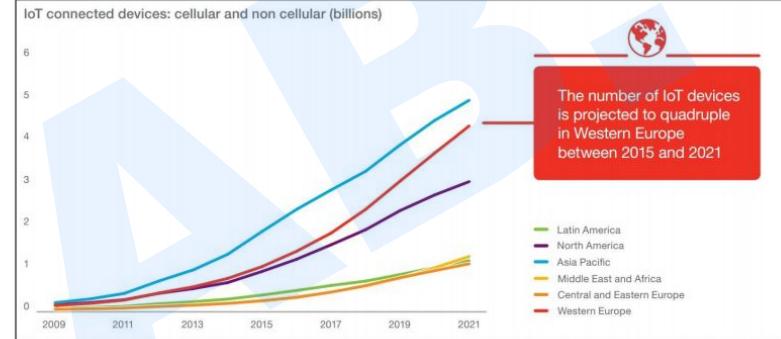
Internet of Thing (IoT) Wave

Internet of Things (IoT): Enabling communication between devices, people & processes to exchange useful information & knowledge that create value for humans

Term first proposed by Kevin Ashton in 1999



Source: The Economist



Source: Ericsson, June 2016

Internet of Thing (IoT) Wave



Connecting inanimate devices over the internet without human intervention



- **Internet of Things (IoT)** is a network of devices which can **sense, accumulate and transfer data** over the internet without any human intervention.



Pre-Internet



Dawn of Internet



Internet of People



Internet of Thing

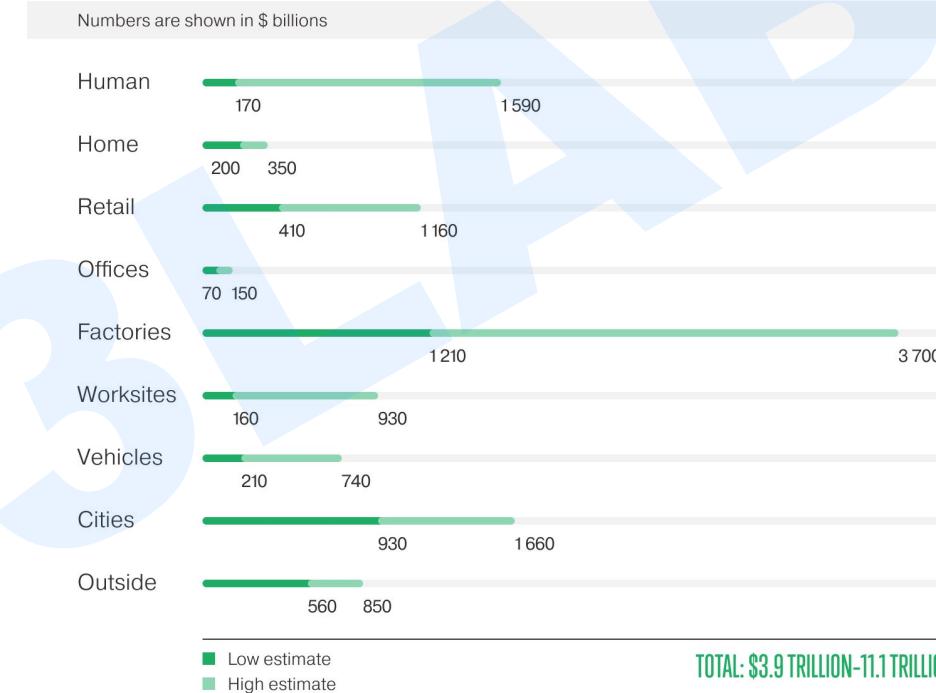


Internet of Thing (IoT) Wave

\$11 trillion per year in 2025.
11% of the world economic.

McKinsey & Company

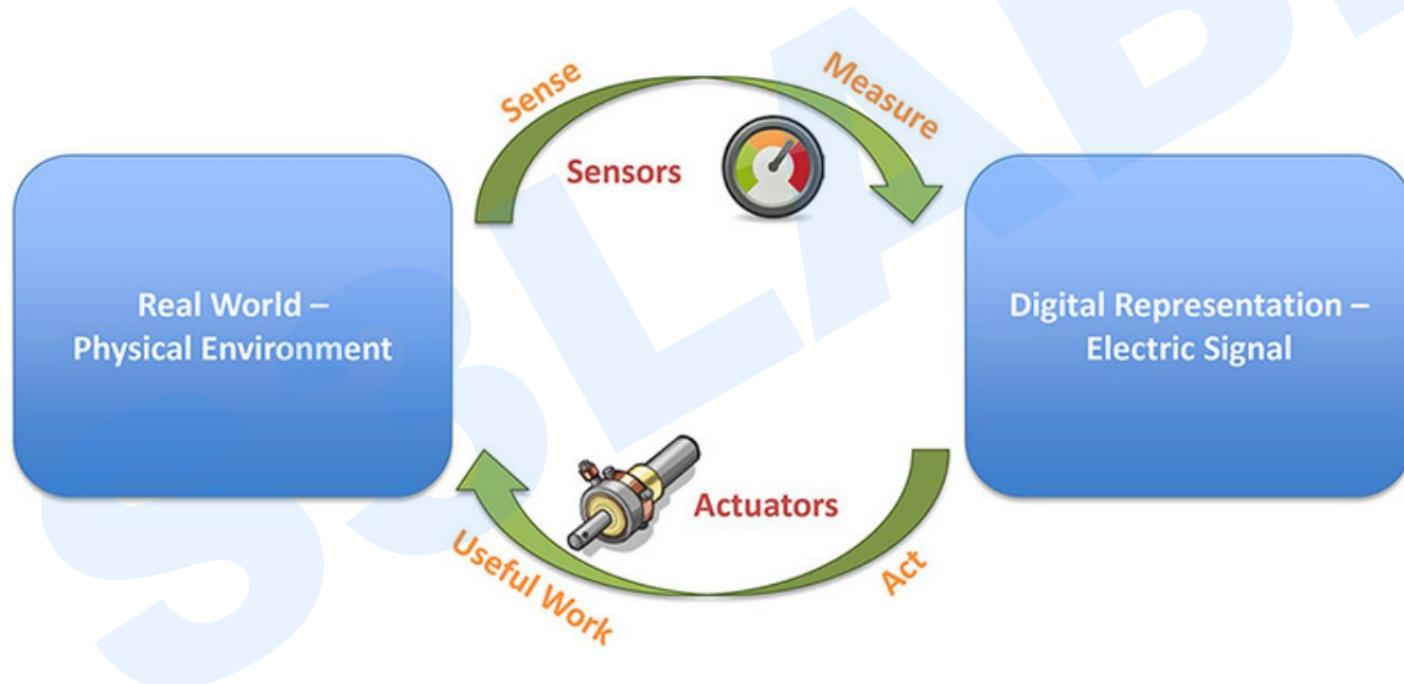
POTENTIAL ECONOMIC IMPACT OF IOT IN 2025





Internet of Thing (IoT) Wave

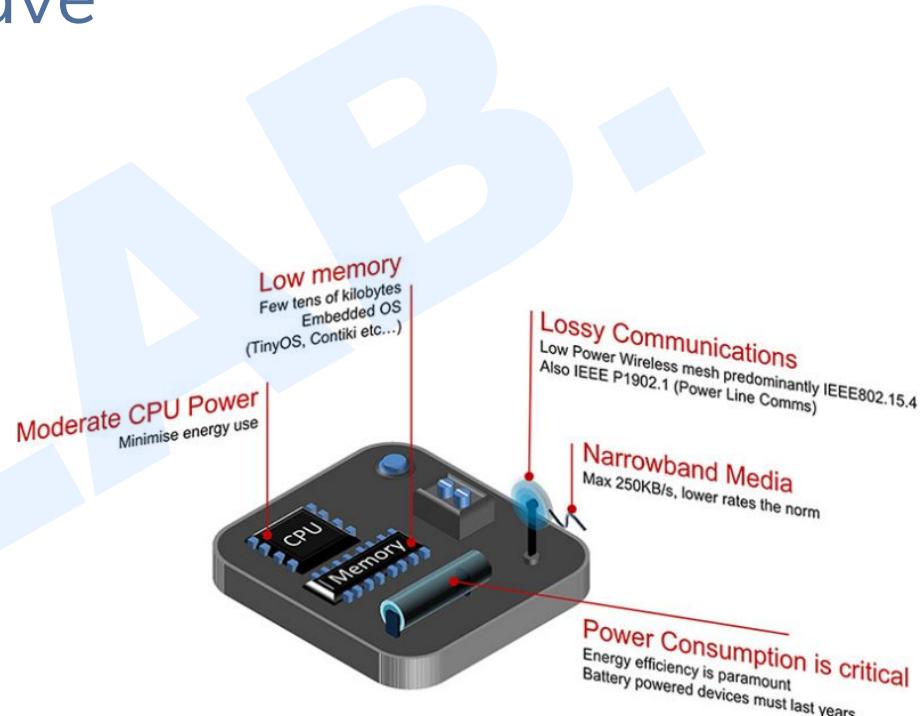
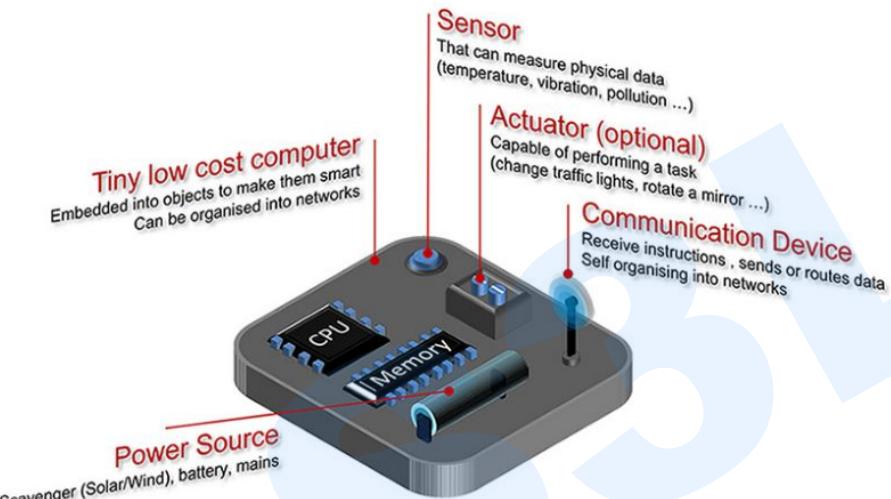
Sensor vs. Actuators





Internet of Thing (IoT) Wave

Sensor vs. Actuators: smart object





Internet of Thing (IoT) Wave

Sensor vs. Actuators: characteristics

Connected to Power or Battery operated

Lower power need to transmit less often, at shorter range, simpler data

Mobile or Static

What is the range and frequency of mobility?
Impact on power and Gateway

Low or High Reporting Frequency

Hundred of times per second, or once or twice a month?

Simple or Rich Data

One status bytes or hundreds of parameters?

Transmission Range

Few feet or several miles?

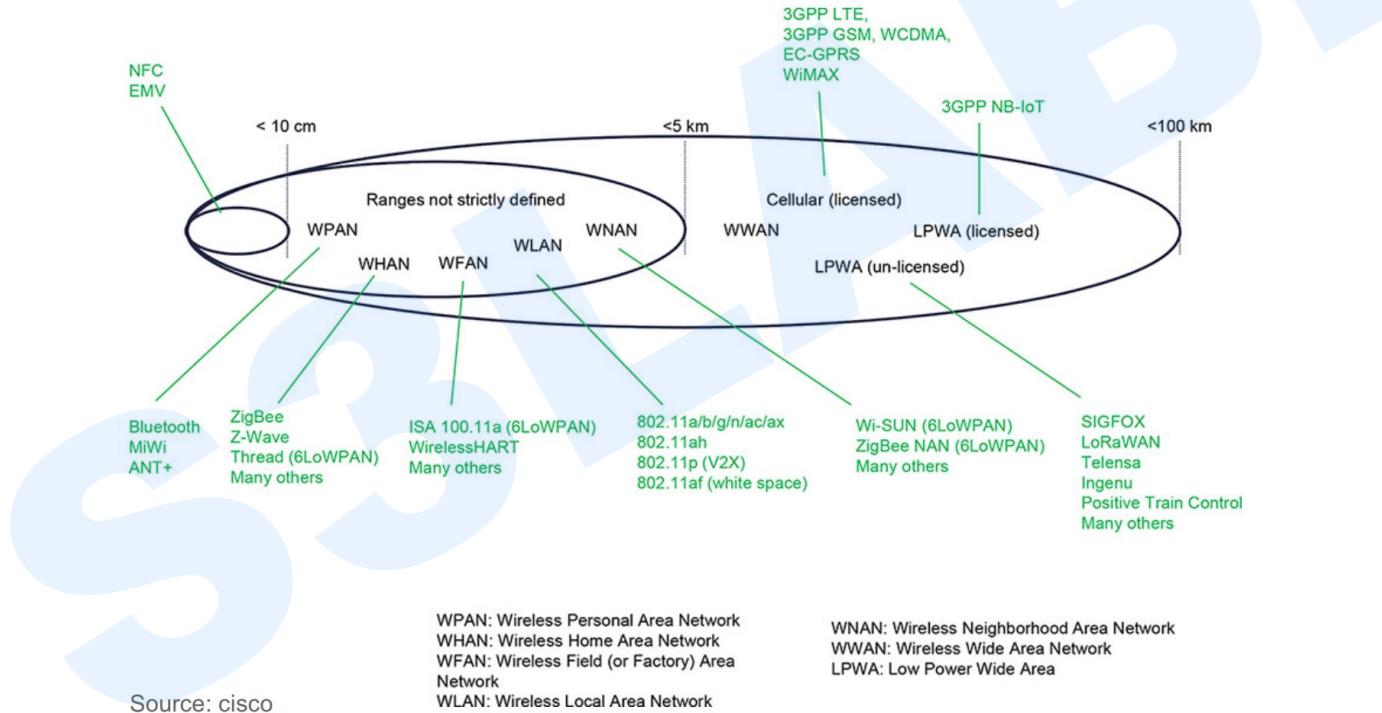
Density per Cell

“a few sensors” or “several thousands”?



Internet of Thing (IoT) Wave

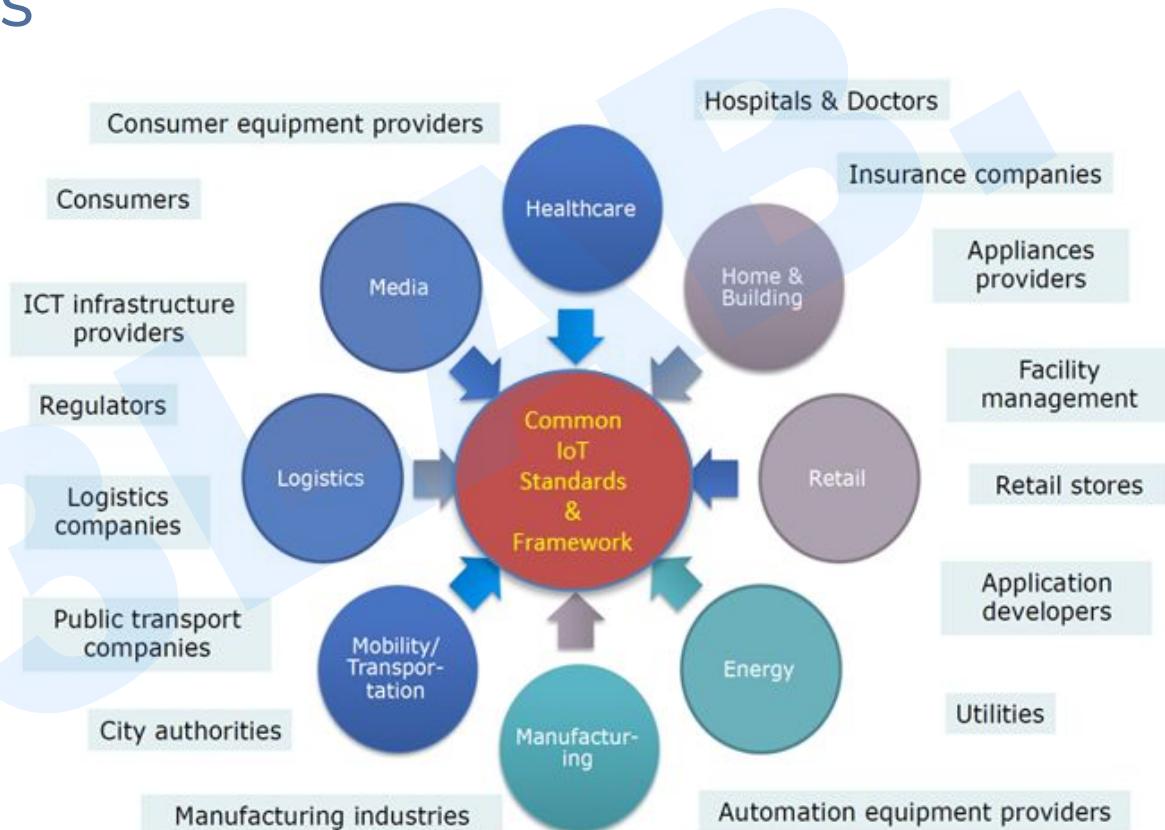
Sensor vs. Actuators: connectivity





IoT Applications

Everything and Everyone is generating Data



IoT Applications

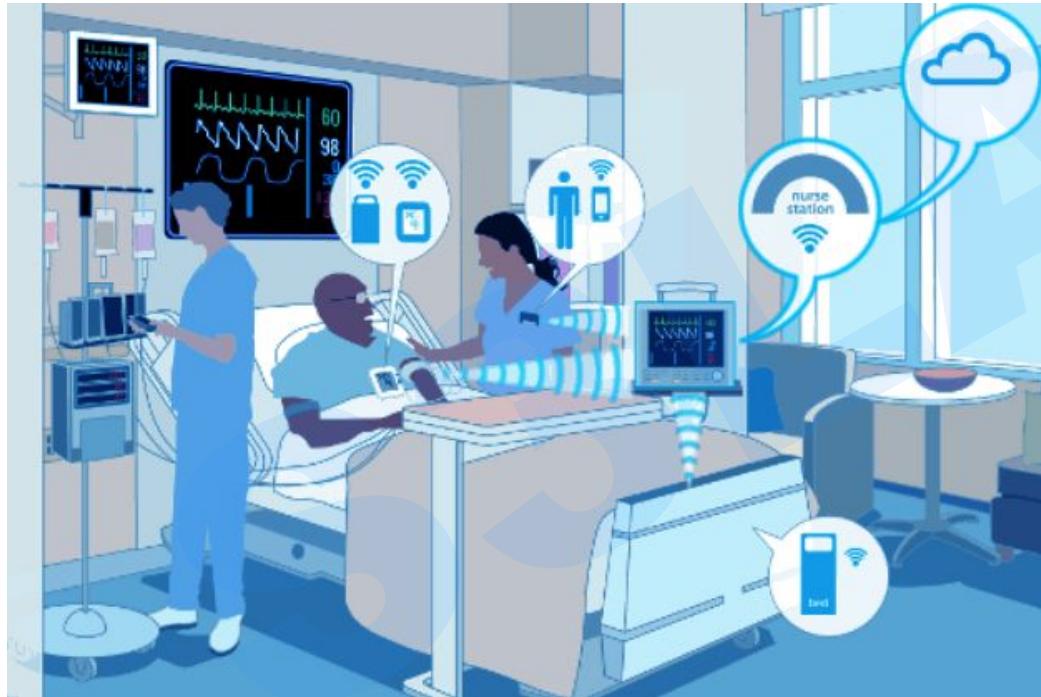
Healthcare





IoT Applications

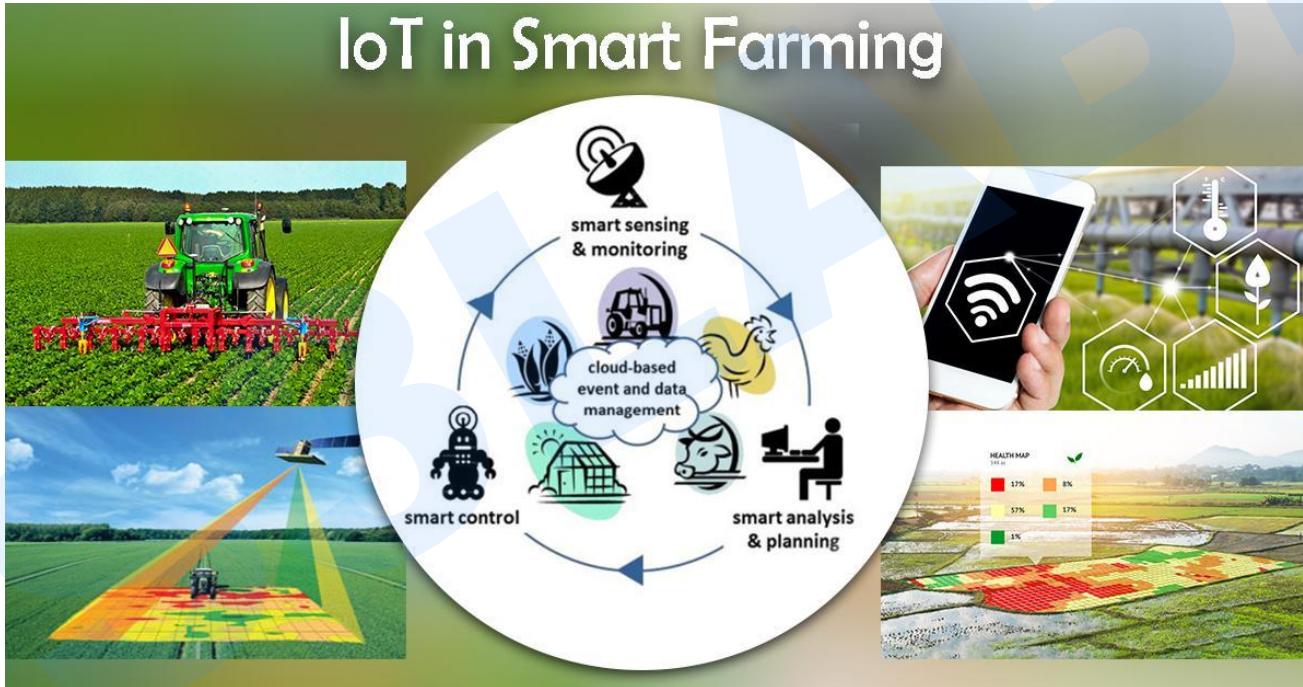
Healthcare





IoT Applications

Agriculture



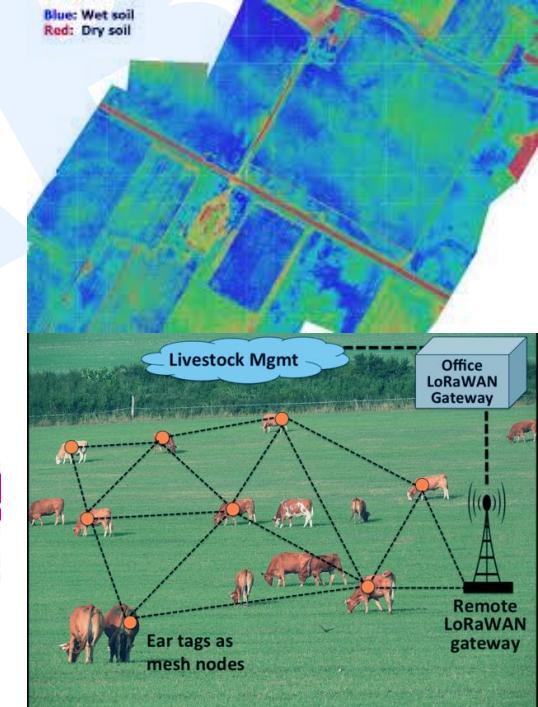


IoT Applications

Agriculture



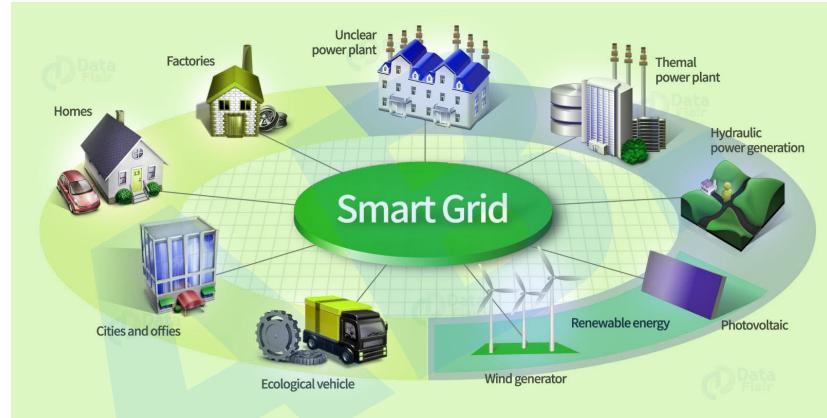
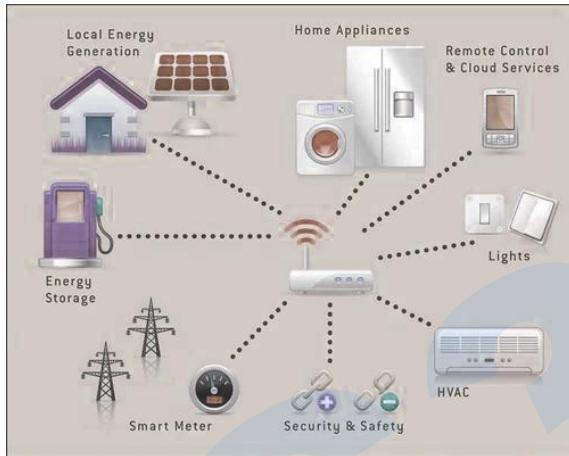
automatically controlled by sensor or time





IoT Applications

Energy



IoT in a Commercial Building



Mobility &
Customization



Occupant Comfort
& Environmental
Control



Energy
Consumption
Monitoring



Building
Functionality
& Area Sensors

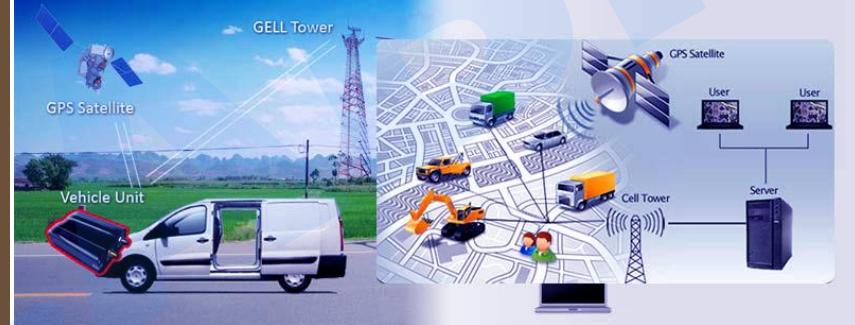


Detailed &
Actionable
Reporting



IoT Applications

Environment



IoT Applications



Government

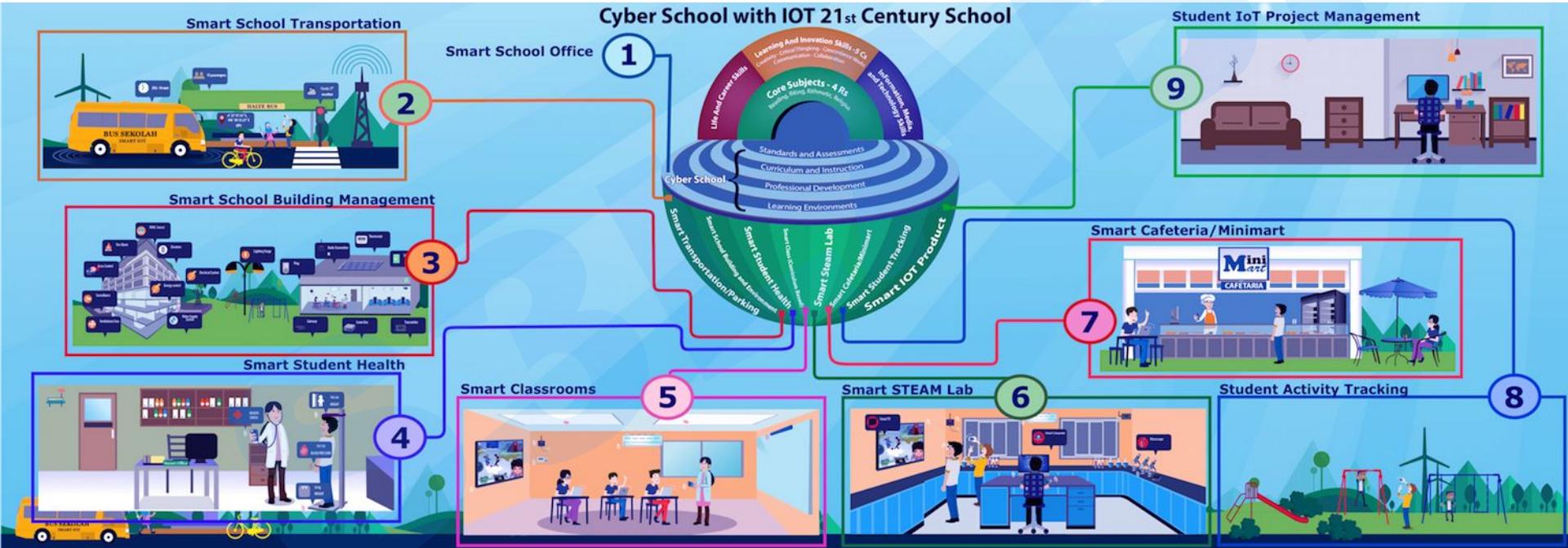
- Smart City, National Defence, Emergency, ...





IoT Applications

Education



IoT Applications

Consumer



\$7 MILLION
WORTH SMART PHONES ARE LOST EACH YEAR.

KEEPING TRACK OF YOUR PHONE IS GREAT... BUT WHAT ABOUT EVERYTHING ELSE?

GPS TRACKER
The GPS tracker uses state-of-the-art GPS and cellular technology to coordinate with GPS satellites for precise tracking anywhere on the globe. Use your smartphone or your computer to track.

TRACKER TAG
Simply attach a Tracker tag to your keychain and pair it with your smartphone. You will be alerted with a phone alarm if you ever leave your keys behind. Capable of 2 way communication with your smartphone, it can be used as a Phone finder & simple luggage tracker.

PHONE TAG
More than an anti-loss device, more than an app. Duet, and the Phone Tag app, is an entire eco-system built to prevent you from losing your smartphone. Never lose your phone again!

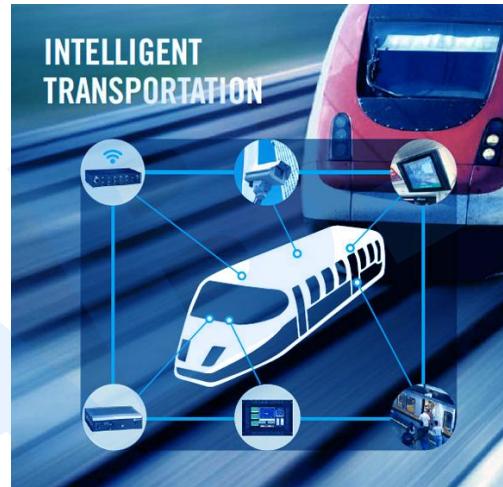
GPS PET TRACKING

This device helps you locate your dog, your cat or any other pet - anytime, anywhere. The device can easily be attached to the existing collar and together with the free Apps, you can locate your pets in real time.



IoT Applications

Transportation





IoT Applications

Building and House





IoT Applications

Advertising





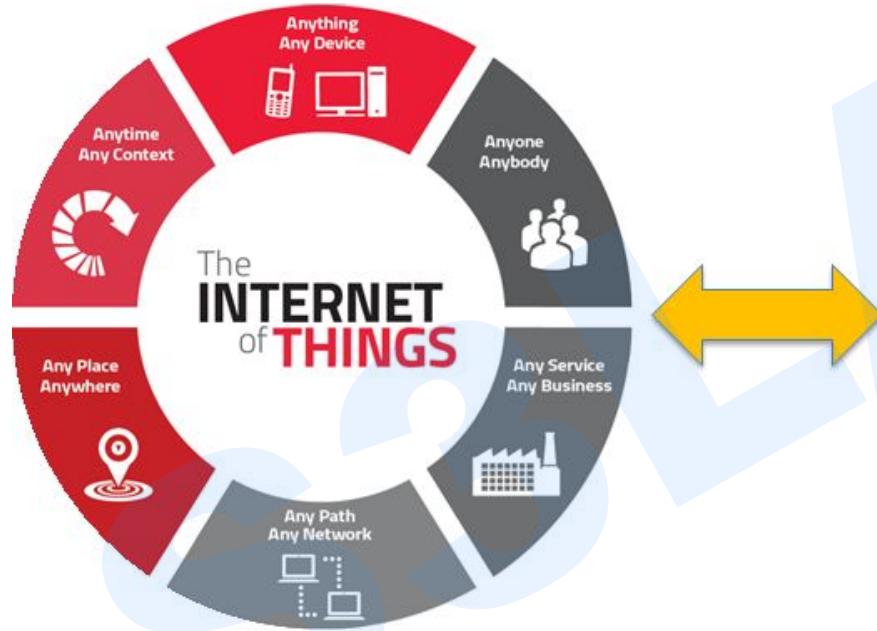
IoT and Big Data

- Around **4.4 trillion GB of data** will be generated by the year 2020 through the Internet of Things.
- More than ten **billions of sensors** and **devices** will be connected to the internet.
- All of these devices will gather, analyze, share, and transmit data in **real time**.

The role of big data in IoT is to process a large amount of data on a real-time basis and storing them using different storage technologies.



IoT and Big Data

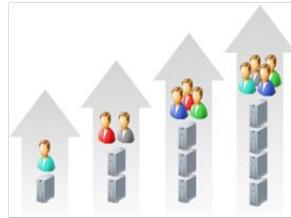


IoT is a King, Big data is a Queen and Cloud is a Palace



IoT and Big Data

Key requirements of platform

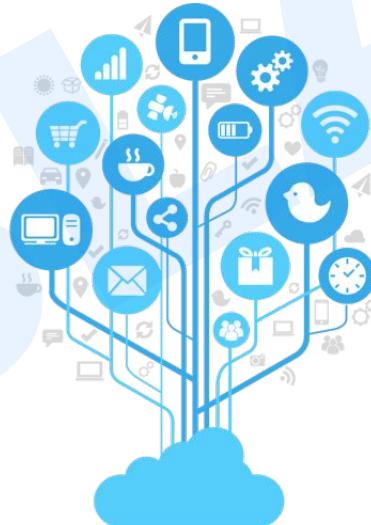


Scalable

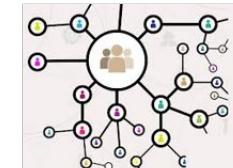


Real-time

Security and privacy



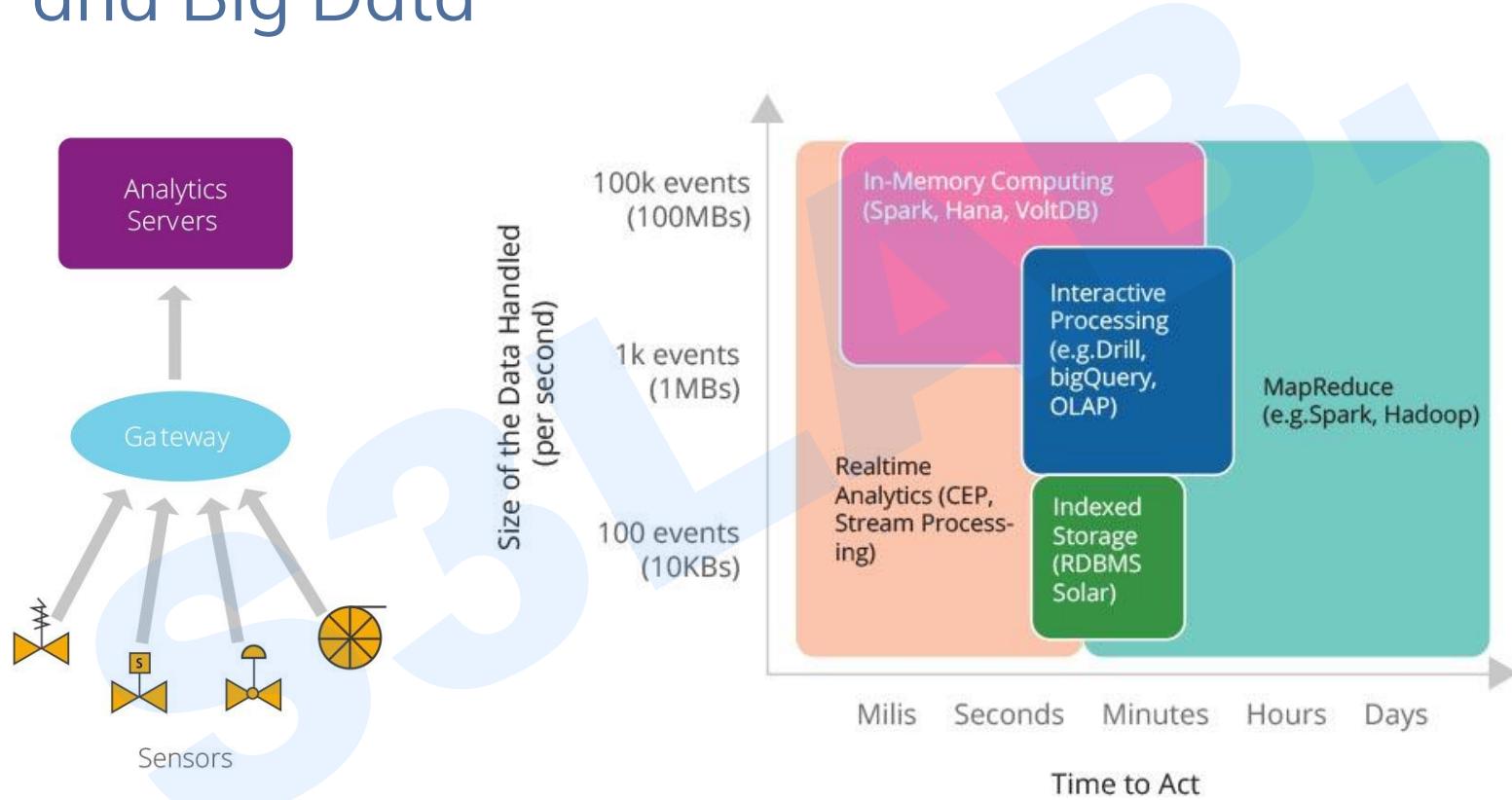
Intelligent and dynamic



Distributed and decentralized

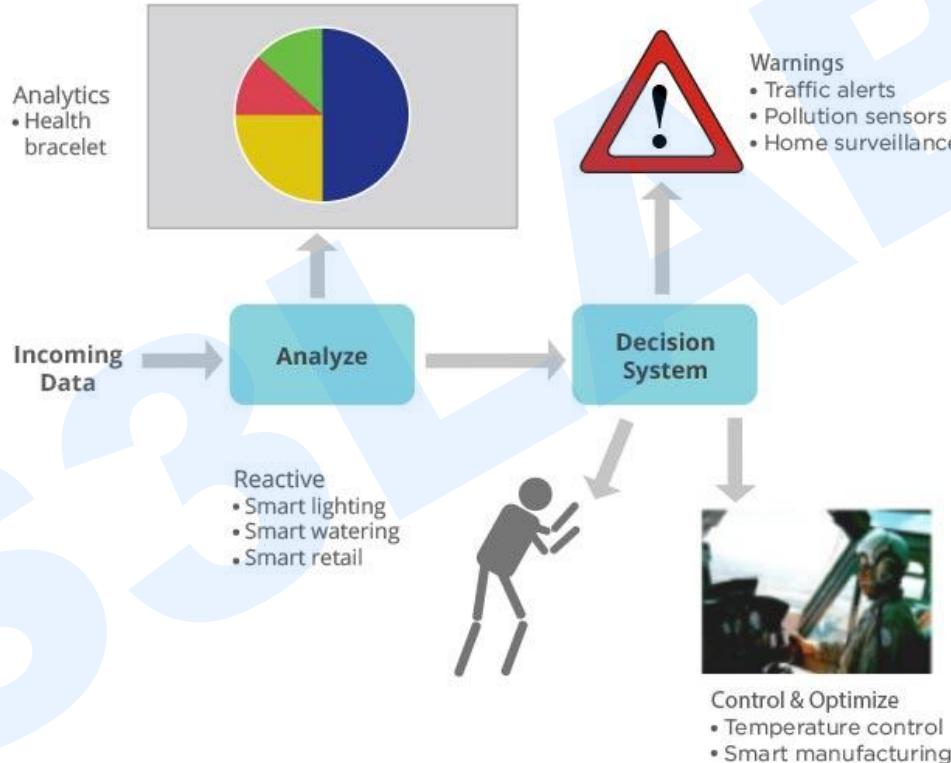


IoT and Big Data



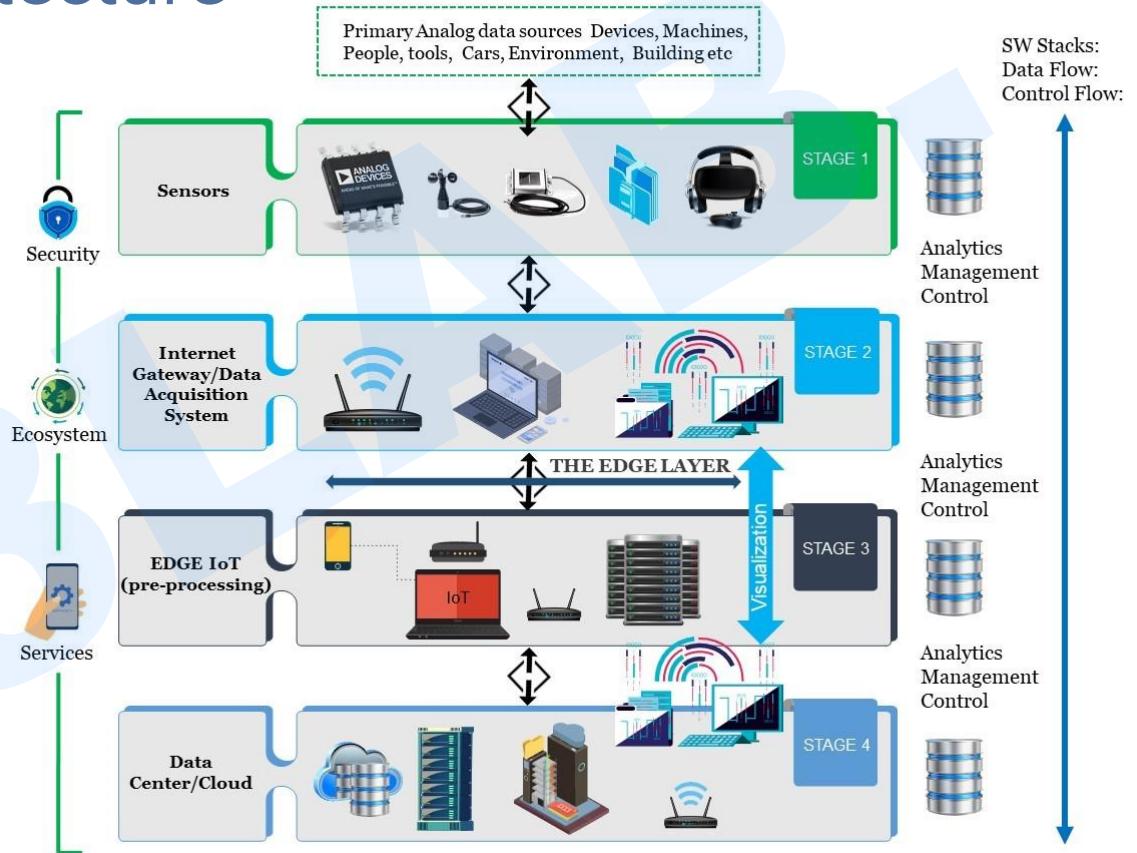


IoT and Big Data



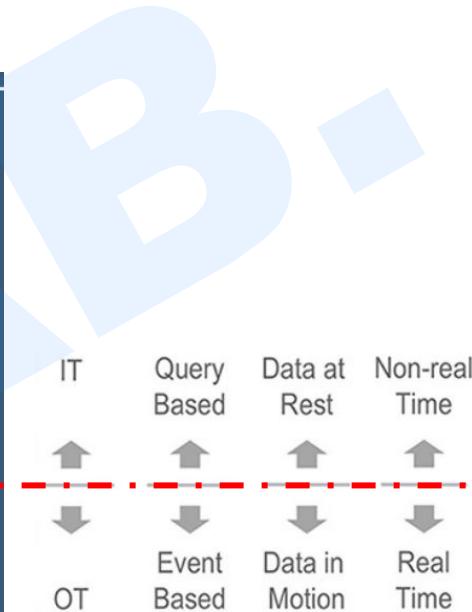
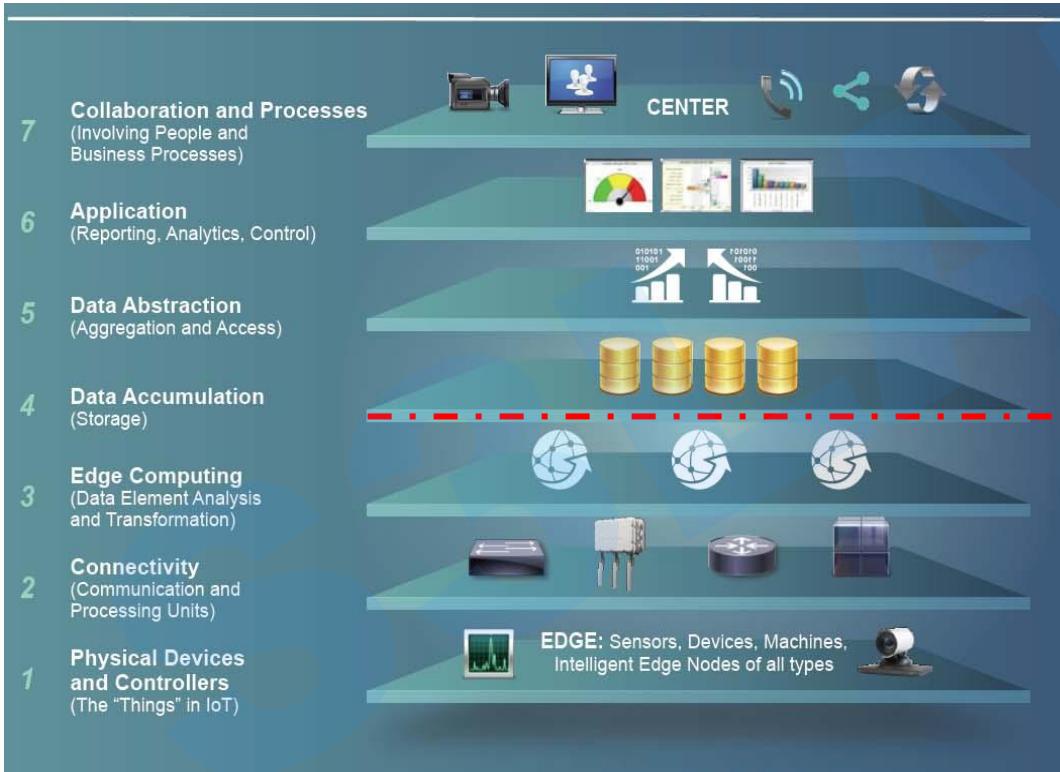
IoT Logical Architecture

The 4 stage of IoT solutions Architecture



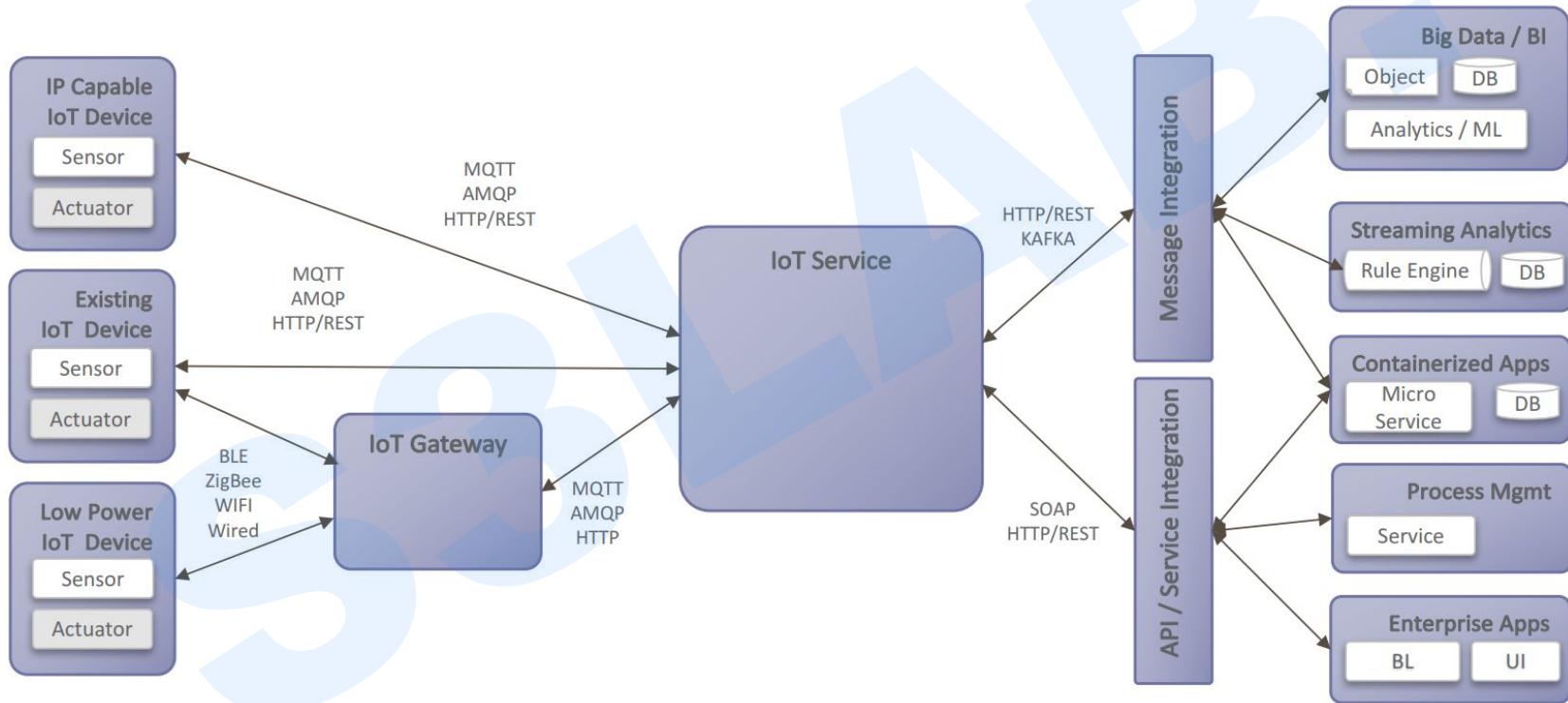


IoT Logical Architecture



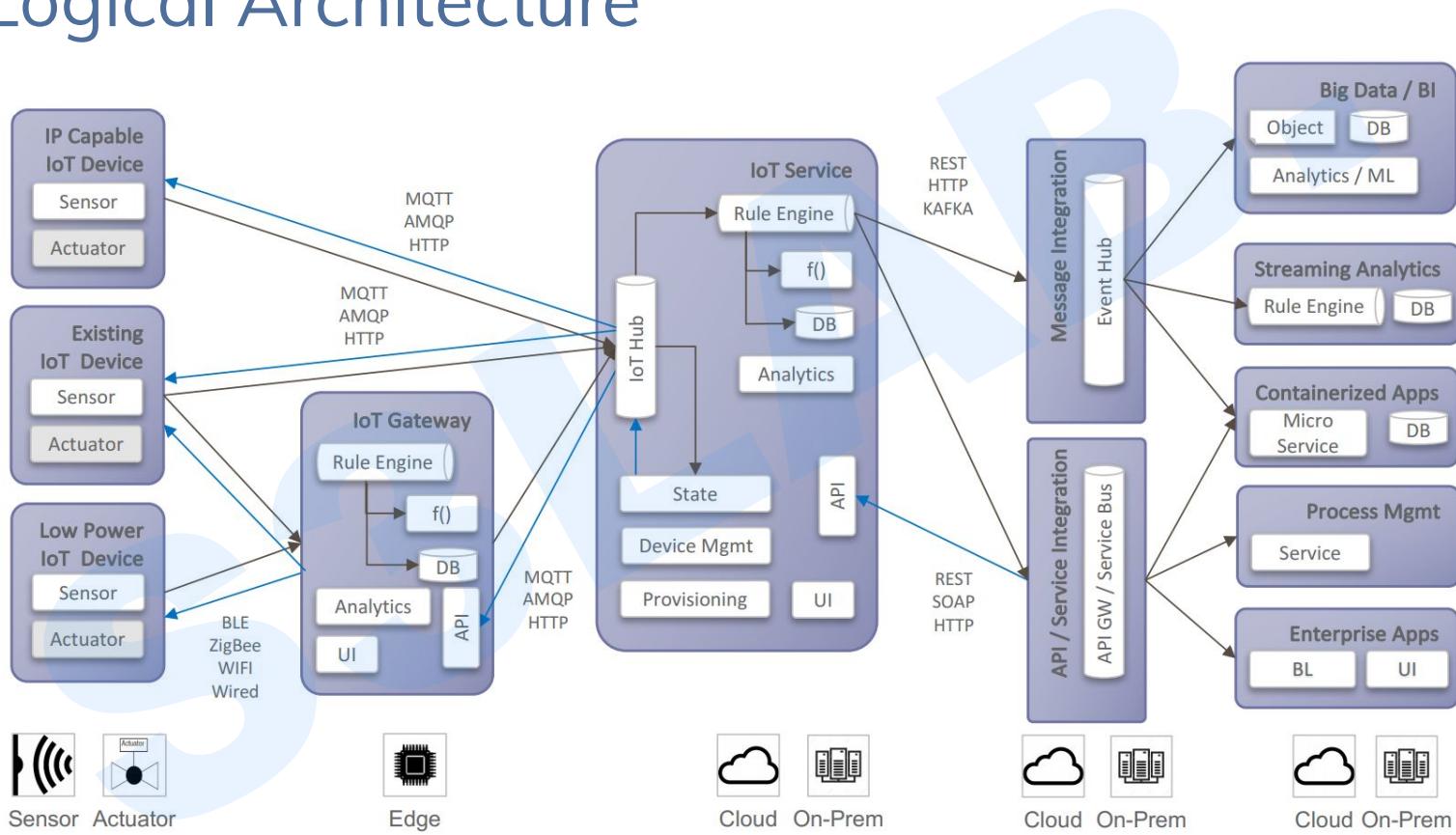


IoT Logical Architecture



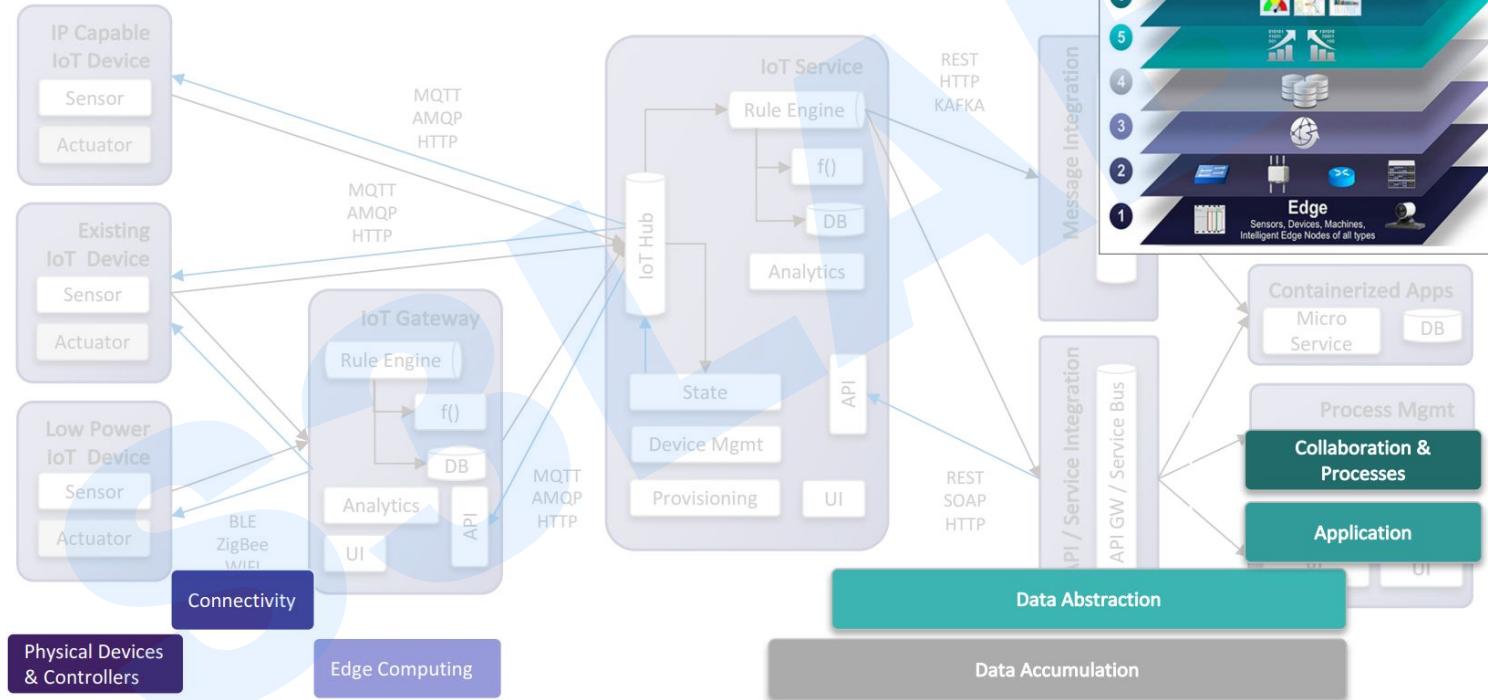


IoT Logical Architecture

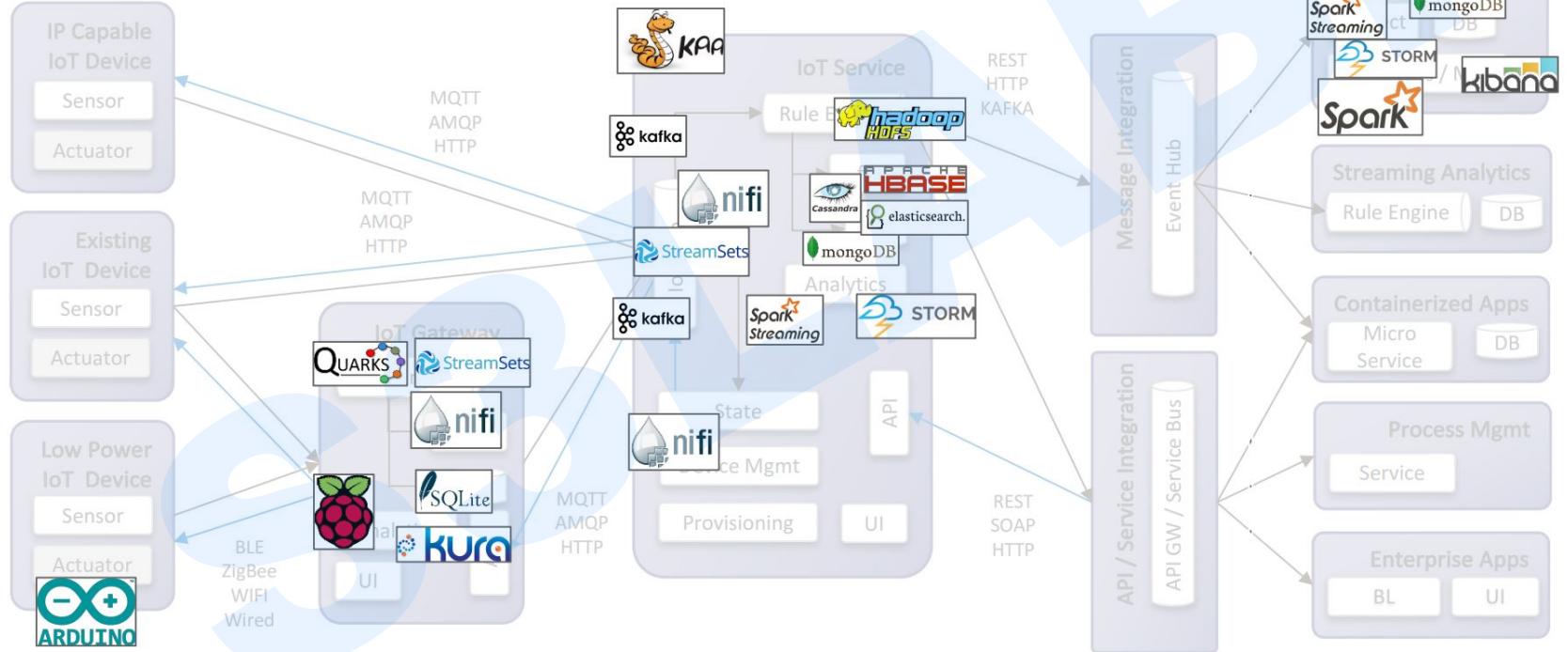




IoT Logical Architecture



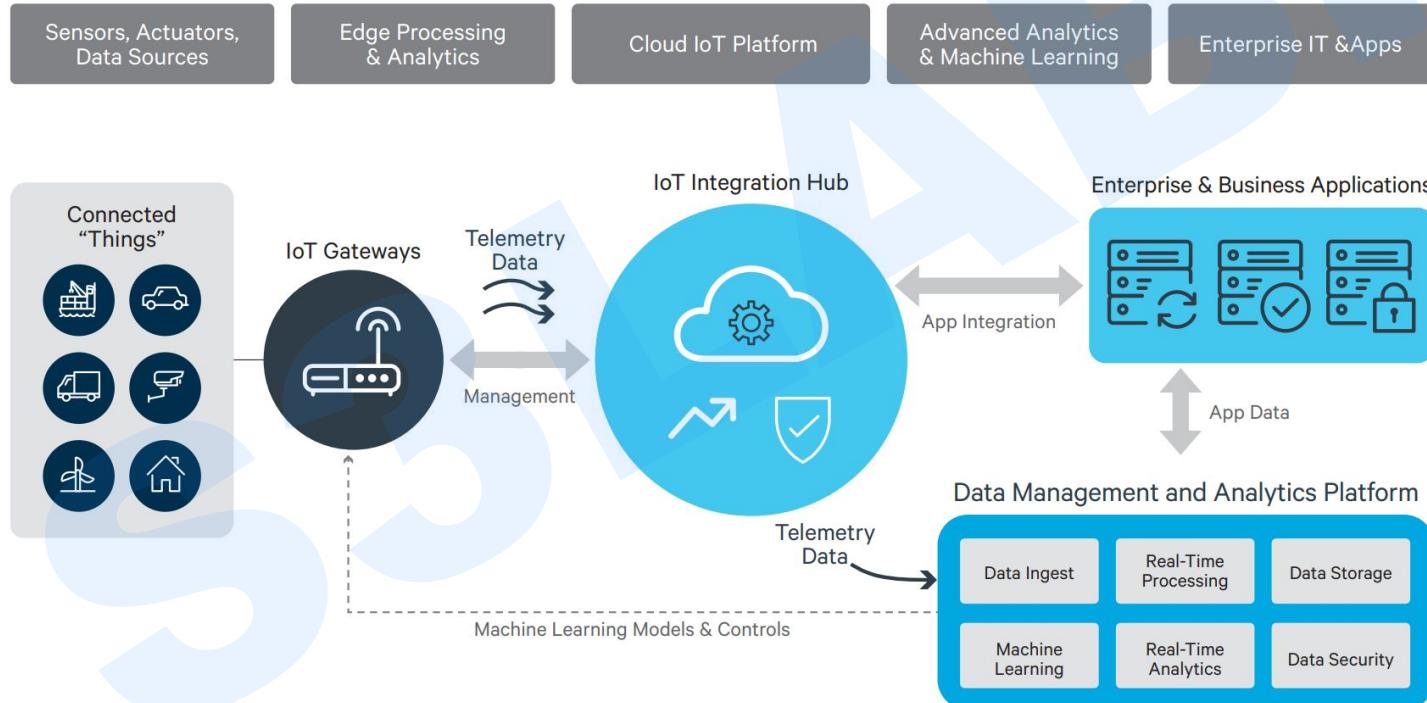
IoT Logical Architecture





IoT In Big Picture

Whole General System

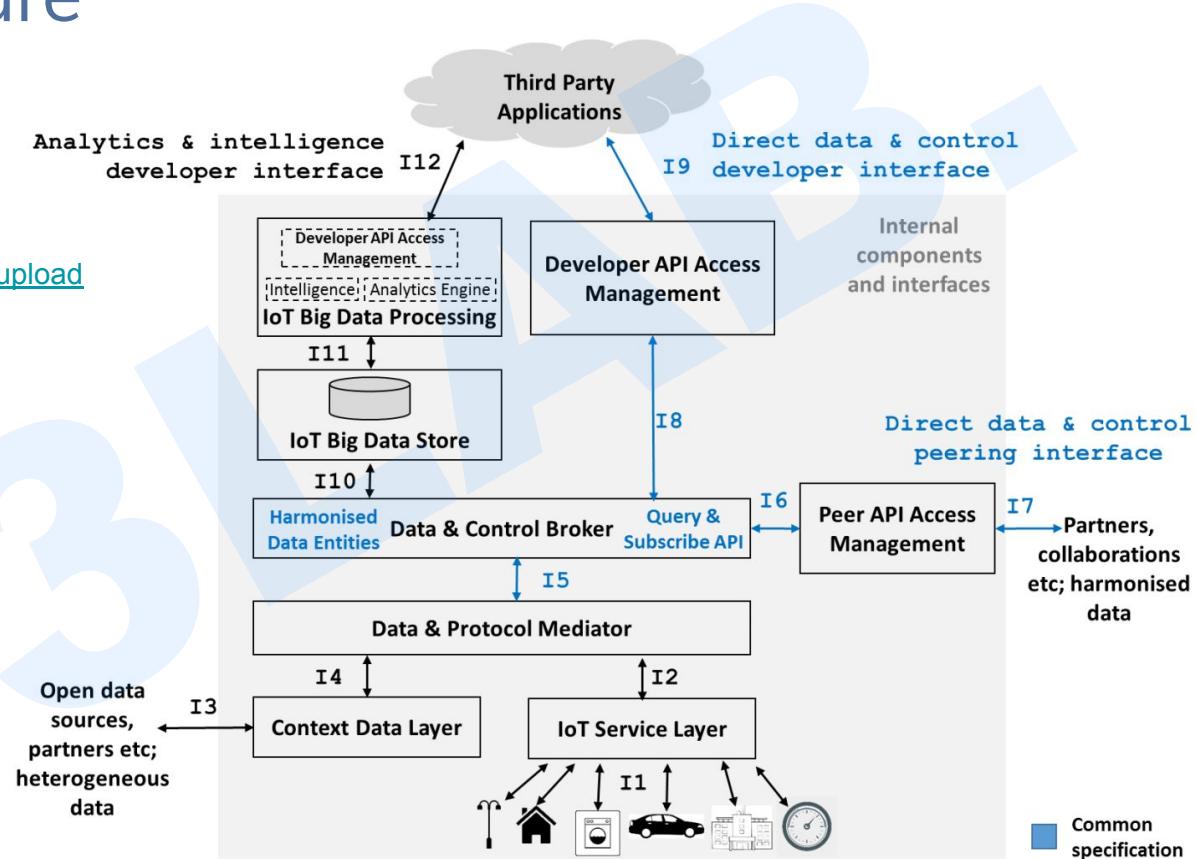




IoT In Big Picture

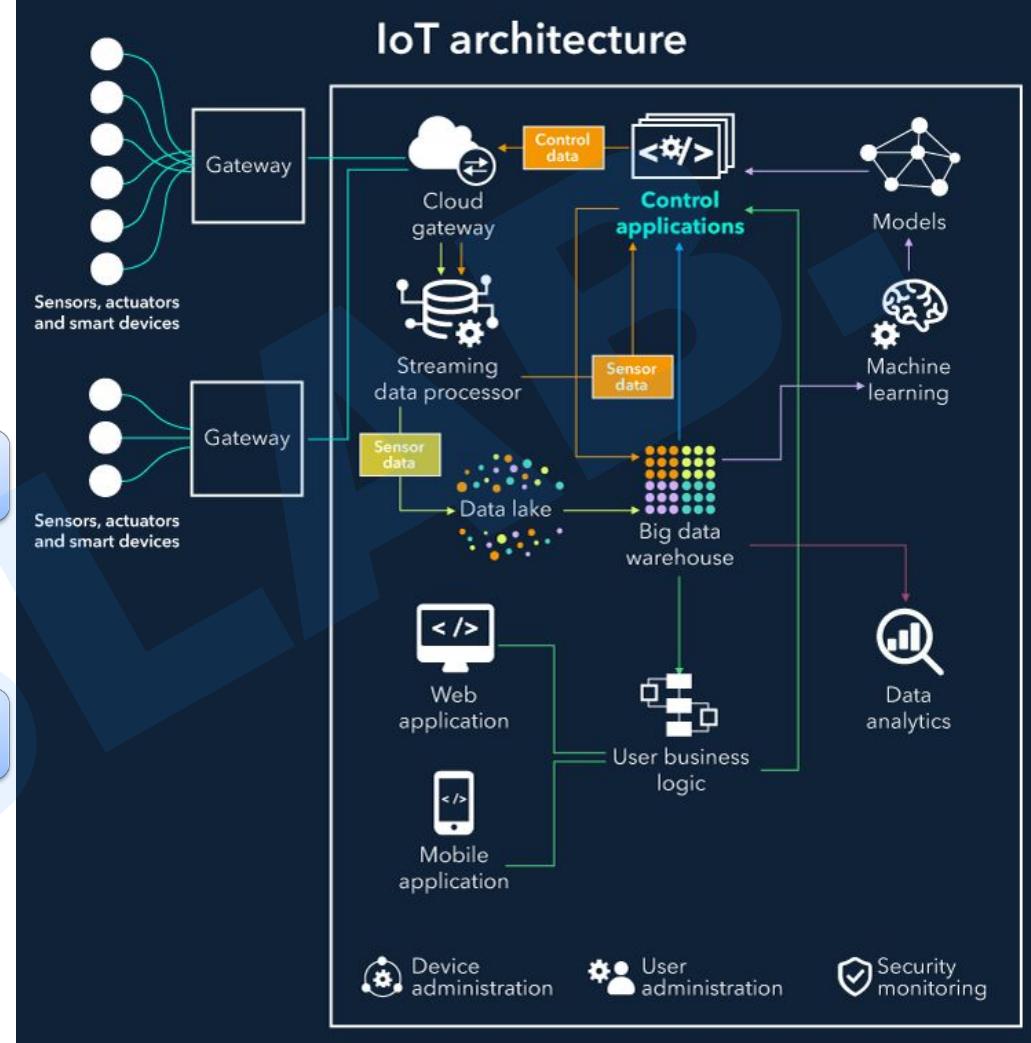
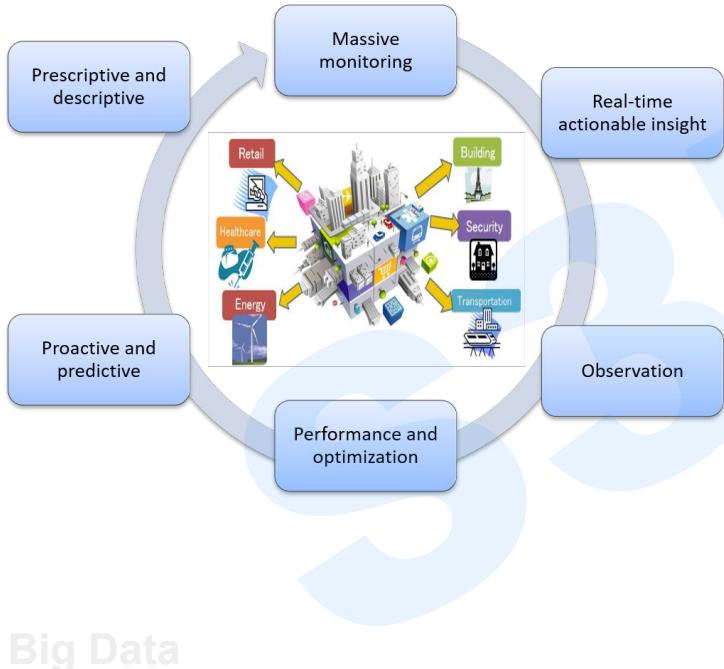
Whole General System

<https://www.gsma.com/iot/wp-content/uploads/2016/11/CLP.25-v1.0.pdf>



IoT In Big Picture

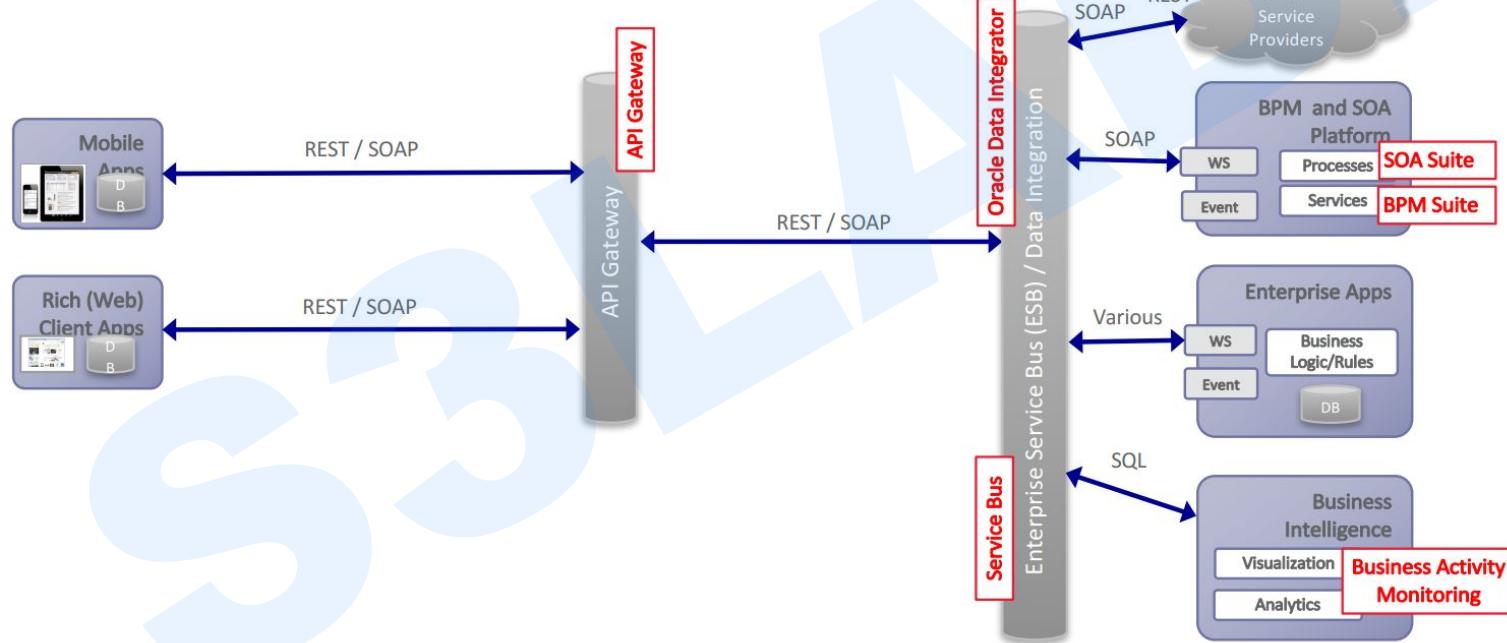
Another View





IoT Integration

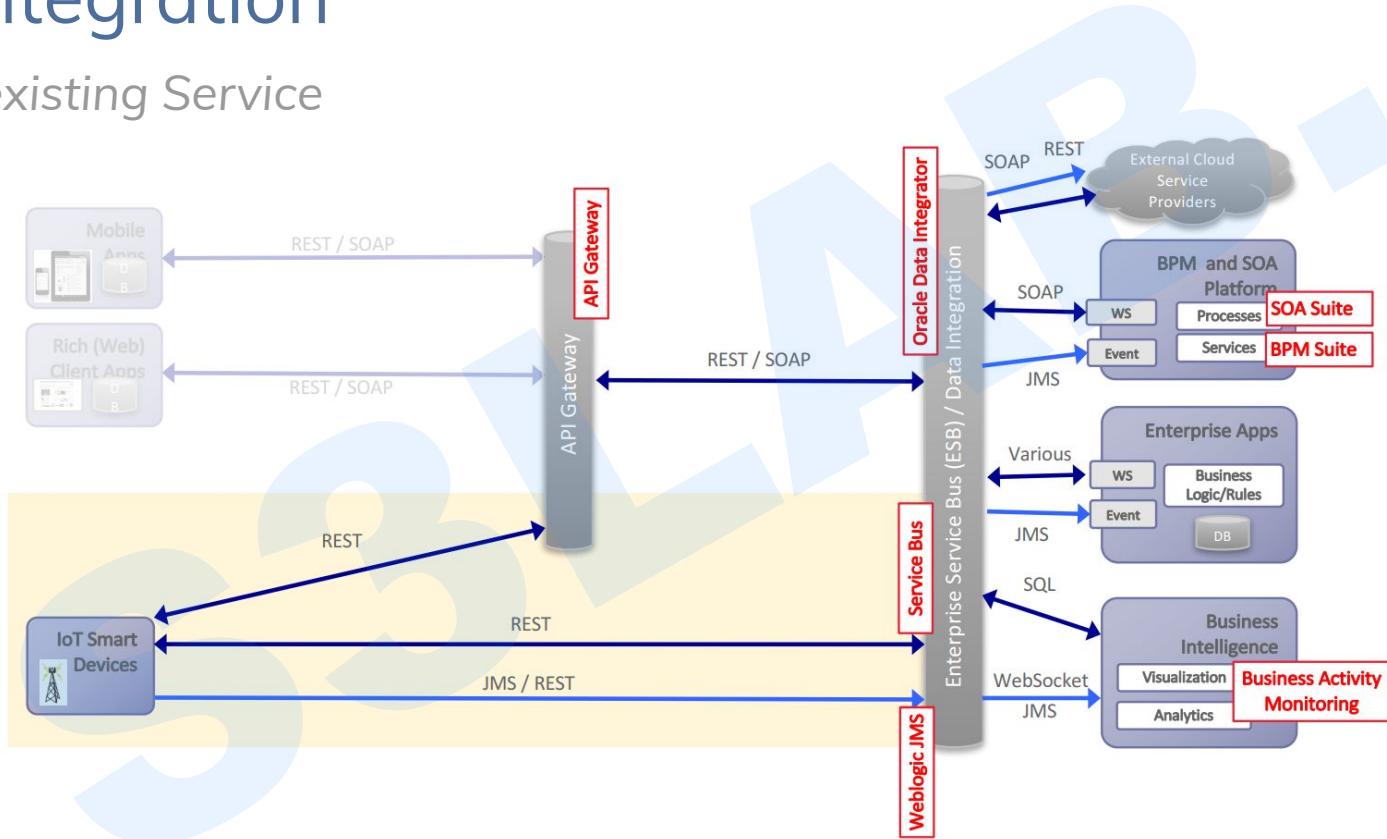
The Existing Service / API architecture as a base





IoT Integration

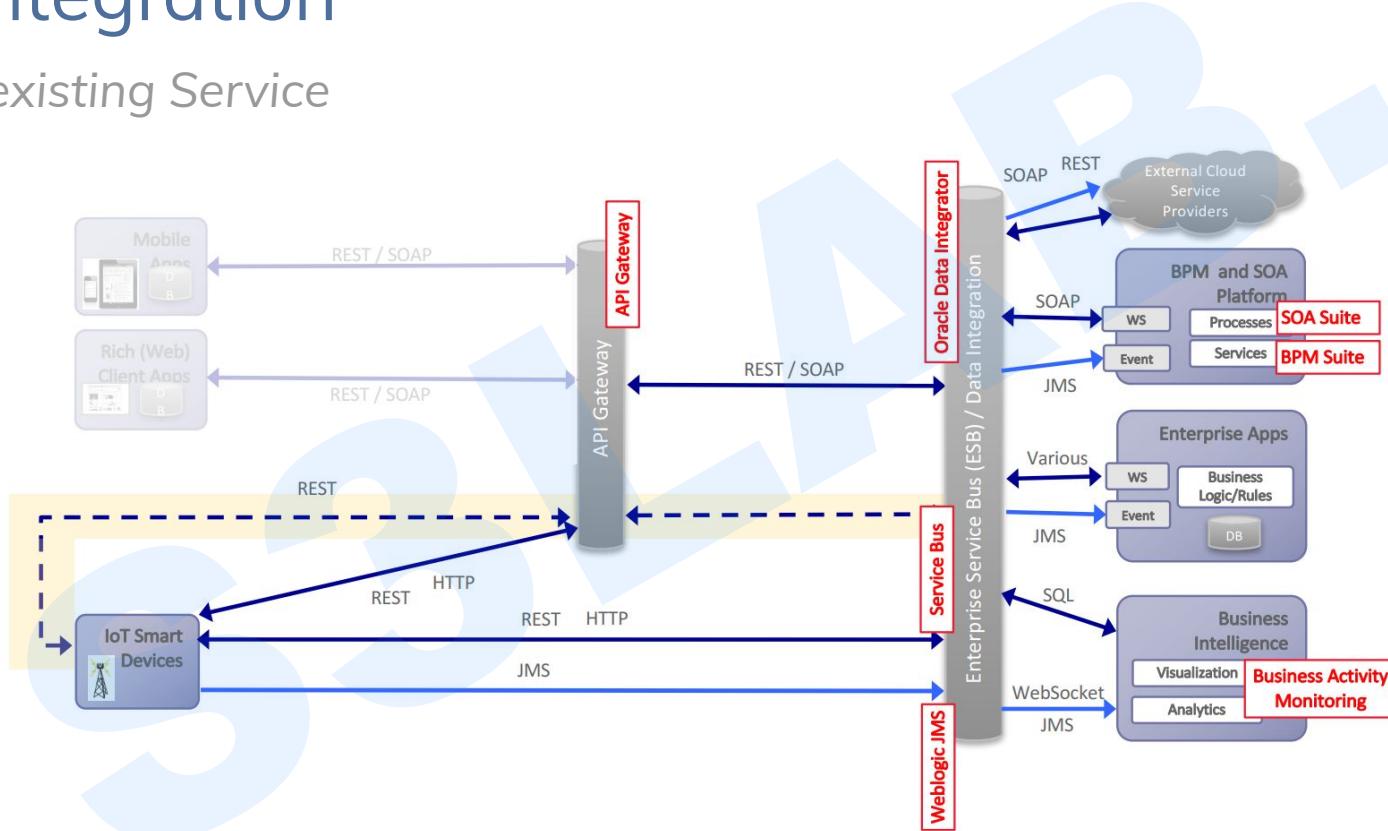
Reuse existing Service





IoT Integration

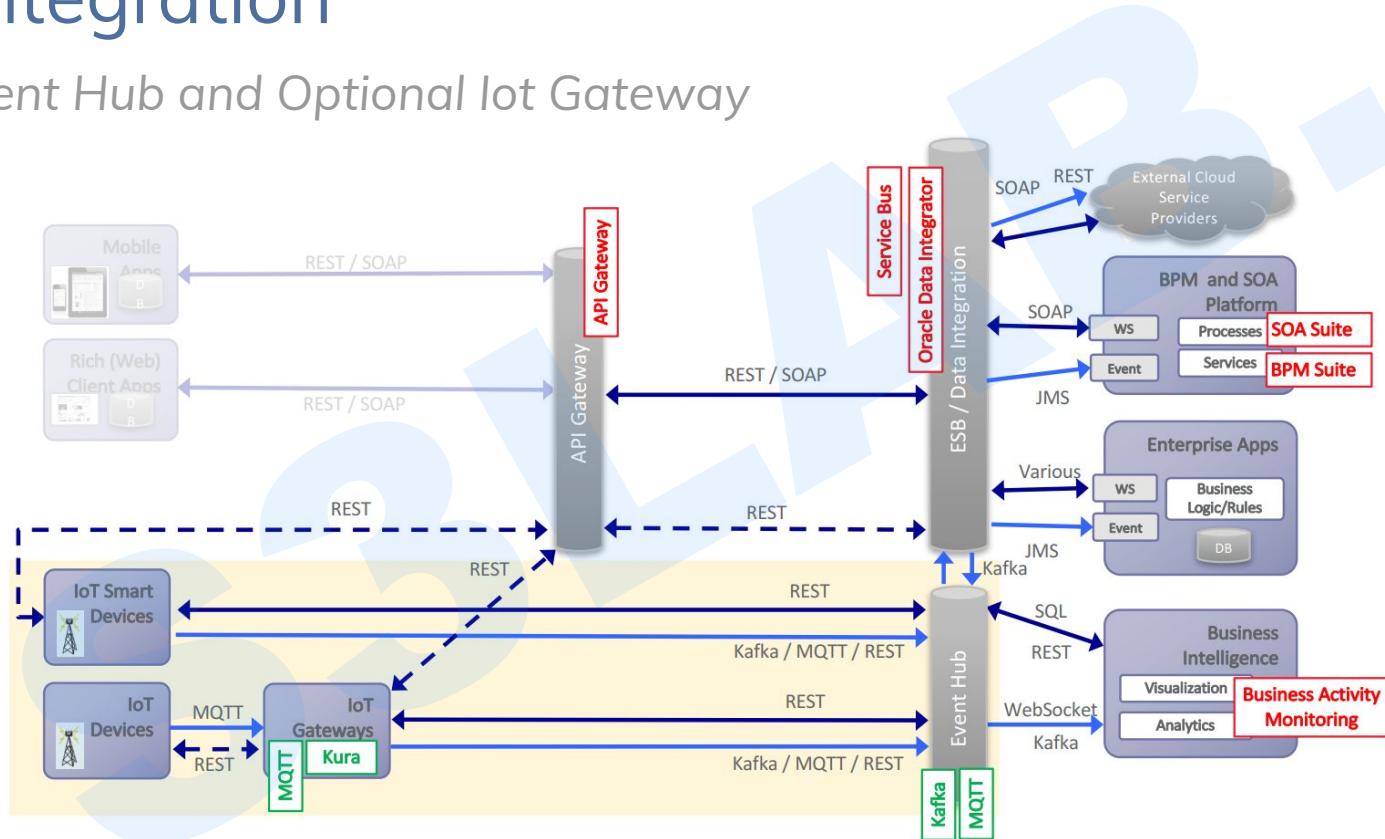
Reuse existing Service





IoT Integration

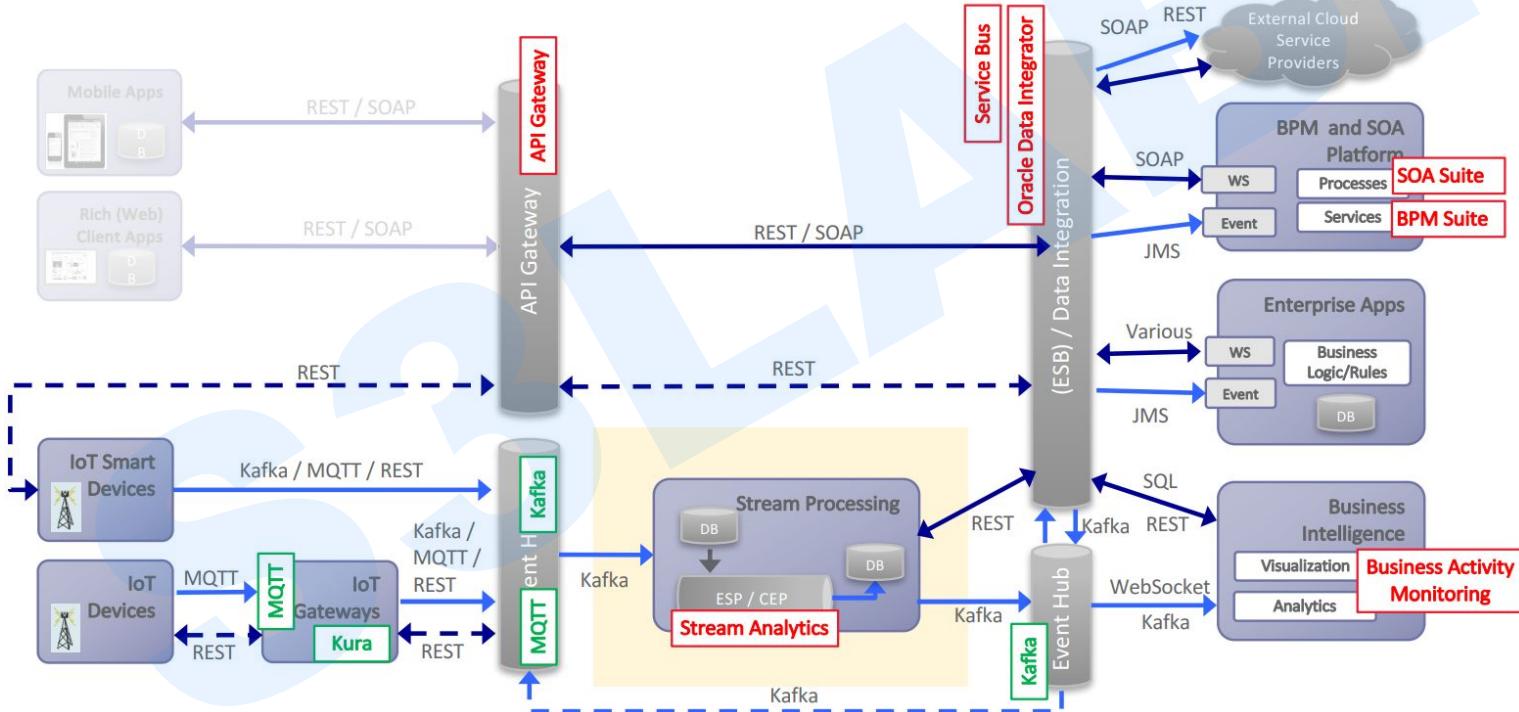
Add Event Hub and Optional IoT Gateway





IoT Integration

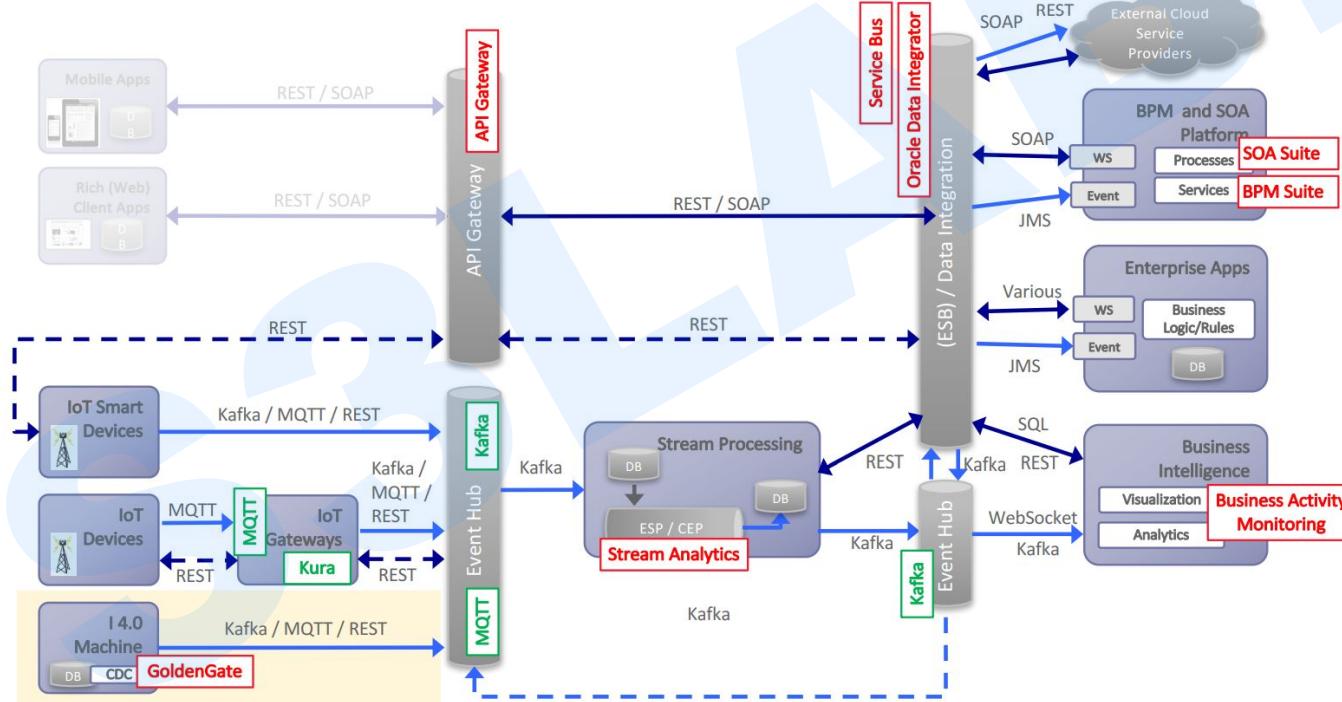
Add Stream Processing / Analytics





IoT Integration

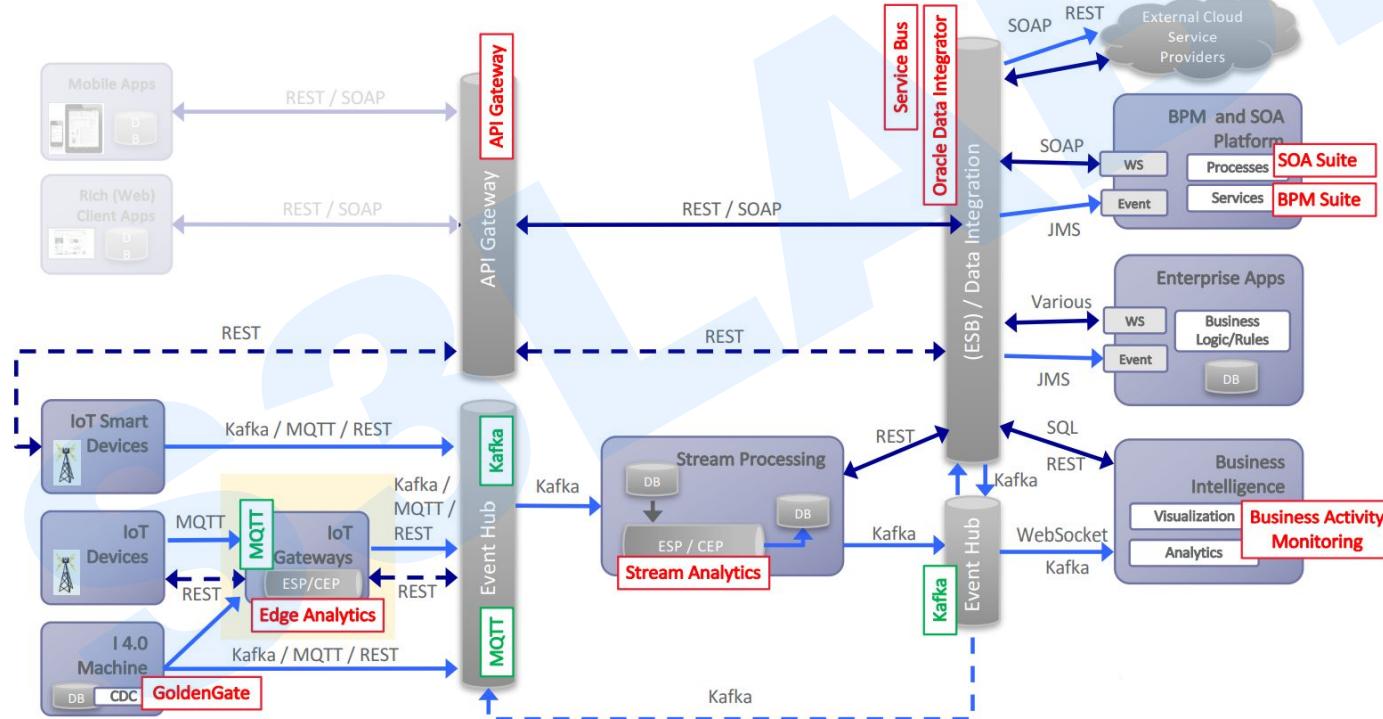
Add Industry 4.0 Data Source (Machine Data)





IoT Integration

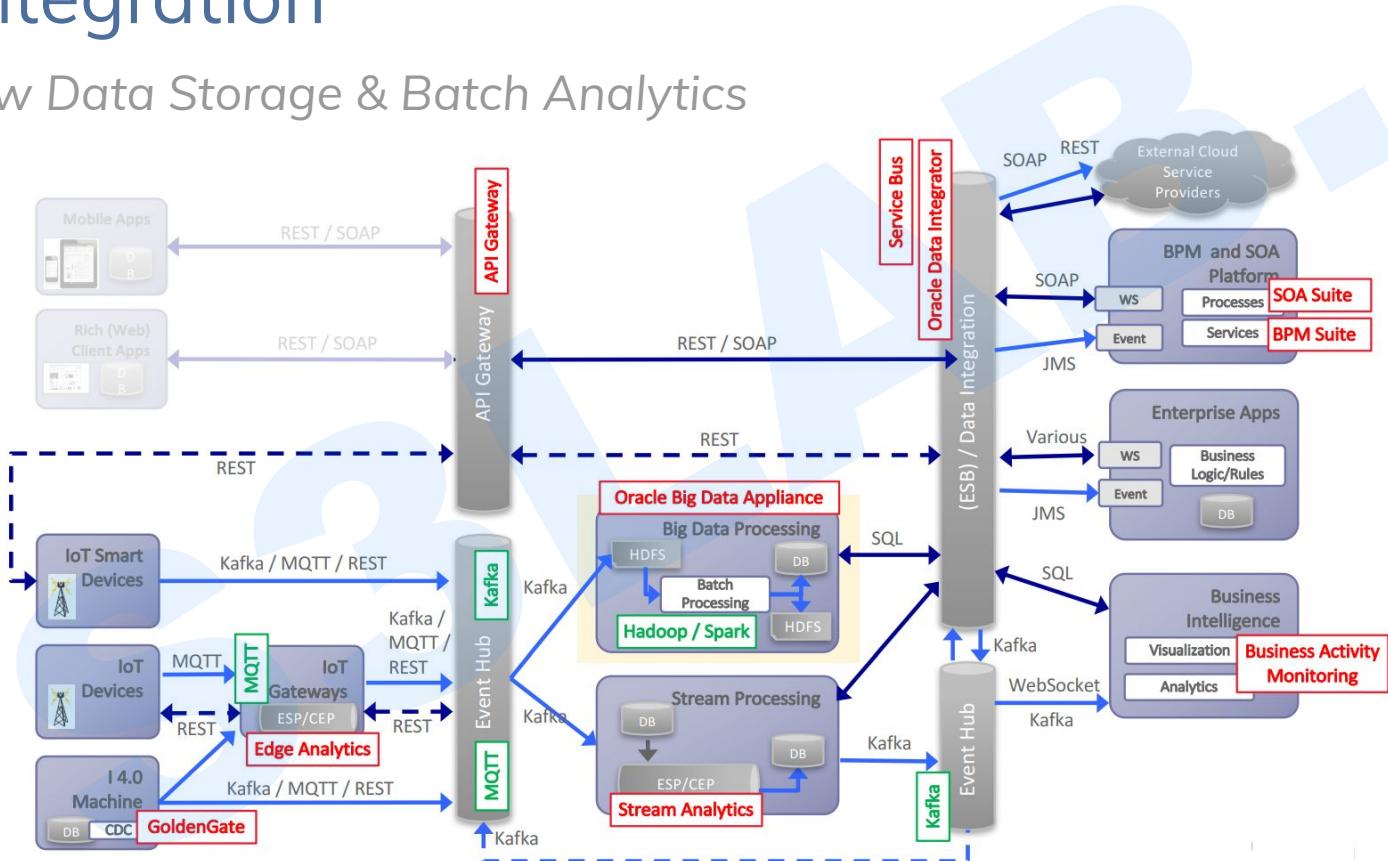
Add Stream Processing / Analytics at Edge





IoT Integration

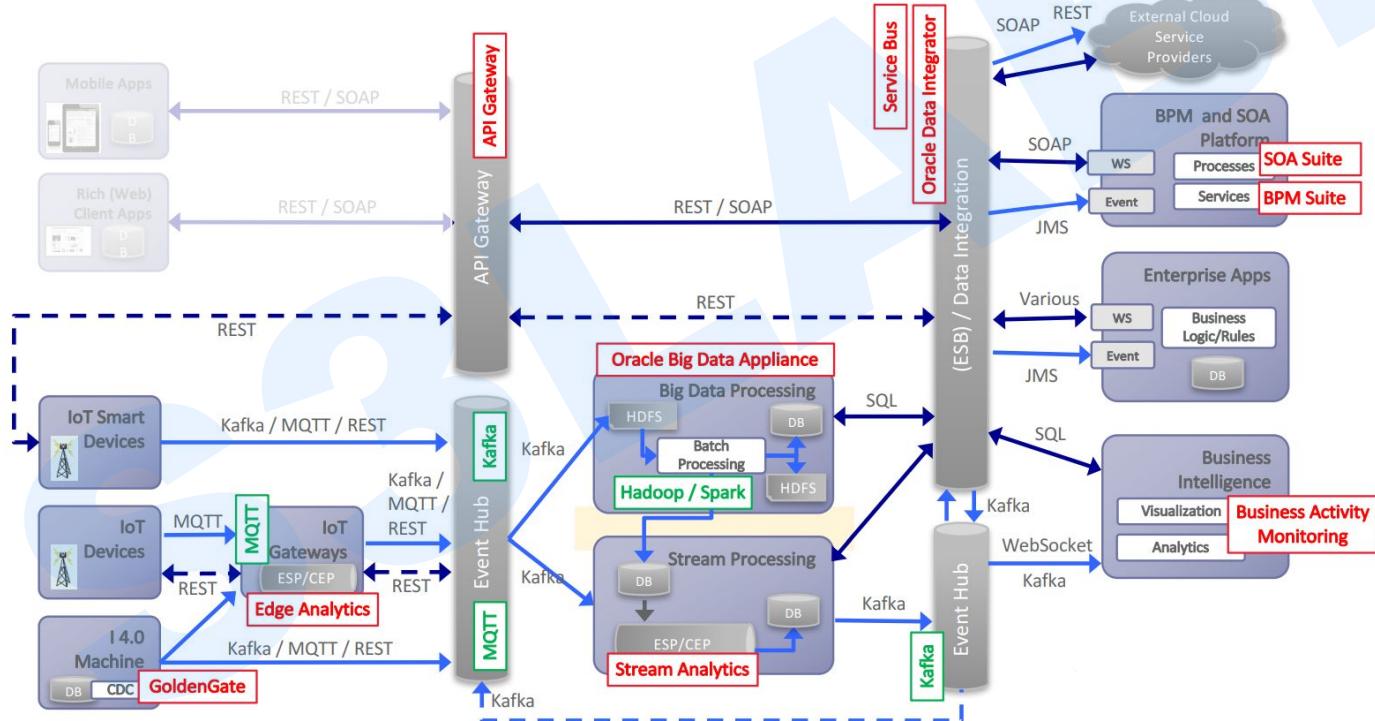
Add Raw Data Storage & Batch Analytics





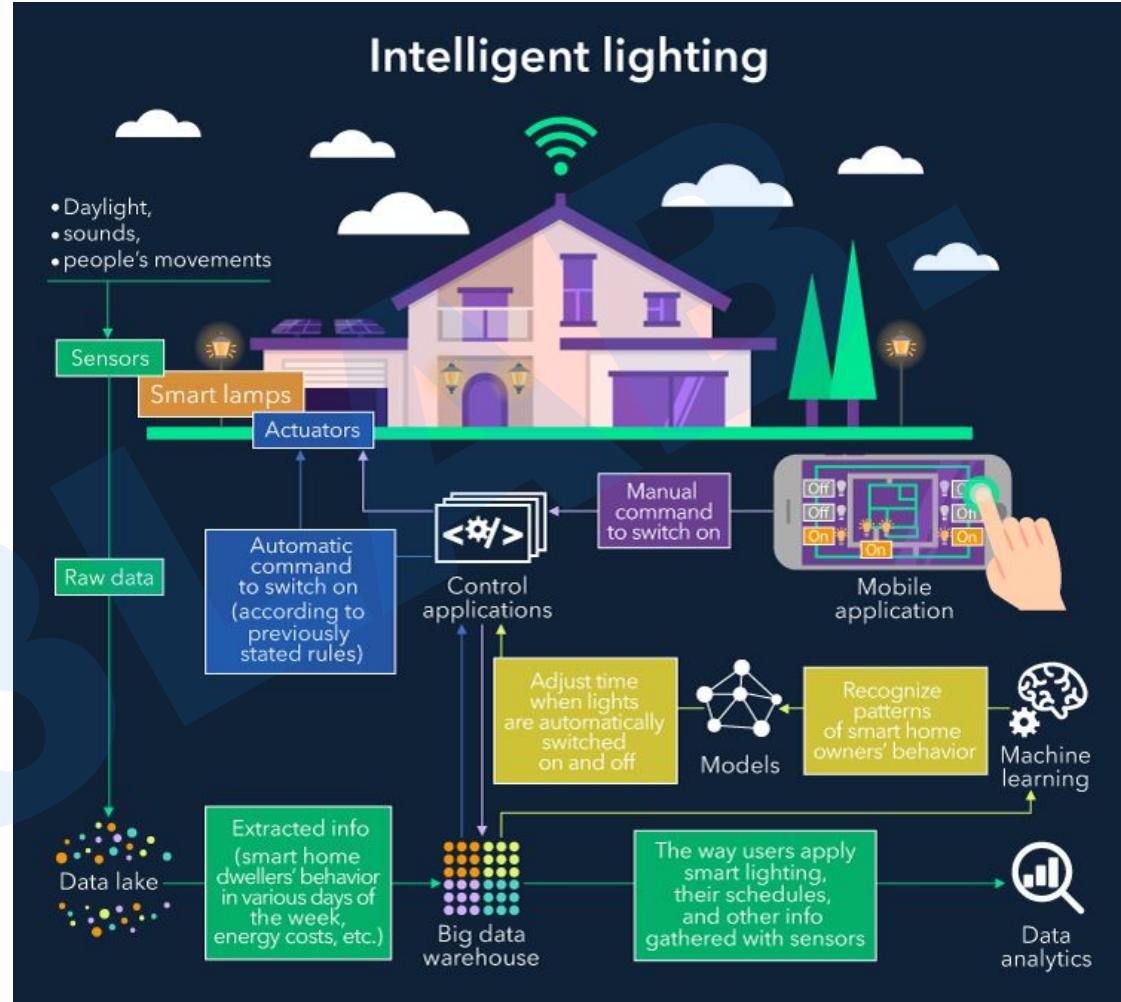
IoT Integration

Add Data Mining / Machine Learning and Model Execution



IoT Examples

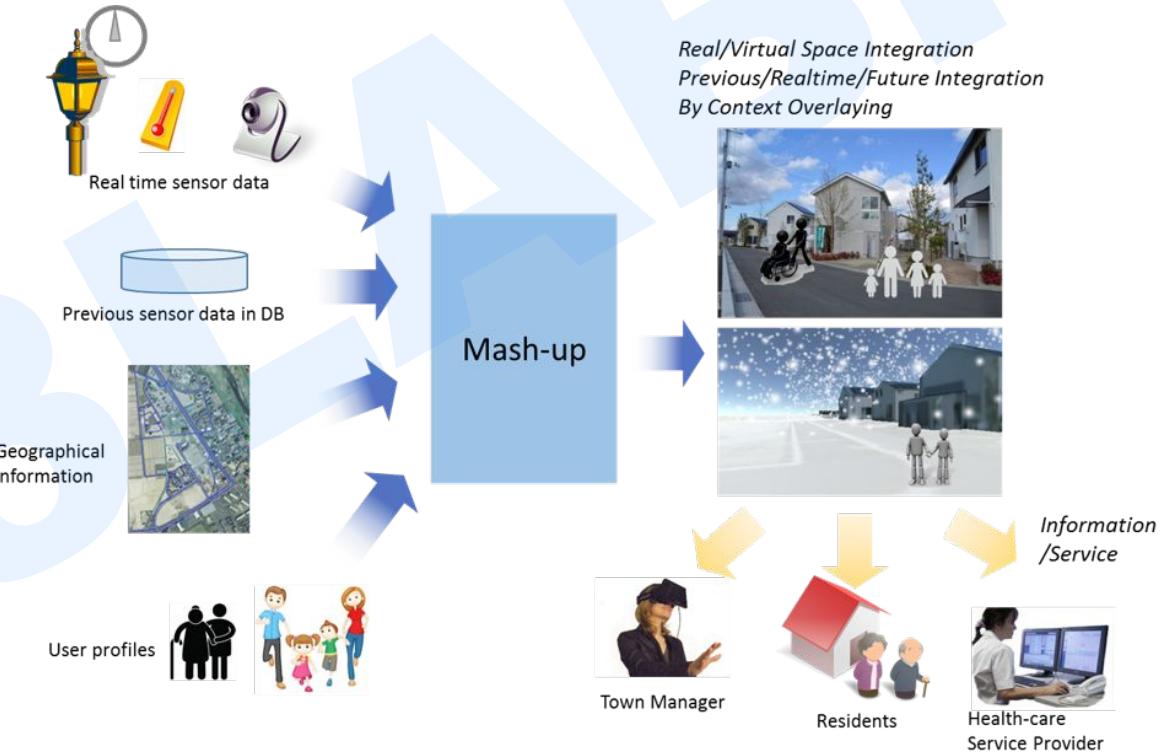
Smart lighting





IoT Examples

Sendai Smart Village in Japan





IoT Funny





Q & A



Cảm ơn đã theo dõi

Chúng tôi hy vọng cùng nhau đi đến thành công.