



SNS COLLEGE OF TECHNOLOGY COIMBATORE



AN AUTONOMOUS INSTITUTION

Accredited by NBA – AICTE and Accredited by NAAC – UGC with 'A++' Grade

Approved by AICTE New Delhi & affiliated to the Anna University, Chennai

DEPARTMENT OF MCA

Course Name : 19CAE725- INTERNET OF THINGS

Class : I Year / II Semester

Unit III – Building IoT With Raspberry Pi
Topic 3 – Web server & API

Leading connectivity platform for enterprise applications, mobile and IoT



3,500+ on-premise enterprise deployments

25,000+ cloud deployments


50% of the Global 500

HQ in San Francisco with offices in New York, Atlanta, London, Rotterdam, Munich, Sydney, Singapore, Hong Kong, Buenos Aires, Rio De Janeiro



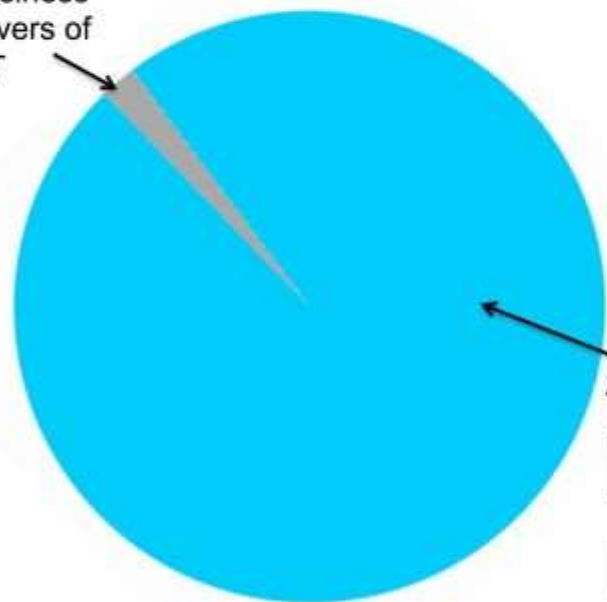
An aerial, high-angle photograph of a city skyline, likely New York City, showing numerous skyscrapers and a river. The image is in grayscale and has a dark, semi-transparent overlay.

To connect the world's
applications, data and devices



To connect the world's
applications, data and devices

Business
drivers of
IoT



**Architectural
Patterns in an
IoT Stack**

Why plan for an IoT stack?

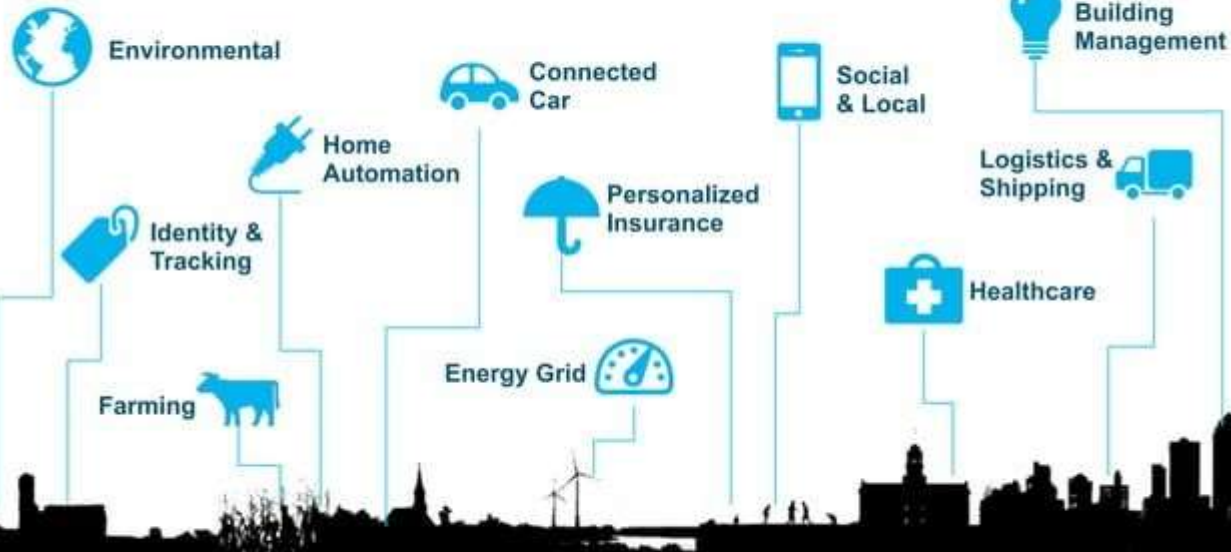
A large, semi-transparent watermark of the MuleSoft logo is visible on the right side of the slide. The logo consists of a stylized 'M' inside a circle, with a checkmark-like shape integrated into the right side of the 'M'.

Everything needs to connect



50,000,000,000+
connected devices

Connecting the physical world to the Web



Architectural patterns in an IoT stack



At a high level this is the general IoT stack



App

Data Processing and
Platform

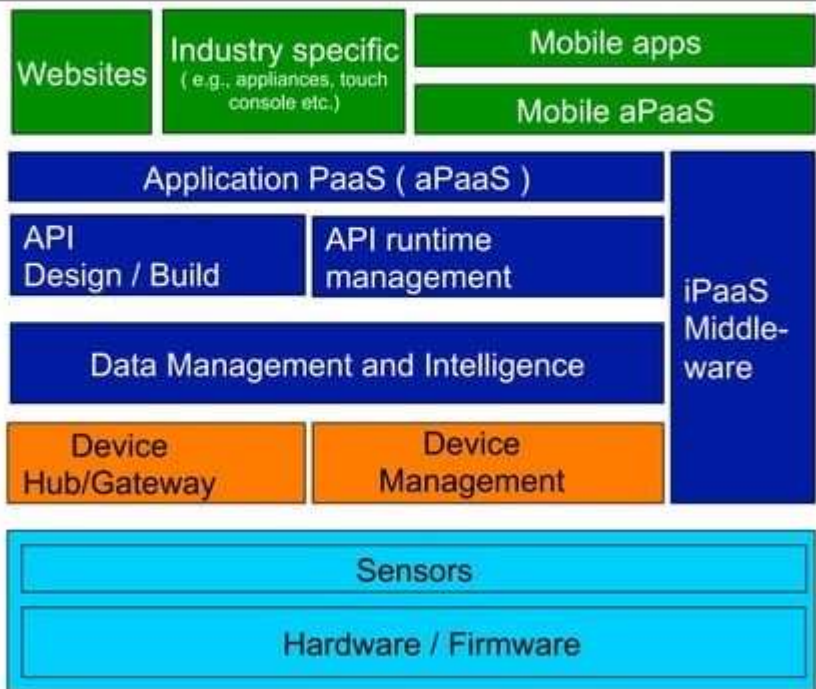
Edge

Thing / Device

Breaking down the IoT stack



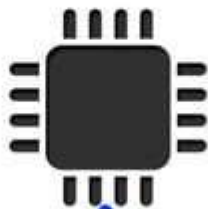
The IoT Stack



IoT Stack: Devices / Things



Devices: Many chipsets / platforms to choose from.
(Becoming more and more vertically integrated with software stacks).



ARM



QUALCOMM®

intel Galileo

AMD

MARVELL®

MICROCHIP

ARDUINO



electric imp



NVIDIA

Big focus on prototyping:
Lots of tools to cater to the makers and tinkerers

Integrated SDKs to speed development, testing and optimization.

MARVELL



intel Galileo



electric imp



QUALCOMM



Dragonboard based on Snapdragon processor (many more like this from many vendors)

QUALCOMM®

RS 232 socket

Ethernet

5M camera

1M camera

HDMI

Snapdragon S3
APQ8060

Radio Card
•WLAN
•Bluetooth

Touch screen Display

Sensor Board

- Pressure
- Temperature
- Proximity
- Ambient Light
- 3-axis
- Accelerometer
- Gyro
- Compass

Keyboard

JTAG
x2
pin
socket

Micro
SD
slots

Mini
USB
Port

3.5 mm
Audio
Jack



Sensors: Smart or Simple



Smart Sensors

Onboarding

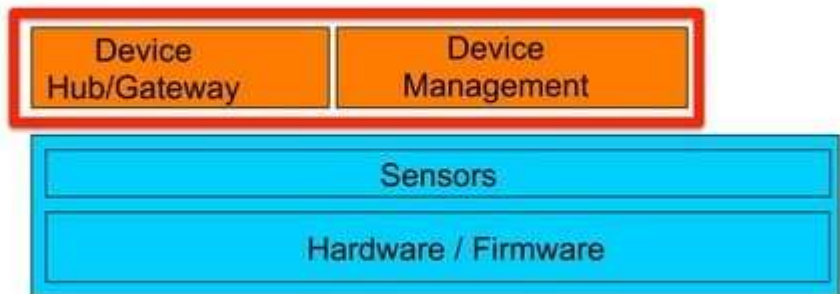
Receive Notifications

Receive Config

Send Data / Events

Simple Sensors

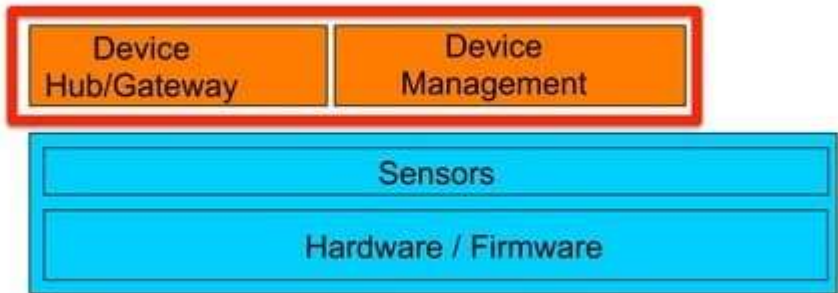
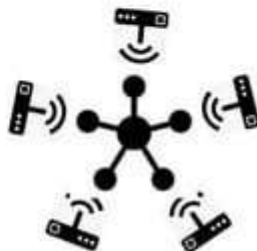
IoT Stack: Device Edge



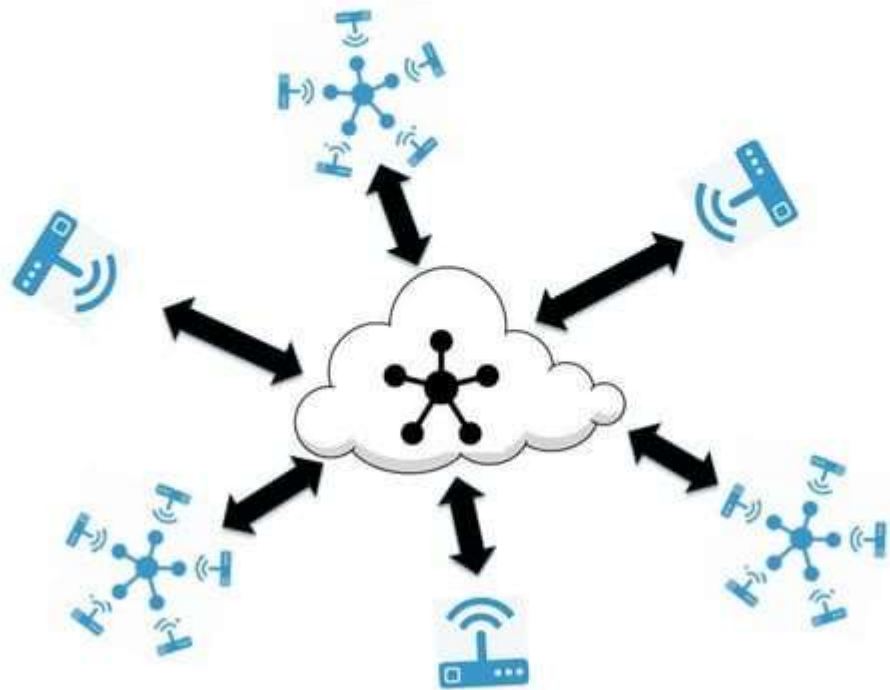
IoT Stack: Device Edge

Key charter is to establish and maintain a secure, robust, fault-tolerant connection between the cloud and the edge devices in order to:

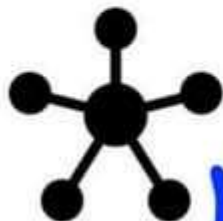
- Collect and aggregate device data
- Manage the device



Typically a combination of a localized gateway, and a cloud based gateway, at the edge



Reference capabilities for a gateway



Enable scalable, real-time, dependable, high-performance and interoperable data and device management related exchanges between publishers and subscribers

Connectivity

Software mgmt

Registry

Routing

Control Events

Actuator

Aggregation

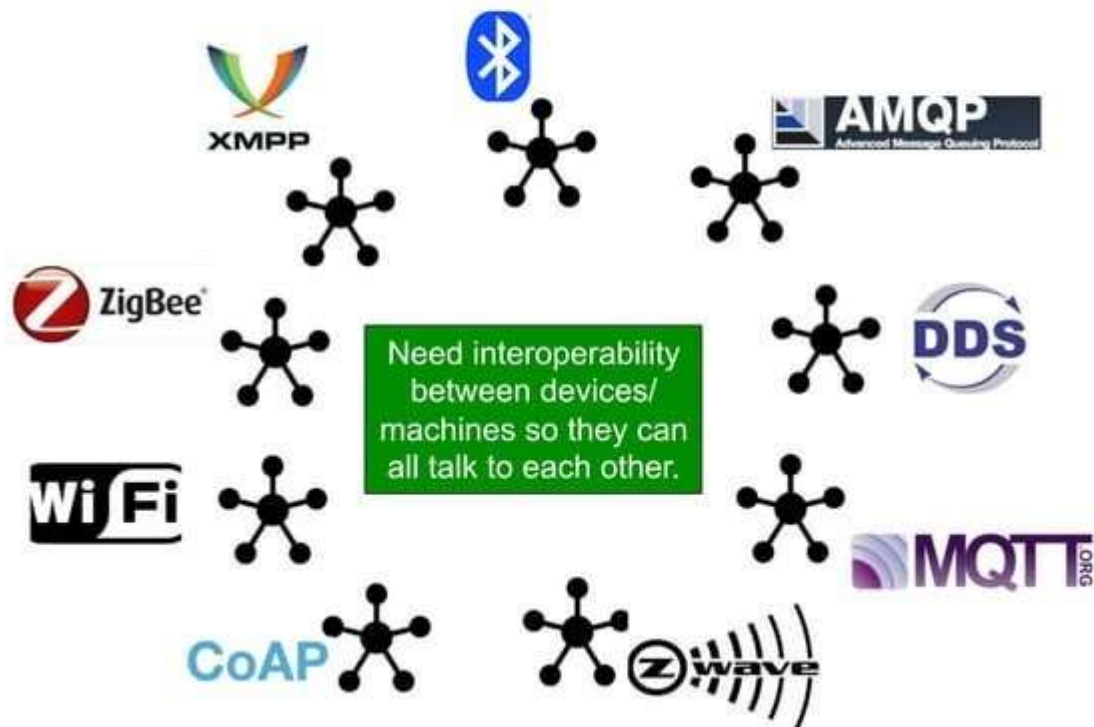
Transformation

Provisioning

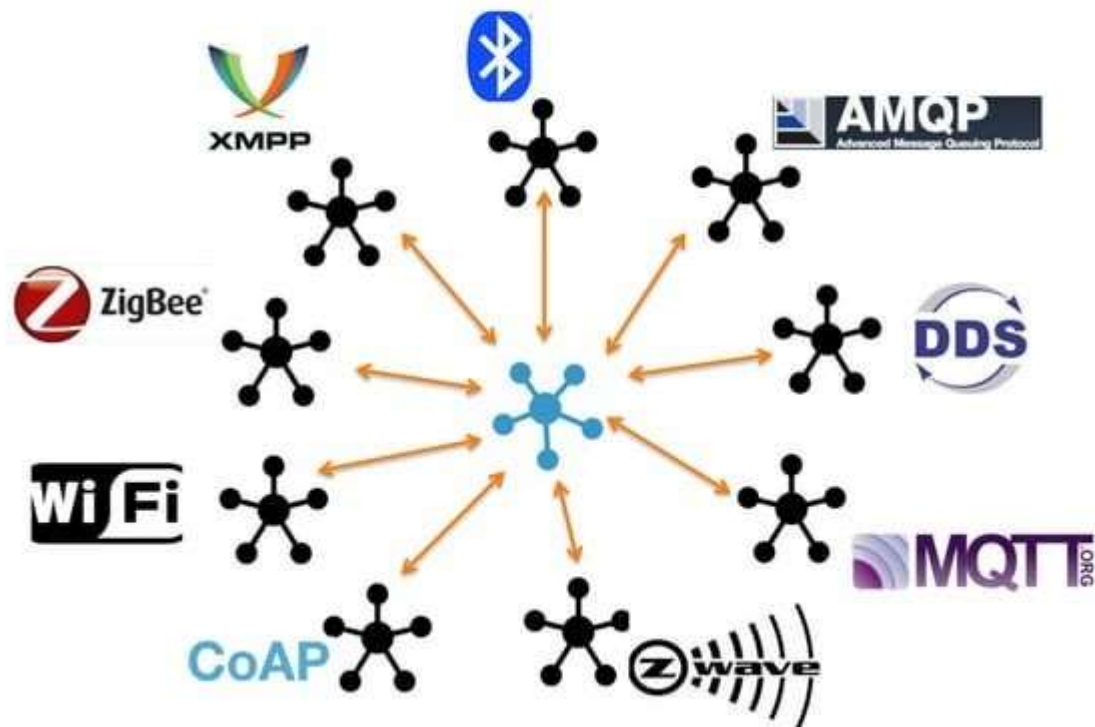
Device, and Device gateway sprawl is going to be a challenge



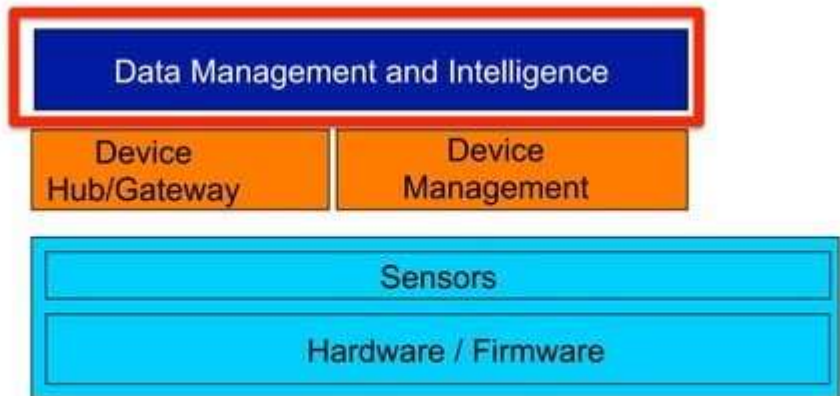
Solution to the sprawl: A hub of all hubs



Solution to the sprawl: A hub of all hubs



IoT Stack: Data management and intelligence



Capabilities required for Data Management and Intelligence



- Data collection, storage, and analysis of sensor data
- Run rules on data streams
- Trigger alerts
- Advanced analytics/machine learning
- Expose HTTP (REST) APIs

Data, HTTP,
connectivity

Data enrichment

Pattern Discovery/
Model re-training

Real time event
processing

Routing and
Orchestration

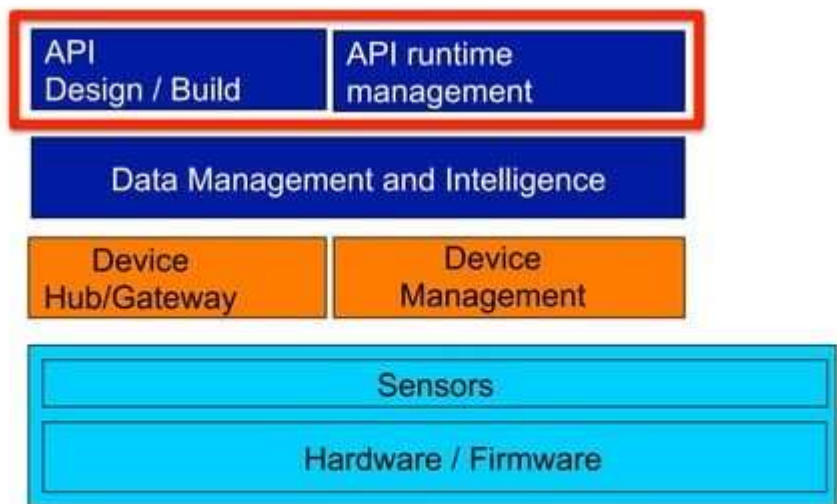
Driving Forces
Identification

Batch processing

BigData solution
connectivity

Predictive Analysis

IoT Stack: API lifecycle tooling and platform



API lifecycle tooling can be split between
design time and runtime

Rapidly design, deploy and publish APIs

API
Design / Build



API runtime
management



API lifecycle: Design time capabilities

Rapidly design, deploy and publish APIs

API
Design / Build



API runtime
management



API design
lifecycle

API spec
creation

Reusable API
patterns

API mocking/
modelling

Deployment
automation

APX Design Lifecycle

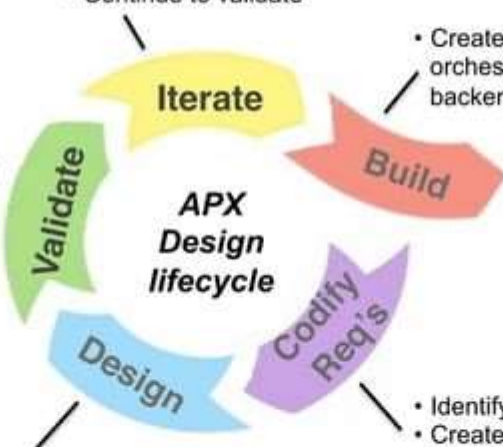
API Design / Build



- Mock up the API
- Publish interactive console
- Create Notebook use cases
- Receive developer feedback

- Modify API design as appropriate based on developer feedback.
- Continue to validate

- Create and implement orchestration logic for backend connectivity

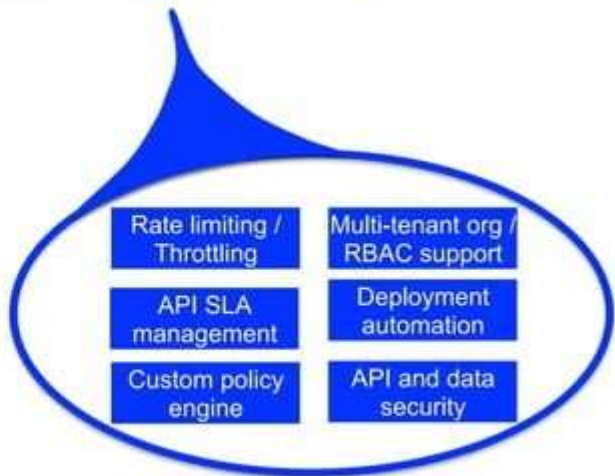
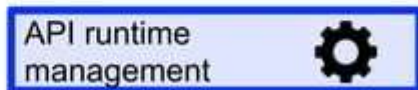


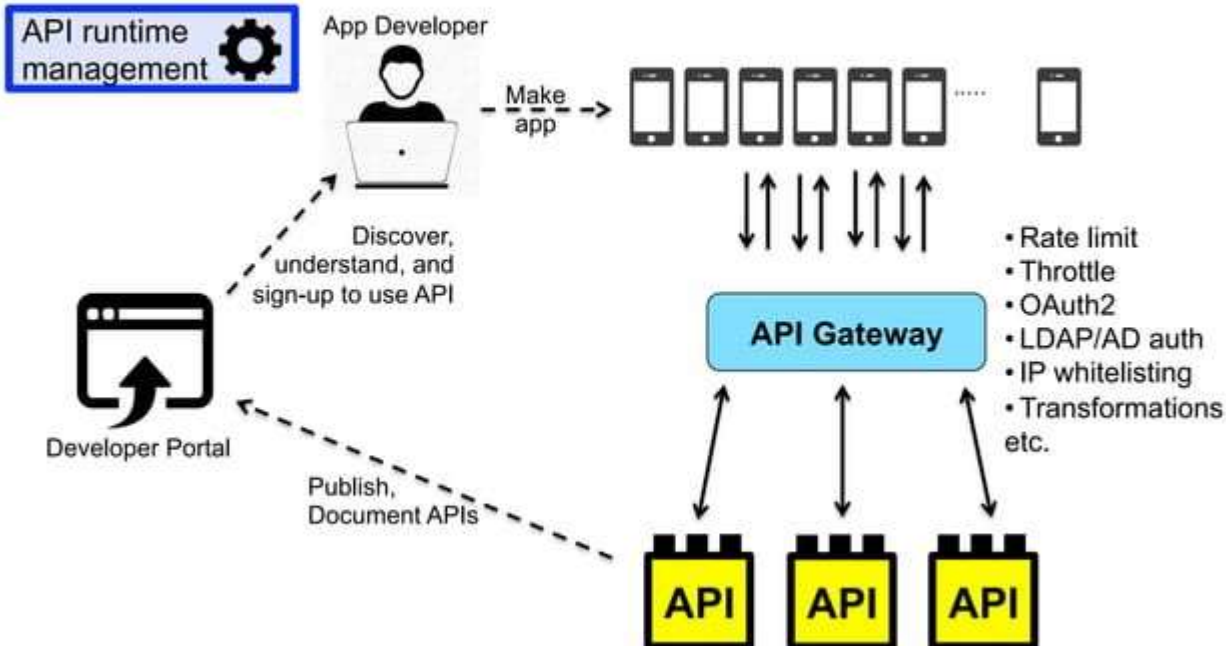
- Model API resource models
- API operations/methods
- Request/response payload/codes

- Identify process and biz reqs
- Create logical data model
- Translate into logical service/API groupings

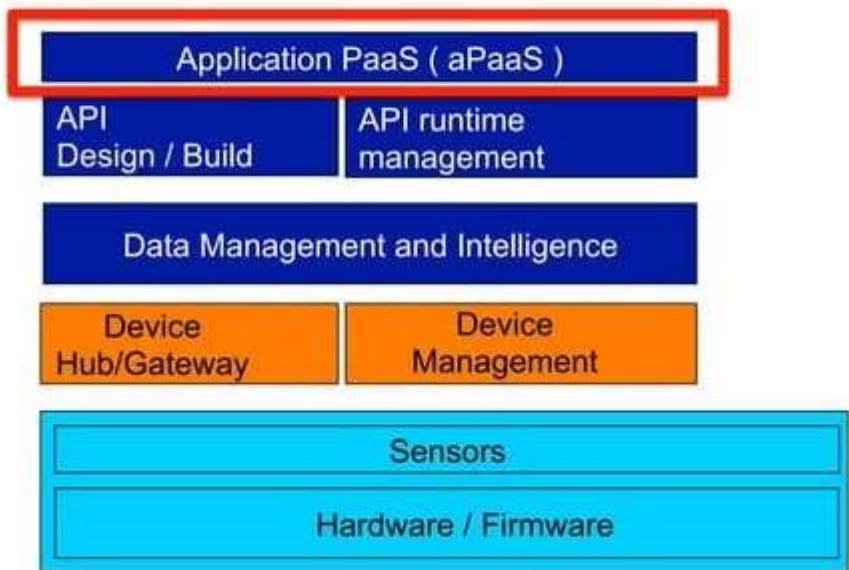
API lifecycle: Runtime capabilities

Rapidly design, deploy and publish APIs





IoT Stack: Application PaaS (aPaaS)



Application PaaS (aPaaS) `</>`



- Hosted in the cloud
- Provides platform to build applications.

OS/DB, Storage, Server,
Network

Design and
Development tooling

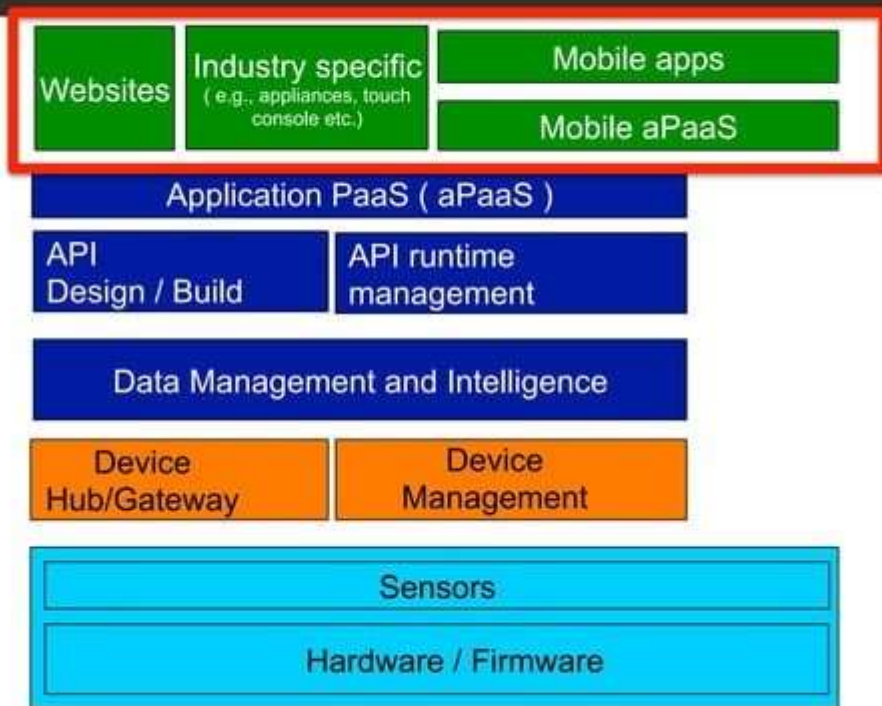
Management and
analytics tooling

Routing, transform,
orchestration services

Web, Database,
Application Server

Administrative portal

IoT Stack: End applications

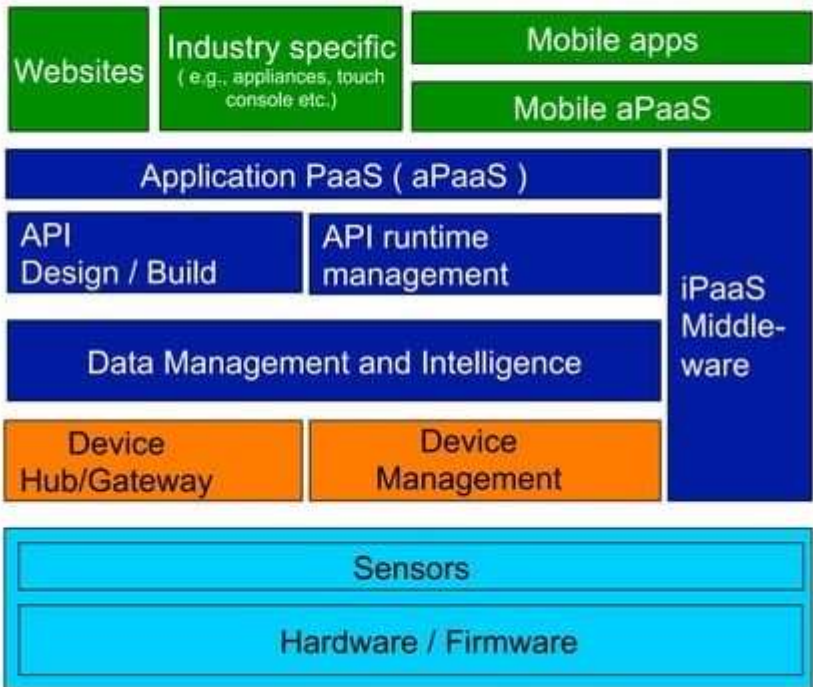


IoT/IoE is a driver of mobile / tablet interfaces

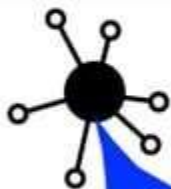


IoT Stack: iPaaS integration – middleware: Don't forget to integrate!

iPaaS
middleware



iPaaS Capabilities: Don't forget to integrate!



Graphical Data Transform

- Business Event Analyzer
- Service Flow Analyzer
- Runtime Perf. Manager
- SLA Alerts
- Dashboard

Enterprise Console: Tracking & Governance

Integration Design Time

- Flow Orchestration
- Service Container
- BPM
- Rules Engine
- CEP

Core Integration Runtime

- Enterprise Security
- REST/SOAP Publishing
- Error Management
- Routing/Mediation
- Mapping/Transform

Code and Visual UI

HA Cluster / In-memory Data grid

Connector DevKit

Cloud Connectors

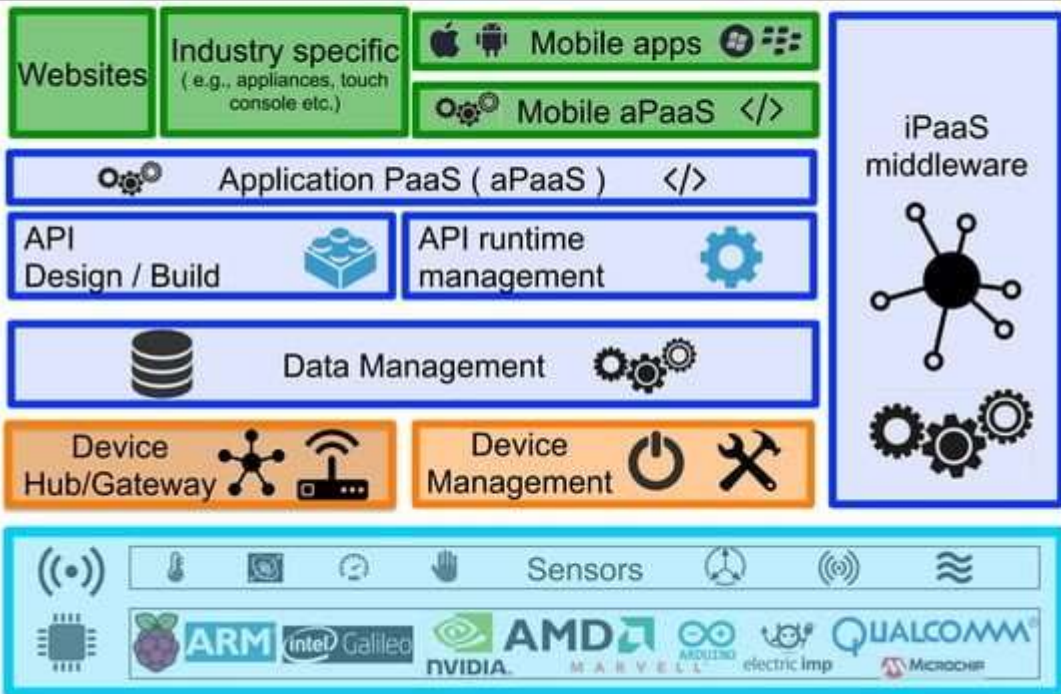
Enterprise Adapters

Connector Platform

Summary



IoT Stack



One final thought: the stack as it exists today is also converging...



App

Data Processing and
Platform

Edge

Thing / Device