
# IOT BASED SERVICES

## Presented by Klaus Mößner

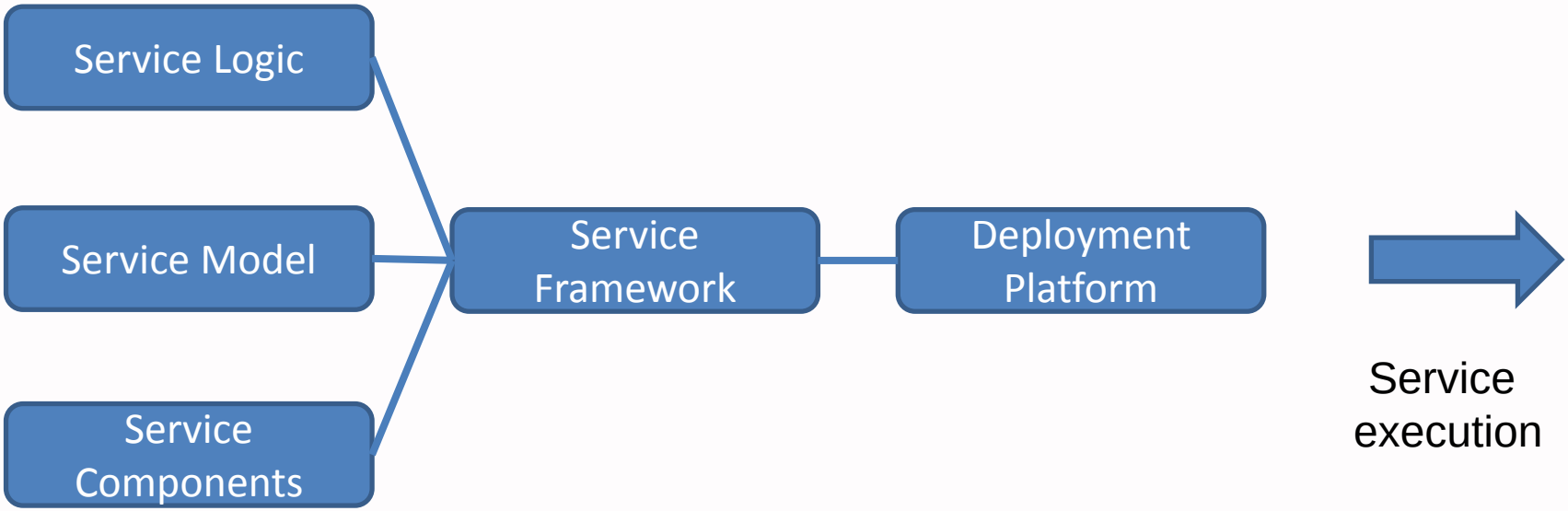
UNIVERSITY OF SURREY


# SERVICES

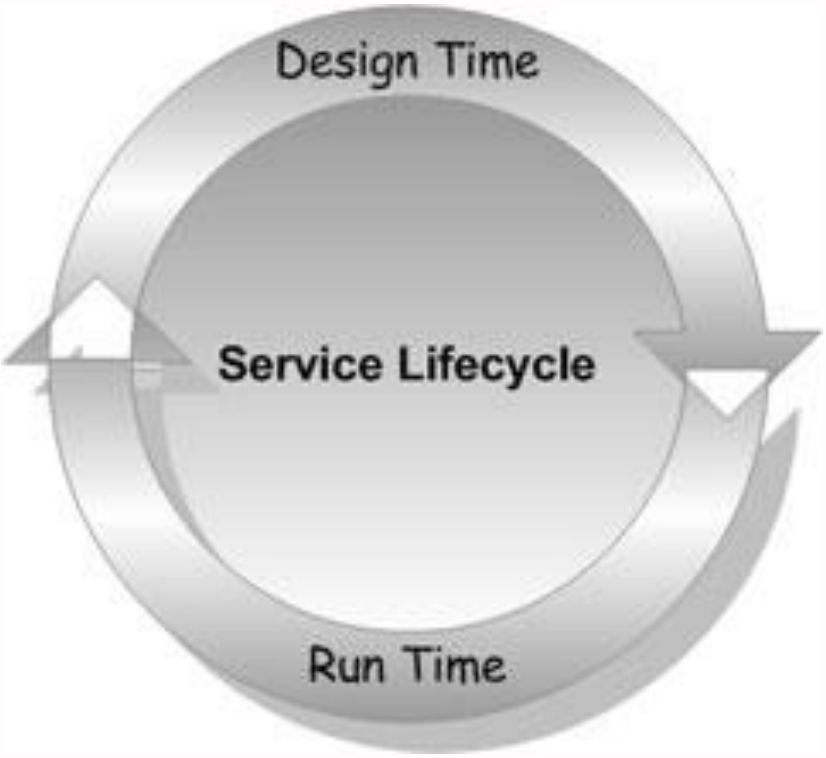
## As we know them

# Simple Service: online payment

# Services – generic elements



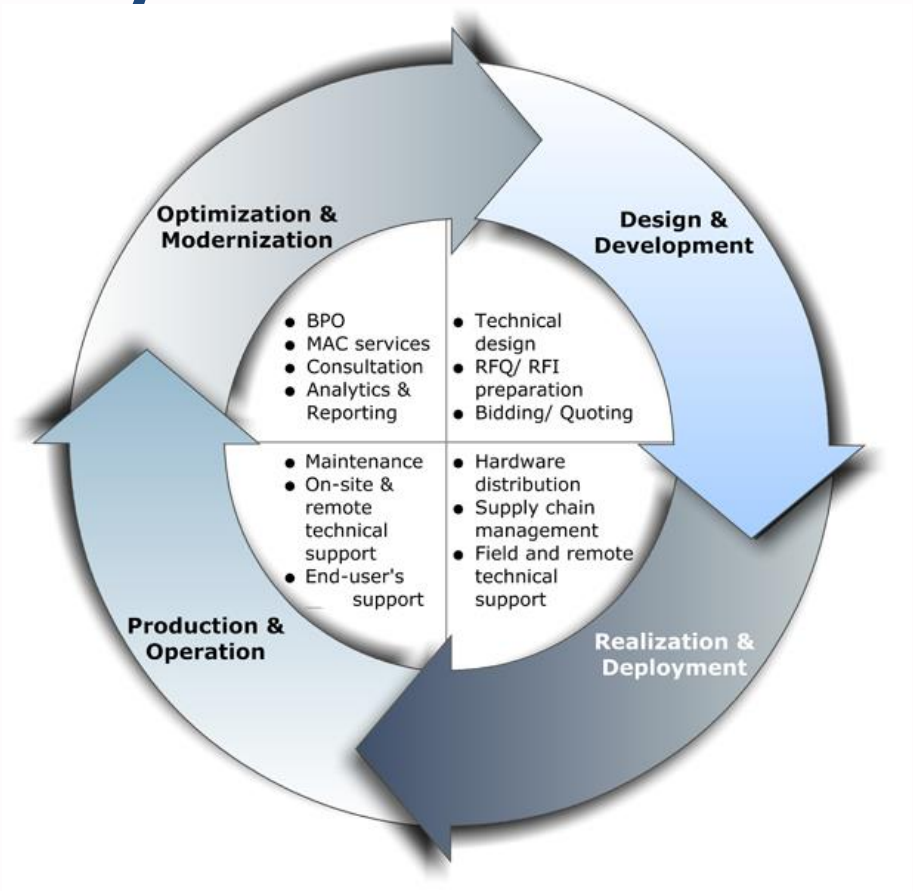
# Service Life Cycle




[http://www.modelingconcepts.com/pages/Srv_Life_Cycle.htm]

# Service Life Cycle

**(less simplistic)**




[http://www.neeco.com/lifecycle-services/overview/]

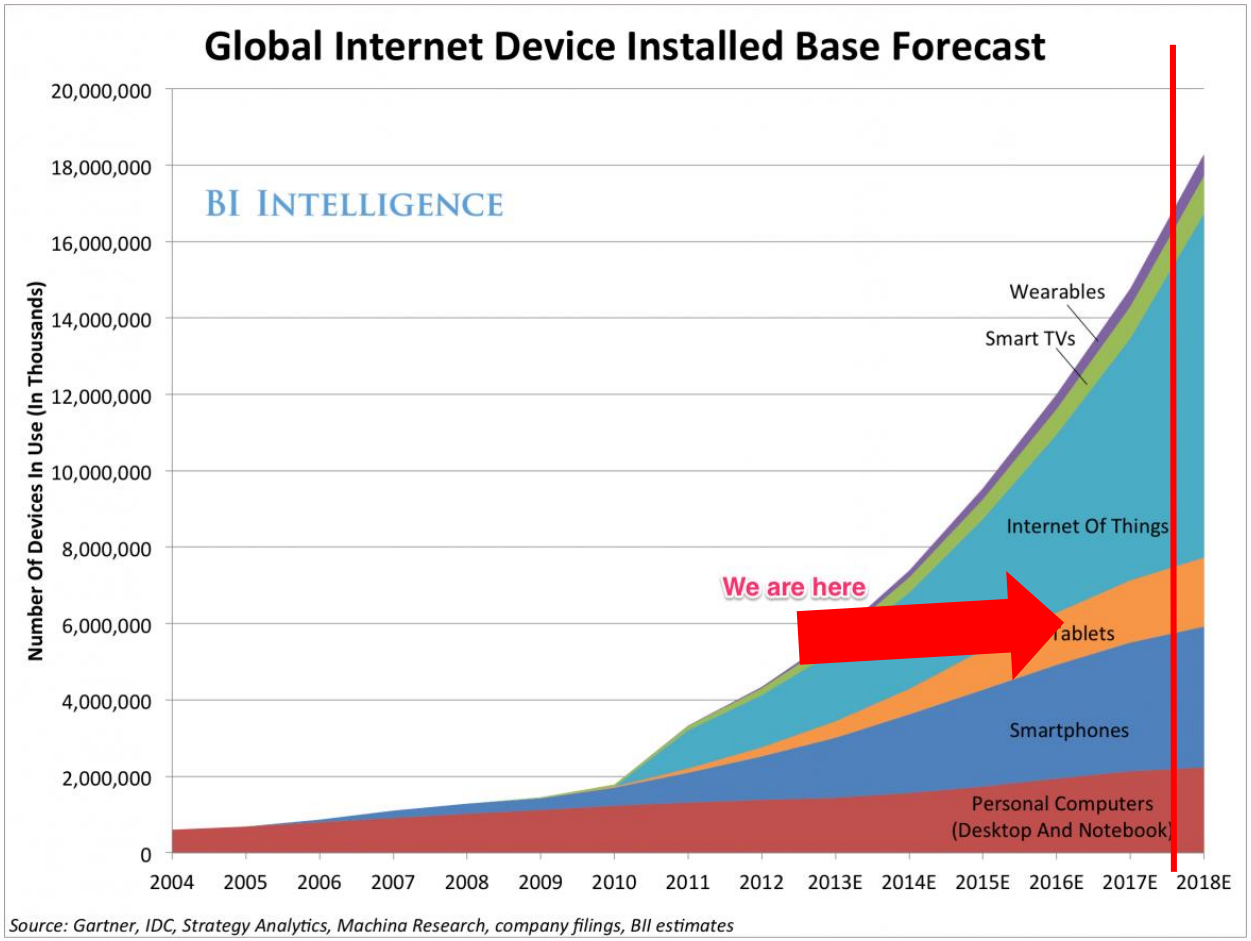
# Quality assurance? → Testing!

- How to test Services?
  - Manually
  - Create service specific automation code (for testing)
  - Use OTS tools (e.g. SoapUI, TTworkbench)
- As service logic is described typically in WSDL, testing can be rather straight forward:
  1. Understand the WSDL file
  2. Determine the operations that particular web service provides
  3. Determine the XML request format which we need to send
  4. Determine the response XML format
  5. Using a tool or writing code to send request and validate the response


# THE IOT

…

# IoT? Why bother?




businessinsider.com.au

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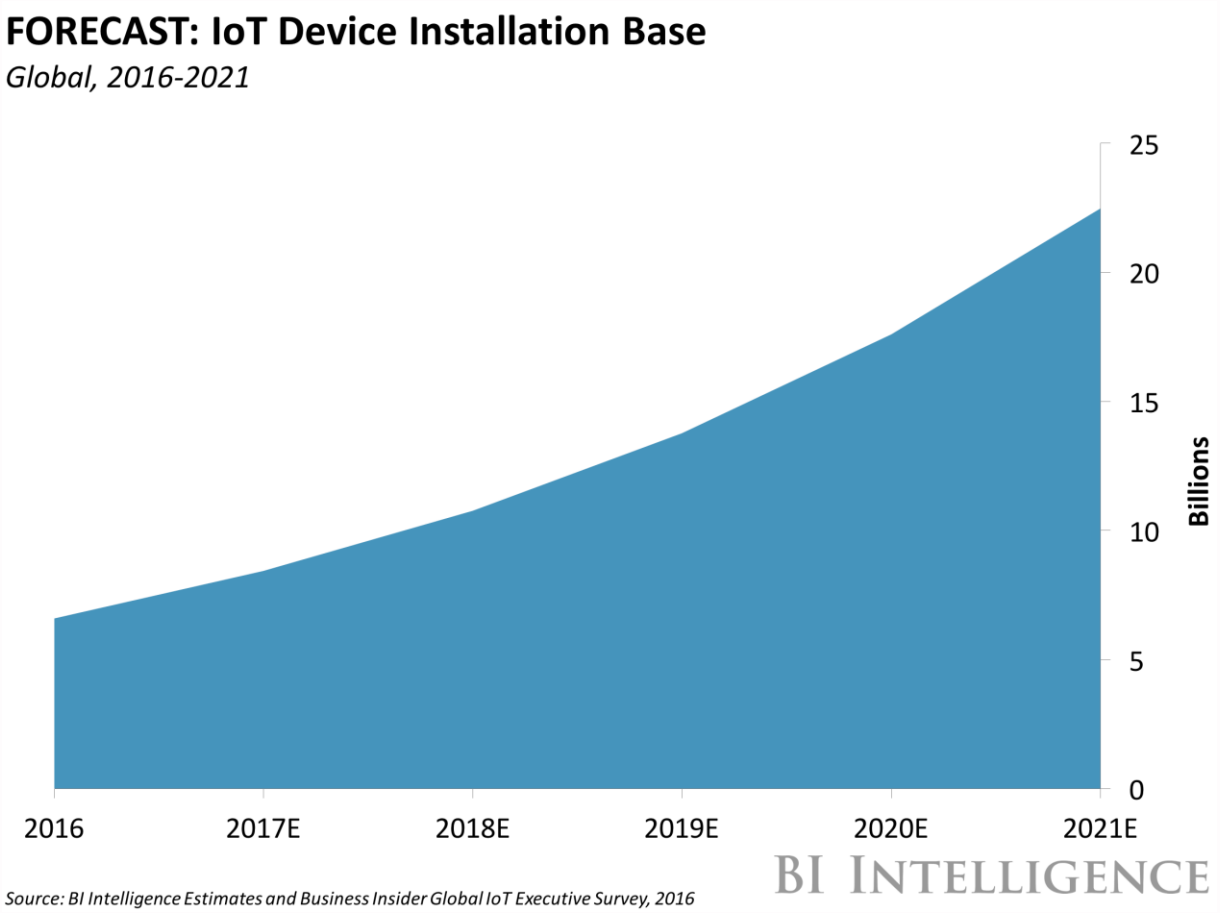


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# Why is the IoT important?

*"The Internet of Things (IoT), is* ***defined as the network of physical objects****—devices, vehicles, buildings and other items—embedded with electronics, software, sensors, and network connectivity that enables these objects* ***to collect and exchange data****…*

*Almost regardless of industry, IoT is predicted to be the single most important factor* ***impacting fundamental business logic*** *in the coming decades."*

Ingrid Wallgren, Business Analyst, 2016

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Home > Features > Data Features

# Boeing 787s to create half a terabyte of data per flight, says Virgin Atlantic

Virgin Atlantic is preparing for a significant increase in data as it embraces the internet of things, with a new fleet of highly connected planes each expected to create over half a terabyte of data per flight.

M
M

How many flights per day?

The report shows that there are **37.4 million flights** scheduled in 2014! That is up 2.7% from 2013. And it means an average of **102,465 flights** per day. The number of daily flights has never before passed **100,000**.

Google

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That's Data Science: Airbus Puts 10,000 Sensors in Every Single Wing!
Posted by Bernard Marr on April 9, 2015 at 7:00pm View Blog

# Automated granting of access rights (to physical objects and data)

theguardian

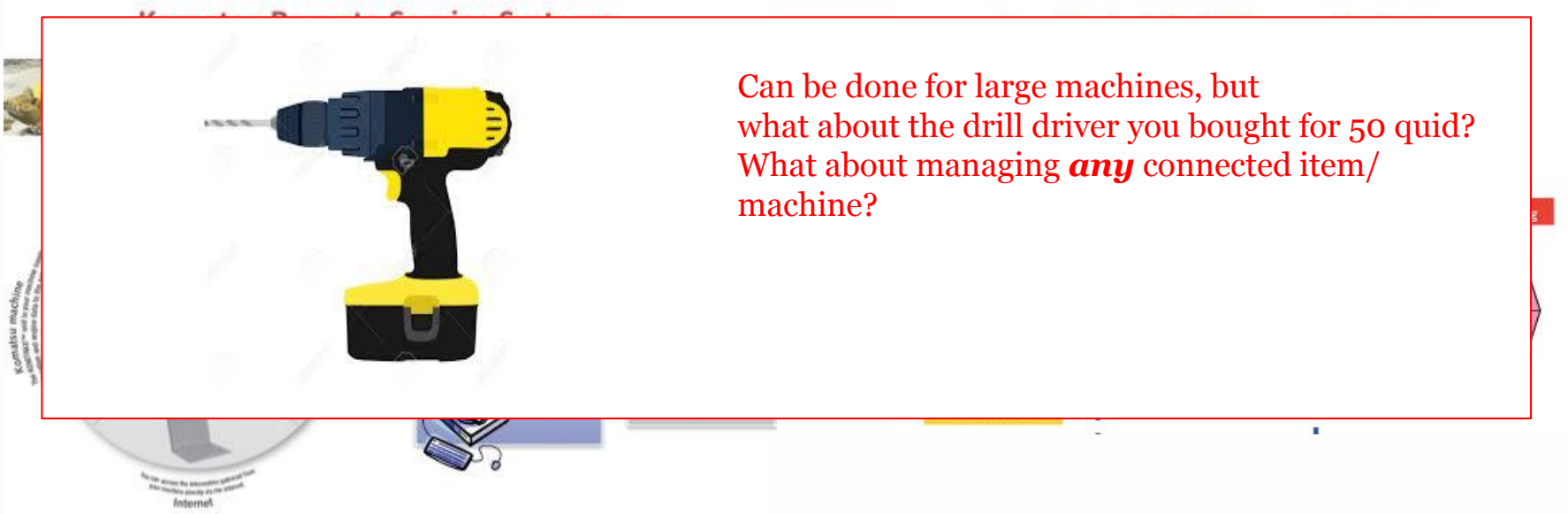
port football opinion culture business lifestyle fashion environment t

## The smart home and a data underclass

The int
data. M

Who grants permission to access and use data or knowledge/information, when? Why? ....

# Machines and maintenance



Can be done for large machines, but
what about the drill driver you bought for 50 quid?
What about managing ***any*** connected item/
machine?

[1] Jay Lee, Hung-An Kao, Shanhu Yang, Service Innovation and Smart Analytics for Industry 4.0 and Big Data Environment, Procedia CIRP, Volume 16, 2014, Pages 3-8, ISSN 2212-8271

Who gets permission to access
and use which part of my data?
How should central access management
work?

7 BILLION PEOPLE – 7 BILLION PERSONAL DATA SETS
(OFTEN QUITE EXTENSIVE)

# Transportation

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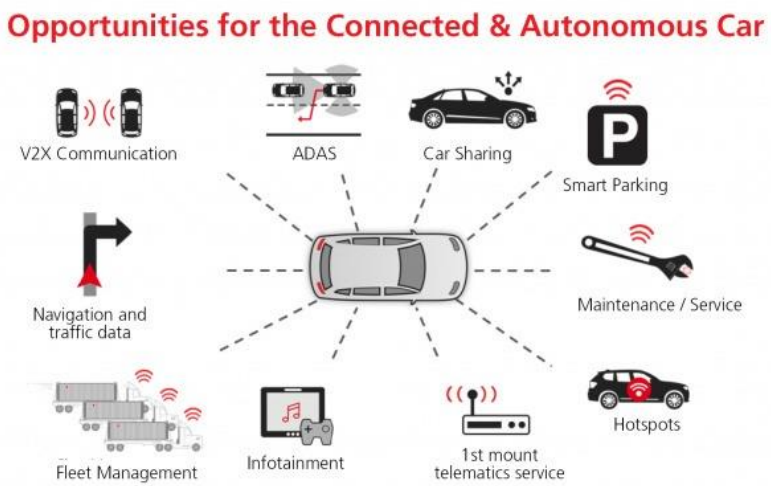
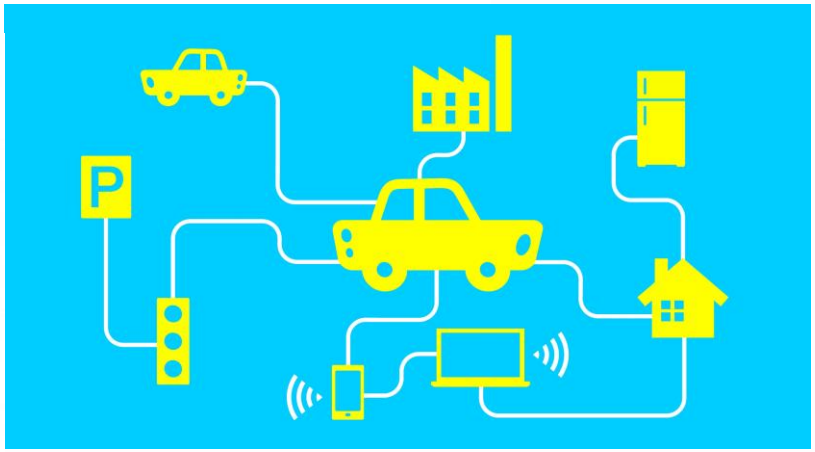
## Connected cars will send 25 gigabytes of data to the cloud every hour




https://www.u-blox.com



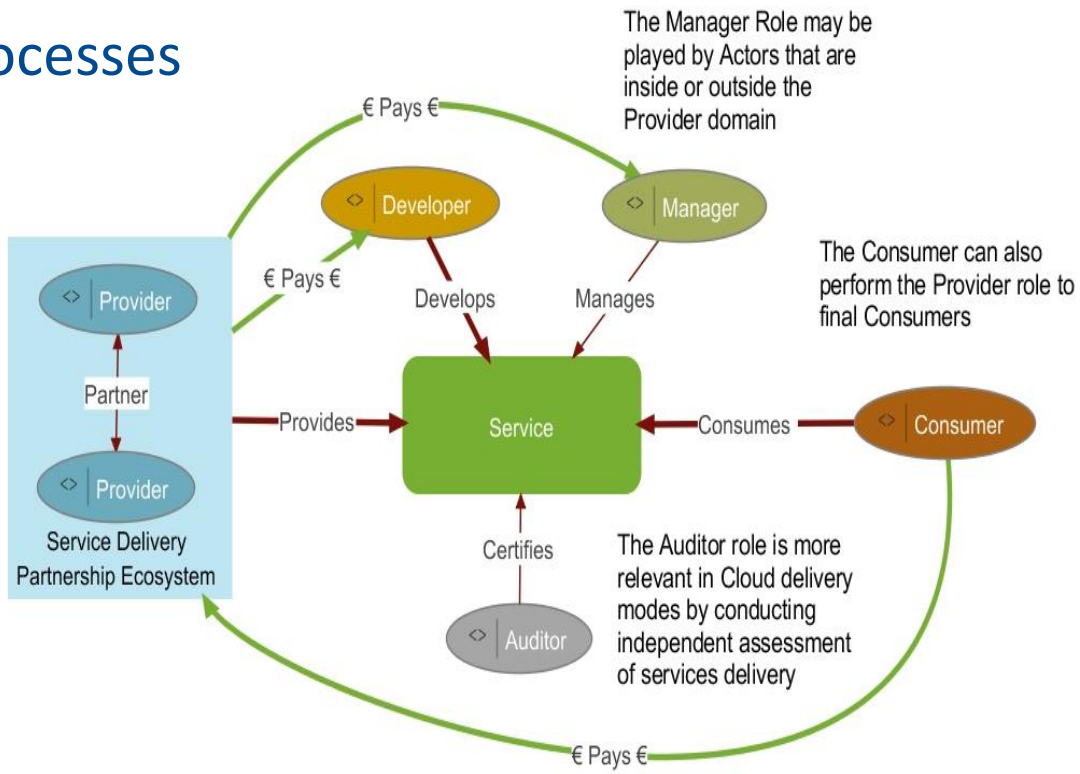
http://blogs.sas.com/


# IOT SERVICES

# Issues with IoT services

- everything is a service, and
- services are business processes

… especially in the IoT



# Looking again at Transportation: Conflict resolution

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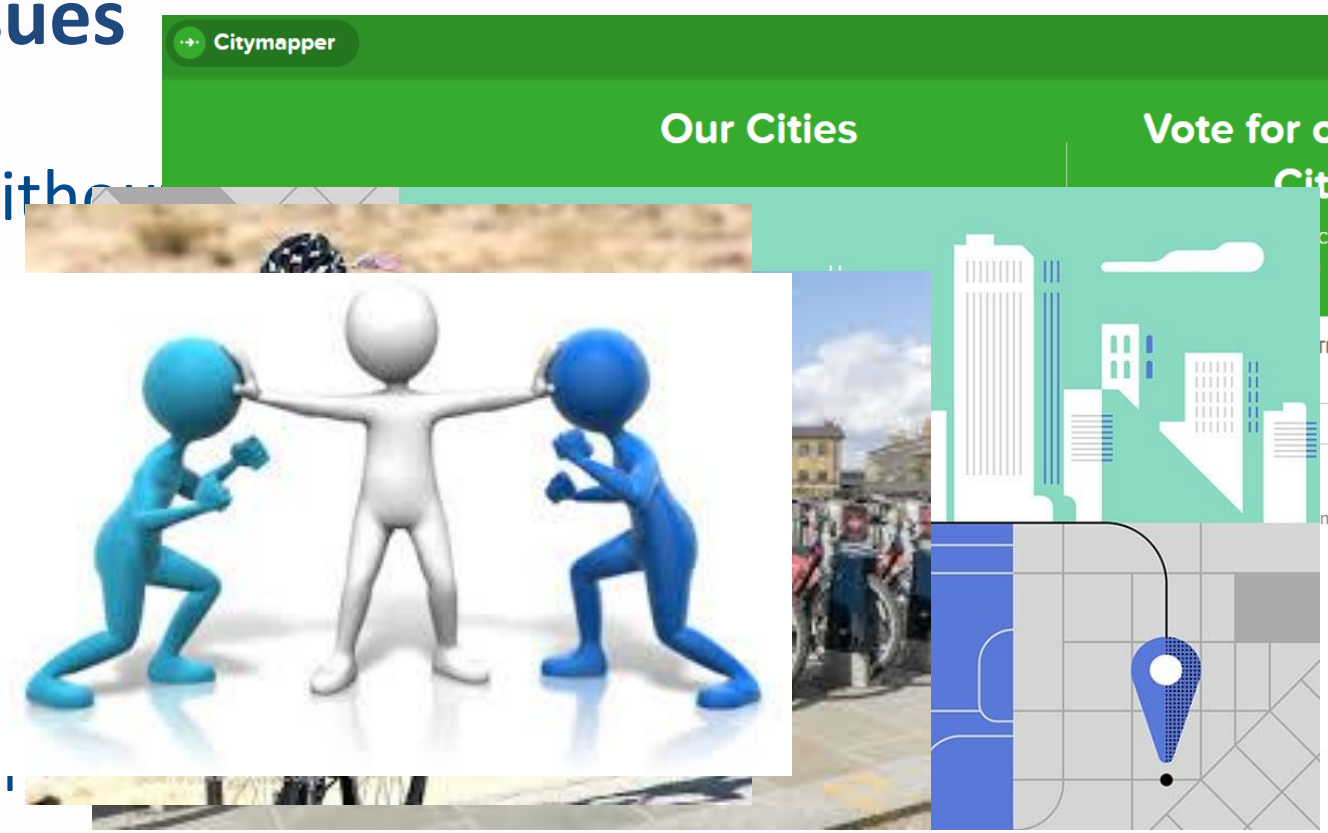
## Connected cars will send 25 gigabytes of data to the cloud every hour



http://blogs.sas.com/

# Functional issues

- IoT services wit
  - Accessibility/L
  - Dependability
- IoT Services w
  - Physical const
  - Logical constr
  - Conflict handl

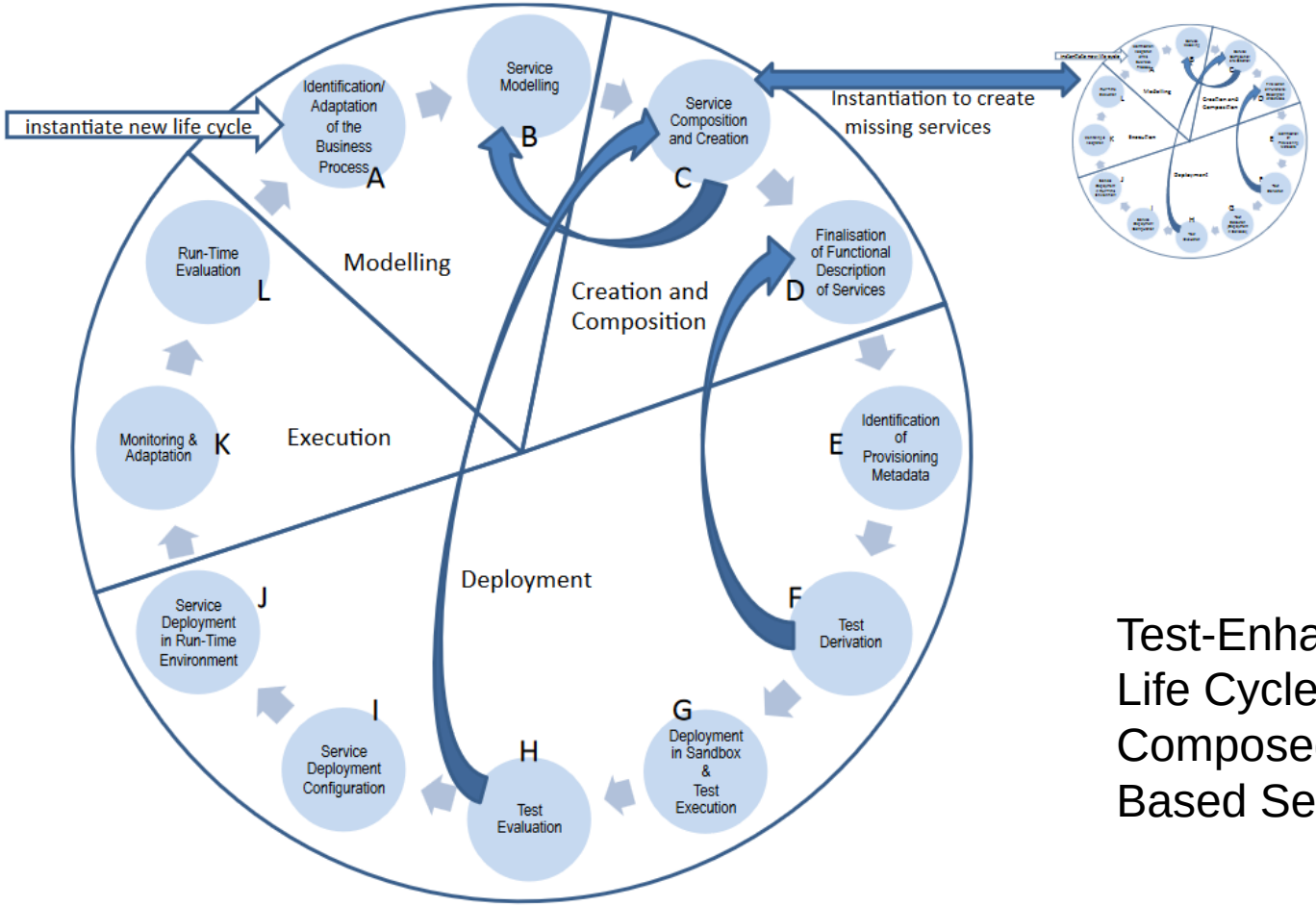


# Looking at the life cycle again

- Provide accessibility
- Ensure dependability
- Ensure operation under physical constraints
- Ensure operation under logical constraints

…

# The IoT Service Life Cycle



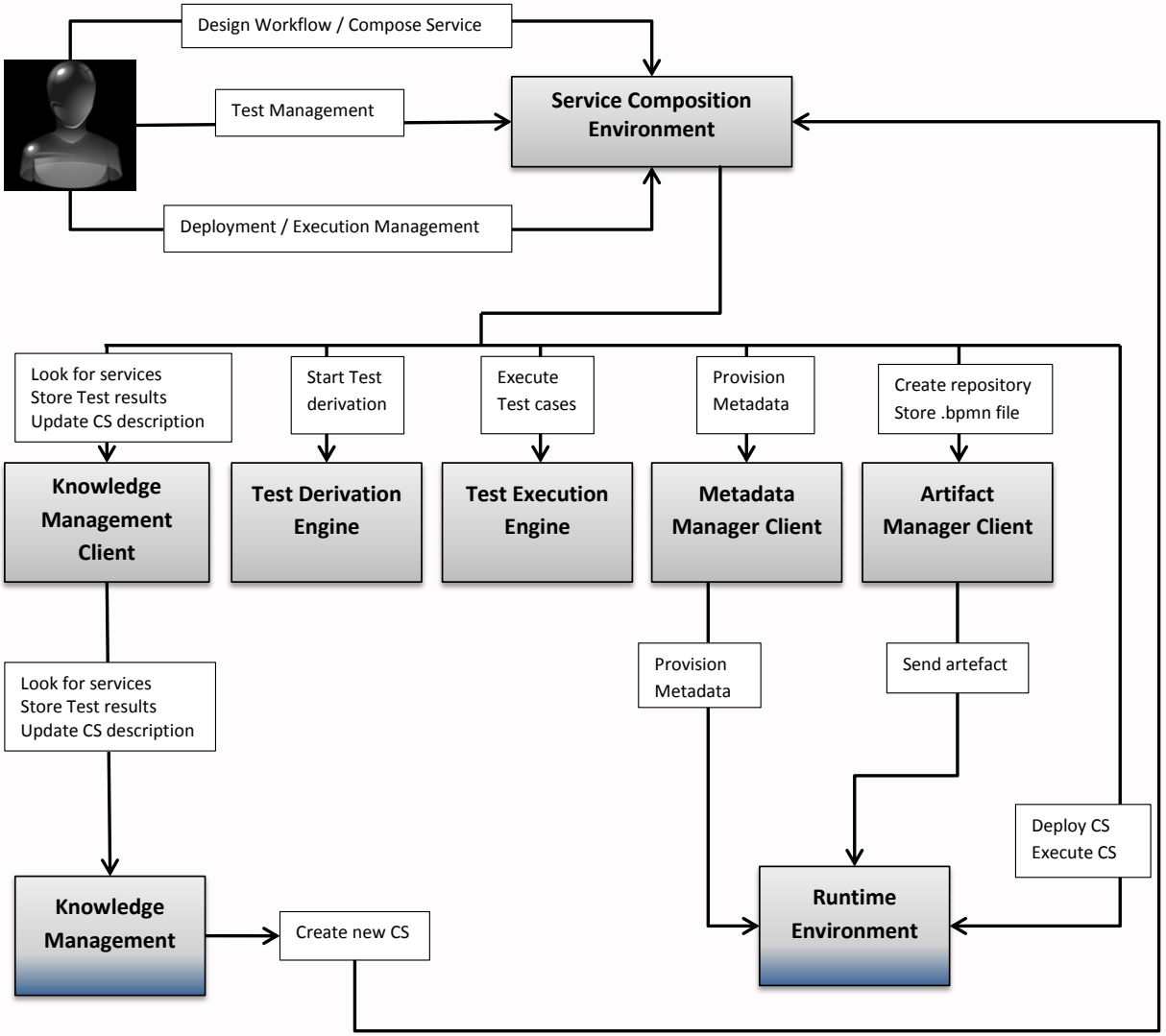

Test-Enhanced Life Cycle for Composed IoT-Based Services

# The key issues for IoT Service delivery

- IoT enabled Business Services: Machine interpretable (semantic) descriptions
- Service Composition: A Knowledge based approach
- Service Components: Re-usable, interoperable and adaptive
- Abstraction: Mapping to heterogeneous platforms and large scale deployment
- Testing (Design Time): Automated generation of tests
- Monitoring (Run-Time): Context-aware service adaptation

- This requires: *machine interpretable description* + interoperable domain knowledge + *automated discovery and composition, reasoning and decision making*

# Build testing into service composition




# OTHER ISSUES

**dependability, reliability are great, but…**

# What about privacy?

- IoT data from our own devices
- IoT data from shared devices that can be linked to individuals

- How can services delivering this (non-functional) requirement be *tested and certified*?

# Who is who and can I trust my sensor?

- Provenance
  - Is my sensor/actuator who it claims to be?
  - Has anybody interfered with the data (actuation signal) since origination?

- Again: How can services delivering this (non-functional) requirement be *tested and certified*?

(note, in literature, *TTCN*-3 has been identified as a potential platform for Intrusion Detection)

# Take away

- Even *simple* IoT Services provide large numbers of potential failure reasons.
- For complex systems/services the number of potential testcases rises exponentially.
- Concerning sharing of sensors, actuators, privacy, provenance and robustness against localization failures, testing will be even more complex*.

* And not feasible without automation.


# THANK YOU!

## Questions?

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# Contact details

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