

Towards the Assessment of Change in Complex Networks



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Outline

- Motivation
- Challenges due to change
- Reliability testing
- Risk assessment and usage profiling
- Summary and outlook

Motivation

- Our background:
 - Test methodology and languages for communicating systems
 - Risk assessments in evolving complex software systems
 - Machine learning in quality assurance
 - Grid interoperability
- Our interests:
 - How do communicating networks evolve?
 - How do changes affect the dynamic communicating systems?

Concepts

Ubiquitous computing Pervasive computing Sensor networks
RFID Wireless ad-hoc networks
Ambient intelligence



Internet of Things

Internet of Things

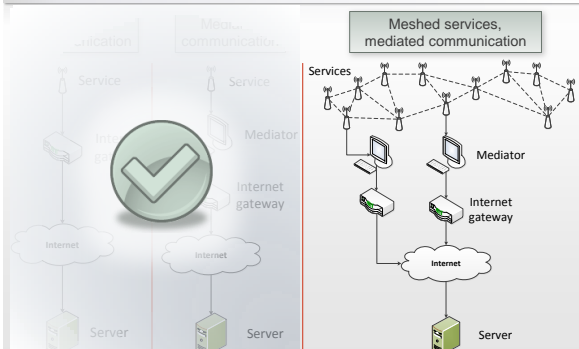
- Network of services **integrated into everyday life** that
 - are affordable
 - are special-purpose or multi-purpose
 - use wireless (ad-hoc) communication
 - may have a limited range for communication
 - may use simple protocols
 - have often low energy requirements
 - gather information to pass on

Software Engineering challenges

- **Reliability** assessment after changes
- **Risk** assessment / change **simulation**
- **evolution** / **predict** the future
- **Interoperability** between services from different vendors
- Service **conformance**

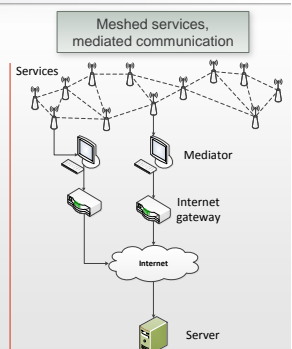
- Transfer experience from our research to the Internet of Things

Internet of Things - architectures



Reliability, usage, and change risk

- New services?
- Lost connectivity?
- Service removal?
- Locality of changes?
- Stability of dynamic routing?
- "Compatible" services?
- ...



Reliability testing



Static Testing

- Analysis of
 - Formal specifications
 - Code
 - Logged runtime data
 - ...

Dynamic Testing

- Dynamic testing:
 - Replace mediator
 - Replace services
 - Functional testing
 - Load testing
 - Stress testing
 - ...
- Runtime verification:
 - Replace services with "fat" reliability ensuring services
 - Check constraints on the fly (temporal logic)
 - ...

Usage profiling



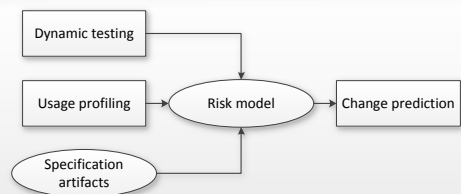
- Network of multi-purpose services:
 - What data does the user actually request or use?
 - Reliability enforcement according to actual network use?
 - Need for different services?
- Collect usage data
- Possible uses:
 - Validation of predicted usage
 - Improvement of risk predictions

Risk assessment



- Building risk simulation models:
 - Data from **dynamic testing**, **usage profiling**, **specifications**
 - Latencies, communication frequency, etc.
 - Use measured data to build the risk models
 - Simulate and analyze prospective scenarios

Summary and outlook



- Risk model predictions are not limited to changes
- Partners needed!

Contact



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