IOT BASED SERVICES

Presented by Klaus Mößner
SERVICES

As we know them
Simple Service: online payment
Services – generic elements

- Service Logic
- Service Model
- Service Components

Service Framework → Deployment Platform

Service execution
Service Life Cycle

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 straightforward:
  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?

Global Internet Device Installed Base Forecast

BI INTELLIGENCE

Source: Gartner, IDC, Strategy Analytics, Machina Research, company filings, BII estimates
IoT? Why bother?

FORECAST: IoT Device Installation Base
Global, 2016-2021

Source: BI Intelligence Estimates and Business Insider Global IoT Executive Survey, 2016
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
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.

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

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

Opportunities for the Connected & Autonomous Car

- V2X Communication
- ADAS
- Car Sharing
- Smart Parking
- Navigation and traffic data
- Maintenance / Service
- Fleet Management
- Infotainment
- 1st mount telematics service
- Hotspots

http://blogs.sas.com/

https://www.u-blox.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

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

What if n cars request priority when nearing a traffic light?

http://blogs.sas.com/
Functional issues

- IoT services without actuation
  - Accessibility/Localisation: can I access where I need it?
  - Dependability: does it work anywhere anytime?
- IoT Services with actuation in public spaces
  - Physical constraints
  - Logical constraints
  - Conflict handling
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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