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# IoT Platforms & Key Technologies for Smarter Cities

IoT PLATFORM FOR SMART CITIES AND MOBILE ASSETS

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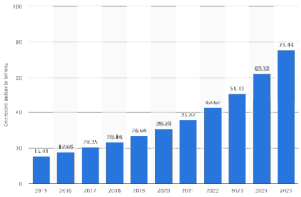
## What is IoT ?

- The **Internet of Things** (**IoT**) is the network of physical devices, vehicles, home appliances and other items embedded with electronics, software, sensors, actuators, and connectivity which enables these things to connect and exchange data, creating opportunities for more direct integration of the physical world into computer-based systems, resulting in efficiency improvements, economic benefits and reduced human exertions.



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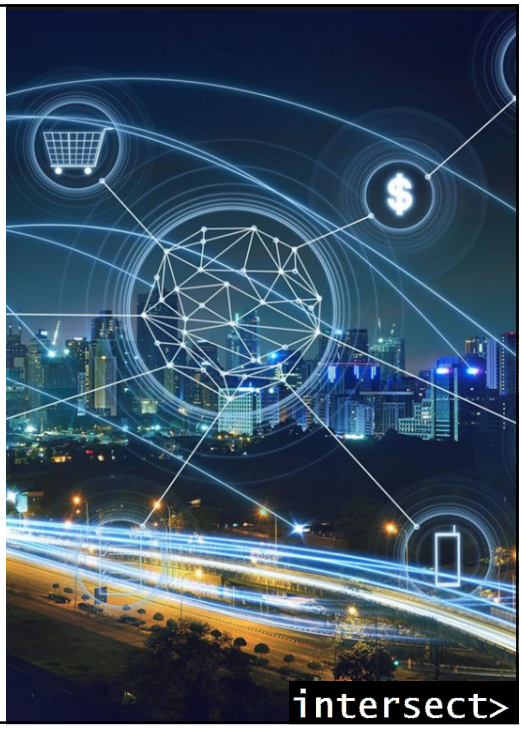

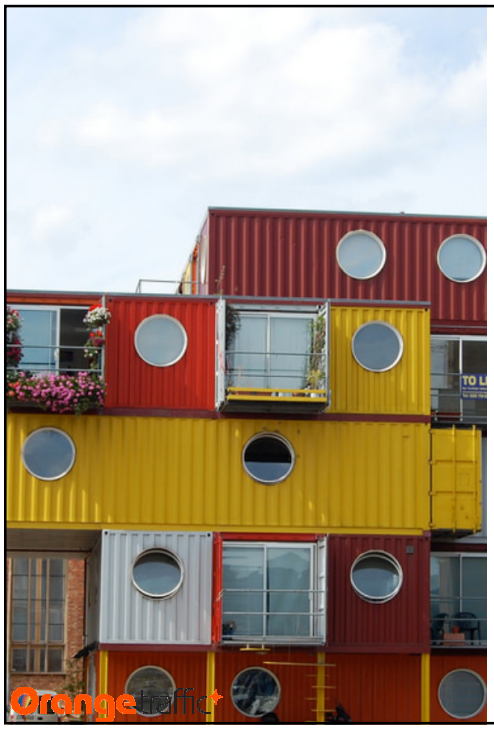

# What is an IoT Platform?

- An assembly of multiple technologies that enables information systems to connect and interact with objects and devices (cloud, wireless, connectivity, objects)
- Leverages IoT principles
- *May* or *may not* include data storage and analytics
- Standard interfaces
- Simplified creation of components, workflows and functions

Linking the virtual and the real worlds together

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# Who Needs an IoT Platform?

- Everyone (ITS is a team sport)
- Cities to :
  - improve operations
  - offer new / better services
  - protect key locations' data sources (real estate)
- Consulting firms/integrators in ITS to :
  - Reduce implementation efforts
  - Offer new possibilities
  - Maximize asset return (ex: PPP)
- Equipment manufacturers
  - Increase use of hardware - new markets
  - Enable easy integration
  - Maximize value creation
  - Reduce time to market
  - RoA (Return on Algorithms)

Have a SPECIFIC GOAL
A platform is a tool not an end result

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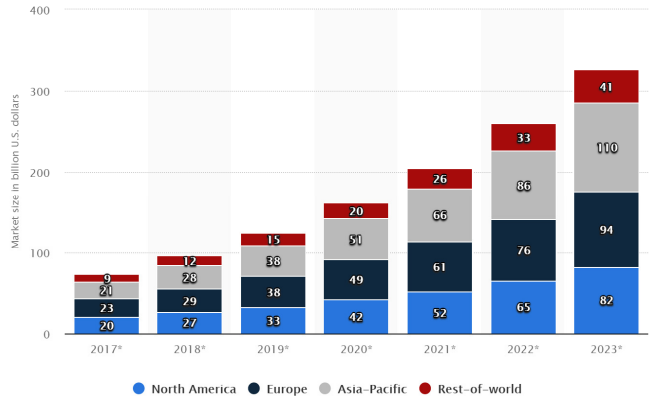
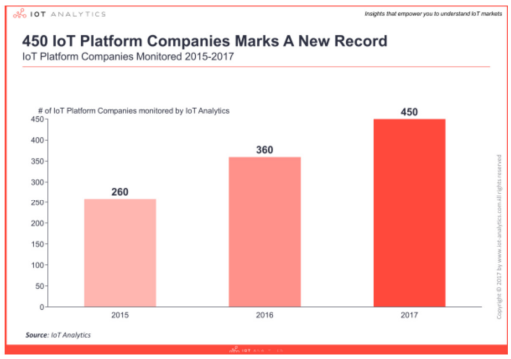
# Market & IoT Platforms




*The IoT platform market keeps growing with more players but for how long – source and more information IoT Analytics*

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# Components in the IoT World

| Principles | Components |
|---|---|
| 1. Focus on value | Analytics, UX |
| 2. Reduce friction | Interchange mechanisms |
| 3. Separate your concerns | APIs & Ecosystems |
| 4. Contextualize | Sensors, metadata |
| 5. Be agile | Device management |
| 6. Use data responsibly | Data storage in proper location |
| 7. Connect and interact | and formats, security |
| 8. Operate transparently | Gateway and real-time intf. |
| 9. Security | Open interfaces |
| | Two-way protection, laws |

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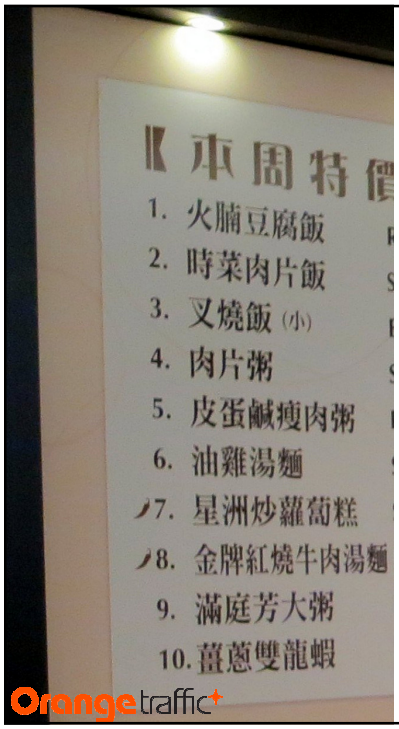


## APIs & SDKs

- API : Application Programming Interface
- Offers services to other softwares or components ; Normalizes interactions;
- Enables reusability of components
- Local VS Global
- Simple and language-universal
- Hardware abstraction (HAL)

## To Edge or Not to Edge ?

- Local reaction
- Reduced bandwidth usage
- Transformation at extraction
- Operations in degraded modes (ex: no network)
- Reduced latency
- Temporary storage

**Edge computing** is a method of optimizing cloud computing systems "by taking the control of computing applications, data, and services away from some central nodes (the "core") to the other logical extreme (the "edge") of the Internet" which makes contact with the physical world.[1]


# Real-Time

- **real-time computing** describes hardware and software systems subject to a "real-time constraint“
- The idea behind IoT is to always operate in real-time when you can
- Hard VS Soft real-time
- Connected vehicle require a quick response
- DSRC and C-V2X are current solutions for vehicle communications and interaction at the Edge, with real-time requirements

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# Separation of Concern

- Do one thing
- Do it right
- Pick the best for each role

**separation of concerns** (**SoC**) is a design principle for separating a computer program into distinct sections, such that each section addresses a separate concern.

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## "Data is the new oil" ? Not so fast …

- Extraction, transport, refining, shipping of finished product, usage, interesting parallel, but it is not accurate
- The difference is that :
  - You can pre-process, filter, and aggregate data on-site
  - You can refine the same raw data in two locations and create two finished products with the same feed
  - The quality and value of the finished product is often linked to the variety of sources of raw data
  - Value also depends on data quality, quantity, and understanding of the context of extraction and metadata

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## Security

- Multi-Layered protection
  - Physical access (Edge)
  - Network access
  - Server access
  - Devices (DoS, Agent)
- Encryption
- Certificates
- Hardware ties
- Built into the platform

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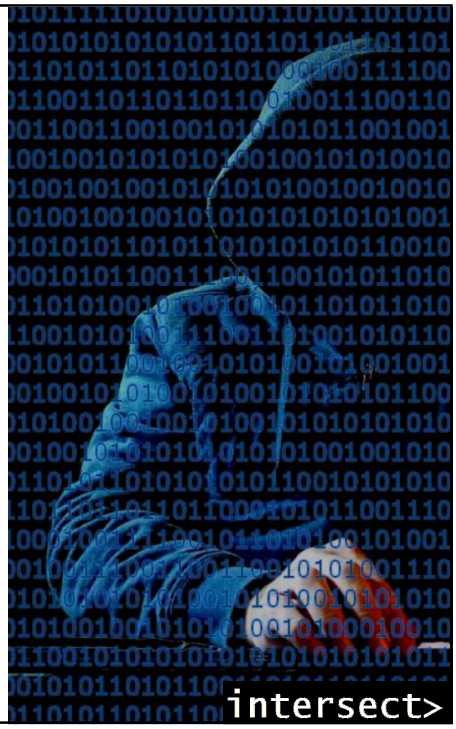
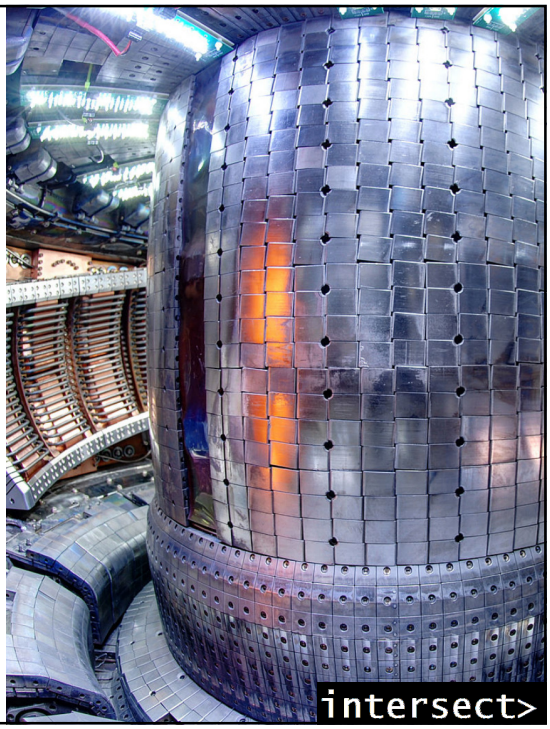


# Sensor Fusion

- Usually every measure requires one sensor with its limitations and calibrations
- Sensor fusion generates new measurements through a combination of sensors
- Fusion can validate single sensor operations
- We need more non-dedicated data sources



The interior of Alcator C-Mod as seen from F port
Image : Robert Mumgaard License : Creative Commons

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# Data Storage

- Storage means responsibility
- Real-time operation with selective storage may be a good trade-off
- How much weight do you want to carry ?

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## *Open Data* VS *Owned Data*

- Major trend towards data openness
- Ownership is even more important and must be discussed
- When you own you can share, trade, monetize, or stop its use by third parties
- Cities must own their data ***then*** share, trade, monetize as appropriate to optimize their operations
- Read the small print !

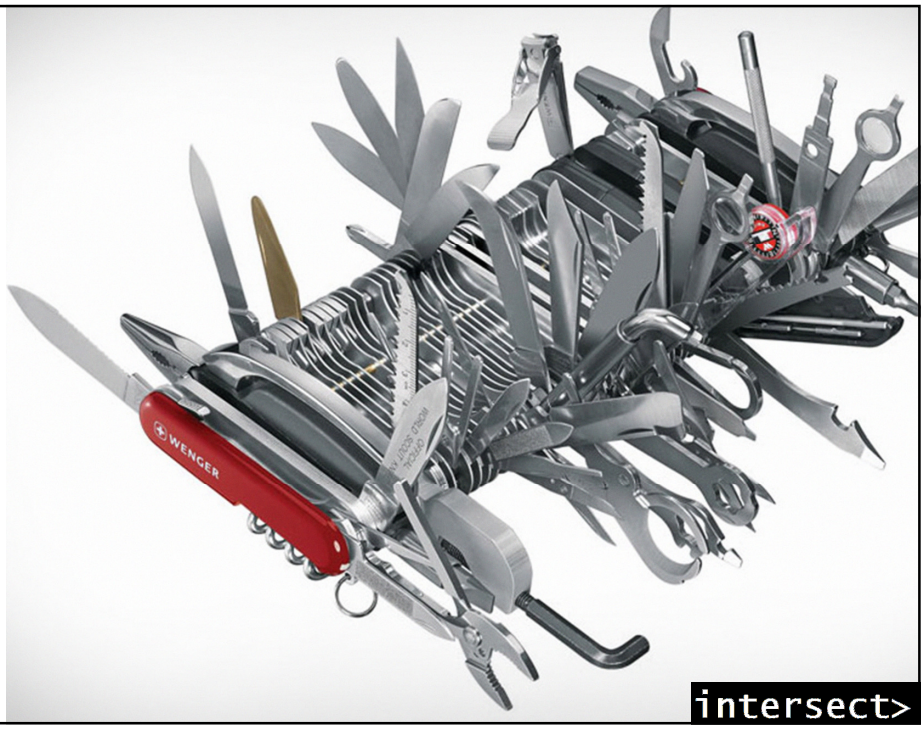
## Data Management

- Access limitations to raw data or meta-data
  - Aggregation
  - Backfill
  - De-Personalized
- Captivity
  - Accessible hardware with embedded recurring fees
  - Specific carrier
  - Data not owned by city – you can use data but do not own it
- Storage
- Forced to use one supplier for subsequent feature additions

**What is important is to know that it exists, and be able to determine when they are an acceptable compromise to reach your objectives**

# What is Intersect ?

It is an IoT platform dedicated to enabling the creation of smarter infrastructures and mobile assets.

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# Ultimate goal – a better city !

Smart city with good mobility, green, connected, inclusive and interactive

# THANKS!

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