



ASSESSING AND IMPROVING THE TRUSTWORTHINESS OF CLOUD APPLICATIONS

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RESEARCH TO INDUSTRY: TALKCONNECT


Talkdesk is a Cloud based solution for contact centers

- Allows easily deploying a contact center at low cost
- *Talkconnect* intends to allow the global interconnection with multiple communication infrastructures
 - TALKCONNECT: Voice Architecture over Distributed Network
- Trustworthiness and QoS are of utmost importance
 - Approach to be (potentially) applied to the project

talkdesk

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TRUST & TRUSTWORTHINESS

Concepts broadly studied in many different areas


- Sociology, economics, psychology...
- **Trust:**
 - Reliance on a system or service that it will exhibit the expected behavior (including many perspectives)
 - Trust Level: estimated probability of this reliance
- **Trustworthiness**
 - Worthiness of a system or service for being trusted
 - Assessed based on evidences
 - Complex and potentially subjective!

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TRUST & TRUSTWORTHINESS

Human Trust and Trustworthiness



- Changes over time and can be highly subjective...

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TRUSTWORTHINESS PROPERTIES

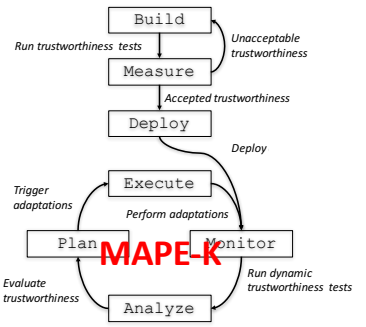
Trustworthiness is frequently seen as a security aspect

- It is trustworthy if it is secure!?
- We consider it a more general notion
 - Even broader than dependability...
- Requires identifying and evaluating all relevant measurable characteristics that may influence reliance
 - Functional and non-functional
- Security, privacy, dependability, performance, fairness, transparency, stability...
 - **Just define them as needed!**

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TRUSTWORTHINESS LIFE-CYCLE



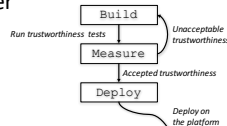
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PHASE 1 - STEP 1: ANALYSIS

Analyze the service under assessment

- Identify the relevant trustworthiness properties and their relative importance
 - e.g., in some cases privacy may be more relevant than performance, and in other cases the reverse may happen
- Can be based on predefined scenarios or using information about other services previously deployed

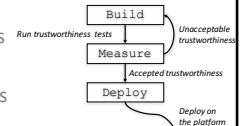


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PHASE 1 - STEP 2: MEASUREMENT

Collect data for each relevant trustworthiness property

- Can be based on different techniques:
 - Running a set of tests
 - Performing static analysis
 - Manual or automated
- Each individual assessment requires a deep understanding regarding:
 - Relevant attributes and properties
 - Thresholds
 - Various measurement instruments

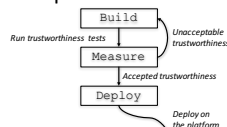


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PHASE 1 - STEP 3: CALCULATION

Calculate the trustworthiness score by using the trustworthiness model

- This model is a representation of the process followed to perform the analysis of the obtained measurements
 - Based on a combination of weights of the attributes that determine the relative importance of each
- Assuring conformance to the service specification and meeting expectations
- Conflicting properties...

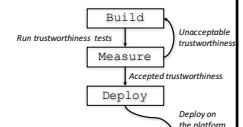


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PHASE 1 - STEP 4: DECISION

At this point a decision is to be made

- If the service under assessment achieves an acceptable level of trustworthiness, then it can be deployed
- Otherwise, further improvements should be applied and steps 1-4 repeated

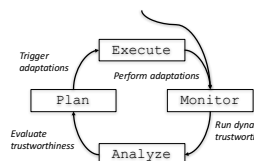


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PHASE 2 – STEP 1: MONITORING

Data related to the relevant trustworthiness properties defined are continuously collected

- Probes collect data that is managed and stored by a monitoring platform
- Tests may be executed to generate/collect data (active monitoring)
 - e.g. attack injection
 - Taking into account runtime aspects and constraints

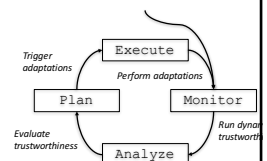


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PHASE 2 – STEP 2: CALCULATION

Calculate the trustworthiness score by using a trustworthiness model

- Similar to Step 3 of Phase 1
- Score serves two purposes:
 - Trustworthiness monitoring – e.g. information to users
 - Trustworthiness improvement



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PHASE 2 – STEP 3: PLAN

Select adequate adaptation solutions to improve trustworthiness

- Estimation may apply
- Predefined adaptation strategies and tactics
- Multi Criteria Decision Making

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PHASE 2 – STEP 4: CHANGE

Adaptation engine

- Actuators to support the adaptation actions
- Phase 2 runs continuously while the service under assessment is being executed
- Go back to Step 1...

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FROM PROPERTIES TO SCORES...

A property may require several different scores

- We need a model to map properties to scores

- Calculating a score requires collecting raw data
- Trust evolves over time...
- Coherence vs Stability vs Fairness vs ...

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EXAMPLE: PERFORMANCE

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TMA PLATFORM

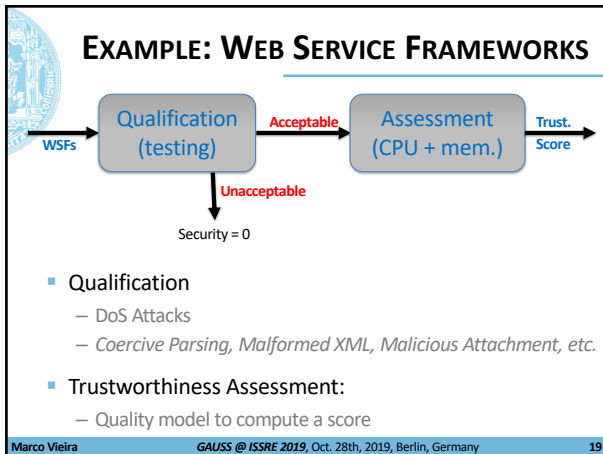
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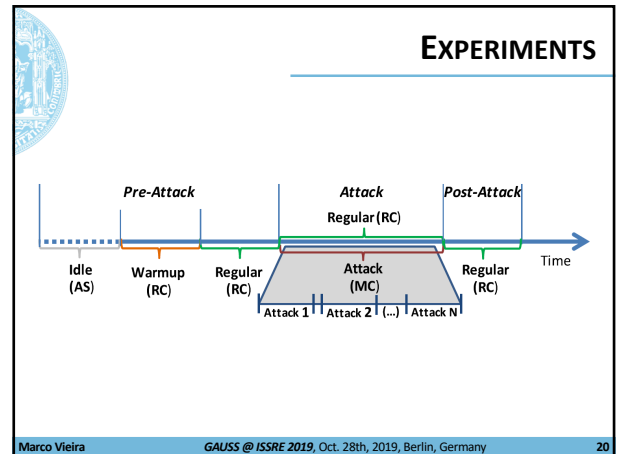
BENCHMARKING PROCESS...

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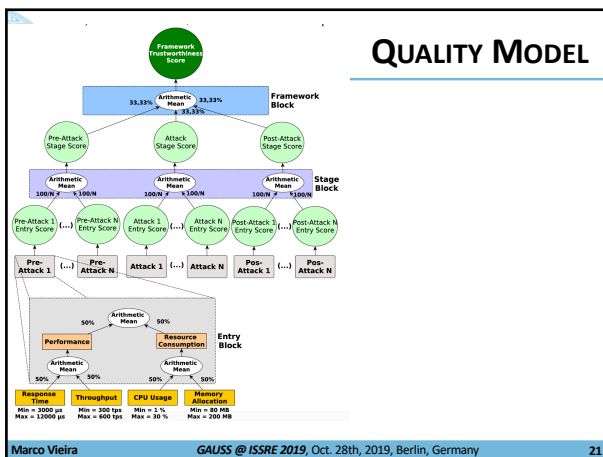
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SYSTEMS UNDER BENCHMARKING

Framework	Version	Security Qualification
Apache Axis 1	1.4.1	✗
Apache Axis 2	1.6.1	✓
	1.6.2	✗
Apache CXF	2.5.1	✓
	3.0.3	✓
Oracle Metro	2.1.1	✗
	2.3.1	✓
XINS	3.1	✗
Spring JAX-WS	1.9	✗
Spring WS	2.2.0	✗

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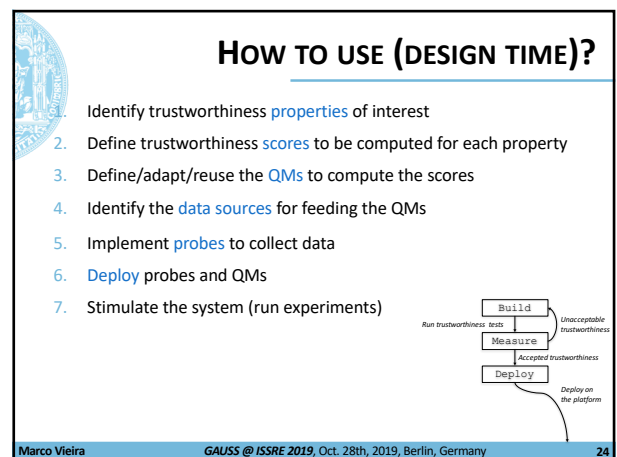
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TRUSTWORTHINESS RESULTS

Scenario	Axis 2	CXF v2	Metro	CXF v3
Neutral	72.3 (1)	70.7 (2)	58.1 (3)	57.9 (4)
Scenario1	73.4 (2)	77.1 (1)	66.5 (4)	70.0 (3)
Scenario2	67.4 (3)	73.1 (1)	66.6 (4)	68.7 (2)
Scenario3	61.8 (4)	70.3 (1)	63.6 (3)	67.0 (2)

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HOW TO USE (RUN TIME)?

1. Identify trustworthiness properties of interest
2. Define trustworthiness scores to be computed for each property
3. Define/adapt/reuse the QMs to compute the scores
4. Identify the data sources for feeding the QMs
5. Implement probes to collect data
6. Identify potential **actuators/adaptations** to ensure trustworthiness
7. Implement **actuators** to perform adaptations
8. Define adaptation **rules**
9. **Deploy** probes, actuators, rules and QMs

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CONCLUSIONS

Trust and Trustworthiness

- Trustworthiness assessment as a way to deal with uncertainty
 - Dealing with multiple properties
- Assessment should cover the entire lifecycle
- QMs allow to bring different observations together
- TMA provides support for monitoring and assessment
- Next: moving from research to industry...

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QUESTIONS?

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