Everything you Ever Wanted to Know about the IoT Universe

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Things
Connectivity
Fog
Cloud
Analytics
Outcomes

Things

The Internet of Things consists of devices, connectivity, data, analytics and outcomes.

The Internet of Things represents
an opportunity of tens of billions o
connected devices and a multi-
trillion dollar market where 70% o
value comes from B2B scenarios.

- Moore’s law: Faster and cheaper computing power
- Metcalf‘s law: Value of network increases as nodes increase
- Koomey’s law: Increasing amount of compute per KWh.

The perfect storm of energy efficient + low cost hardware, pervasive wireless, simple development and cloud computing power to crunch big data allows things to do their thing.

Sensors sense & actuators act.

Sensors & actuators are typically connected to a small device called a microcontroller or MCU like you find on the Arduino UNO.

Sometimes, sensors & actuators are connected to larger devices like the Raspberry Pi that can support an embedded operating system.

The amount of available CPU, ROM, RAM & storage resources typically drive which programming languages can be used.

Things use device SDKs to handle two-way communication w/ gateways & clouds via the most widely used transports & wire protocols.

Device SDKs help things model & serialize the data they send & the commands they receive while providing local persistence & retries.

Things get security & identity help
from Device SDKs w/ support for
transport encryption plus gateway
& cloud authentication.

To be successful, device SDKs must work w/ the most widely used programming languages & run on the most widely used operating systems.

Connectivity

Consumer things typically communicate their internal state via HTTP and RESTful APIs.

ndustrial things often
communicate their internal state
via existing M2M wire protocols.

M2M wire protocols used by
things include AMQP, MQTT,
CoAP, LWM2M & XMPP just to
name a few.

Some things discover and communicate their internal state directly with other things.

Things transmit over a variety of wireless protocols including Wi-Fi, Bluetooth, ZigBee, Thread, Z-Wave, LoRaWAN, Sigfox, & Cellular.

Some things talk to each other via
6LoWPAN (IPv6 over low-power,
wireless personal area networks).

Other things talk directly to the cloud. #IPv6

Things on-the-go or residing in remote areas may use SIM cards provisioned by a mobile operator or a connectivity service provider.

Fog

Most things in homes, factories and other types of buildings talk to a field gateway which often lives at the network's edge.

Field gateways often translate the
wire protocols of things they're
talking to when speaking different
languages.

To be useful, field gateways must communicate via myriad wireless & wired technologies.

Simple field gateways act like routers & pass everything they receive to the cloud.

Smarter field gateways aggregate & filter the data destined for the cloud based on rules.

ntelligent field gateways bring
advanced analytics out to the
edge & may make decisions w/o
the cloud.

The derived insight response time for your #IoT solution will dictate whether decisions are made in the fog computing layer or the cloud.

Cloud

Telemetry is sent securely over the Internet from things or field gateways to a hyper-scale, cloud based, IoT platforms.

oT platforms handle identity and security by registering each thing & assigning them a key/token in order to perform per-device authentication.

n addition to maintaining a list of
devices, IoT platforms store extra
metadata about your things to
provide context.

oT platforms must also send
commands to update the state or
change the behavior of registered
things.

Companies w/ critical M2M & SCADA systems may be wary of sending data over the Internet and prefer to use private circuits.

Each data event must include a unique identifier so a lookup can be performed to determine metadata about its source.

Analytics

Data will follow either a real-time (hot path) or batch (cold path) for analytics.

Whichever analytic path the data follows, the latest state of the device sending telemetry must be saved.

n a hot path, data is handled by
event/stream processing
technologies and/or custom code.

n hot path analytics, a set of rules
are applied to both streaming and
reference data to trigger events
and alarms.

n a cold path, data is serialized
and saved to storage for later
analysis.

Predictive analysis can be performed on cold path data via Machine Learning technologies.

We've gone from static reports to interactive dashboards to predictions and recommendations that drive decisions and action.

Whether the analysis is simple or complex, the derived insights represent the value prop of IoT.

Outcomes

Actionable insights are visualized w/ reporting dashboards and/or web apps.

Other insights require integration with other backend systems.

Mobile apps are a great way to turn insights into action on any mobile device.

nsights can be shared with a
broad ecosystem of employees,
customers and partners using
Web APIs.

Things need full lifecycle device management just like your smartphone.

Be cognizant that IoT solutions can be price sensitive since everybody gets paid: sensors, MCUs, power, connectivity, platforms, storage, analytics and outputs.

Due to this price sensitivity, use cases that provide minimally incremental value won't cut it. Your IoT value prop must be big!

oT devices in the future will get
smaller, their compute power will
grow, batteries will last longer,
connectivity will become more
pervasive & costs will drop.

n 1969 we received telemetry
from astronauts on the moon &
sent commands to their
spaceship. This IoT mountain is
not too high to climb.

Don’t overthink it.

We’re Done