

Tackle the Challenge of Digital Transformation

- Quality Engineering und Skills

Dr. Armin Metzger,



Hamburg, 2019-09-06





25 years of experience

Quality assurance, development and processes

Scientific and industrial projects

Complex and safety critical domains e.g. healthcare and automotive

1992 – 1998: FAU Erlangen-Nürnberg
Researcher, Experimental Particle Physics

1999 – 2015: sepp.med gmbh
Department manager, leading consultant and business developer

2016 - 2017: ASQF e.V.
Director, managing expert and business developer

2018 - : GTB e.V.
Executive Director, managing expert and business developer

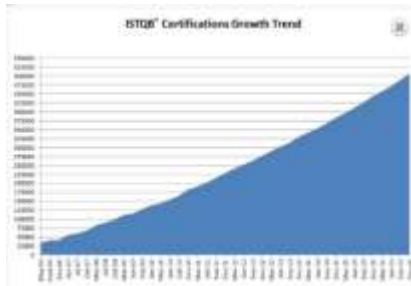
Founding member and former president of the German Testing Board e.V.

German Testing Board Skills for Software Quality

GTB – national chapter of ISTQB®

ISTQB® Certified Tester – The #1 Scheme for Software Testing Skills

> 600,000 certificates worldwide



<http://www.istqb.org/about-as/facts-figures.html>

- **Internet of Things, AI et al – A Phantom Menace?**
- Tackeling the Challenges - Quality Engineering and Skills
- Tackeling the Challenges – Test Automation
- Conclusion



... with volatile and changing Consumer and Business driven Requirements ...



dbi-solutions.de/expertise/digitale-transformation/

Major Changes in Usage
Data driven Value Chains
Adaptive Business Processes
Everything from Everywhere





Long Operation Lifetime

Source: Quality Analysis with IoT-Testware, Axel Rennoch, Sascha Hackel
meet the industry, Potsdam, May 17, 2018

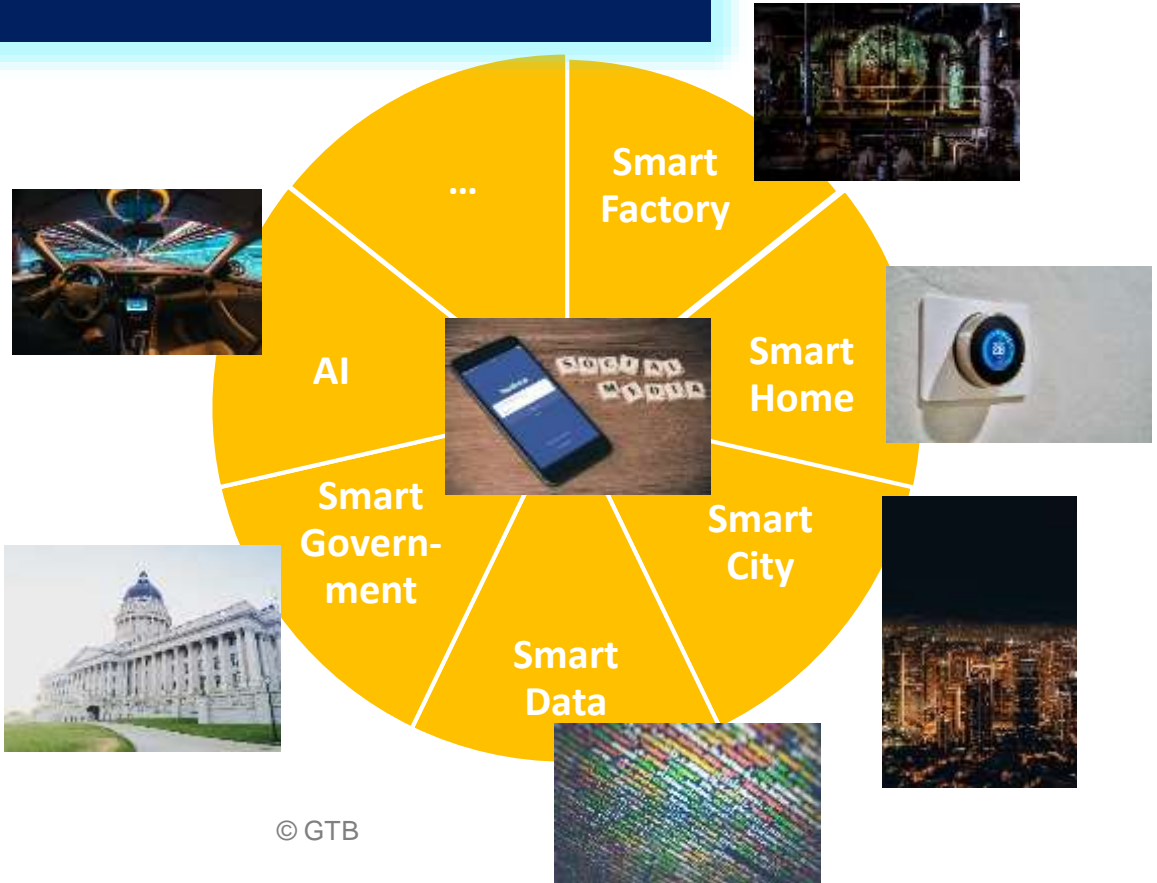
... on a highly heterogenous HW and SW Platform ...



http://www.iadvize.com/blog/wp-content/uploads/sites/10/2015/07/header-DigitaleTransformation_Kundenservice_iAdvize.png

... with an increasing Number of Smart Objects ...

The Internet of Everything
Intelligent Smart Objects connected to People, Processes, ... , Ethics



... and dynamical and unpredictable Behaviour ...

Dynamical interacting Environments
Rising Dynamics
Frameworks like Services, Interfaces, ... will change over the System Lifecycles

http://www.iadvize.com/blog/wp-content/uploads/sites/10/2015/07/header-DigitaleTransformation_Kundenservice_iAdvize.png

Major Concerns - IT-Security (and Ethics)

- **Mirai botnet, October 2016:**
 - botnet using **insecure configured** IoT-devices
 - attack causes **blackout** and **disruption**
(e.g. Amazon, Netflix, Twitter, Github)
- **Wannacry, May 2017:** cyber attack on steel mill in Germany, ...
- **KRACK** (Key Reinstallation Attack), October **2017:**
Replay attack on Wi-Fi Protected Access protocol (WPA2), ...
- **Spectre and Meltdown, January 2018**
 - **Spectre:** vulnerability that perform branch prediction in modern microprocessors
 - **Meltdown:** hardware vulnerability that allows to read all memory

Source: Quality Analysis with IoT-Testware, Axel Rennoch, Sascha Hackel
meet the industry, Potsdam, May 17, 2018

Künstliche Intelligenz erfindet eigene Verschlüsselung

Zwei künstliche neuronale Netzwerke von Google haben selbstständig gelernt, ihre Kommunikation kryptografisch abzusichern. Wie sie es tun, weiß kein Mensch genau.

Von **Patrick Beuth**

31. Oktober 2016, 16:21 Uhr / [177 Kommentare](#)

IT-Security, Reliability
Interoperability, Connectivity



<https://www.zeit.de/digital/datenschutz/2016-10/google-kuenstliche-intelligenz-erfindet-eigene-verschluesselung>

kmpkt

TIER MENSCH ROBOTER QUIZ

KMPKT AUSSER KONTROLLE

Facebook musste AI abschalten, die „Geheimsprache“ entwickelt hat

Veröffentlicht am 28.07.2017 | Lesedauer: 2 Minuten

Von Philipp Nagels



78



”

WIR VERSTEHEN SCHON JETZT IM ALLGEMEINEN NICHT, WIE KOMPLEXE AIS DENKEN, WEIL WIR IN IHREN DENKPROZESS NICHT WIRKLICH HINEINSEHEN KÖNNEN.

DHRUV BATRA,
Facebook AI Research (FAIR)



Interoperability, Connectivity
Reliability
IT-Security, Ethics

<https://www.welt.de/kmpkt/article167102506/Facebook-musste-AI-abschalten-die-Geheimsprache-entwickelt-hat.html>

Aus Microsofts nettem Chat-Teenie wurde in nur 24 Stunden eine Nazi-KI

„Tay“ sollte eigentlich reden wie ein Teenager. Nachdem der Bot auf Twitter Amok lief, musste Microsoft sie in den vorzeitigen Ruhestand schicken. Der Fall zeigt, wie wichtig Regeln bei Machine Learning sind.



Bild: Screenshot Twitter

Ethics!!!

<https://motherboard.vice.com/de/article/xygbe4/diese-ki-ist-schlimmer-als-hitler-666>

Artificial Intelligence
An Evolving Black Box

... in search of the right Paradigm Changes

Thesis:
Major paradigm changes will rapidly and significantly impact the ecosystem

Missing comprehensive standards for methods, architecture and process

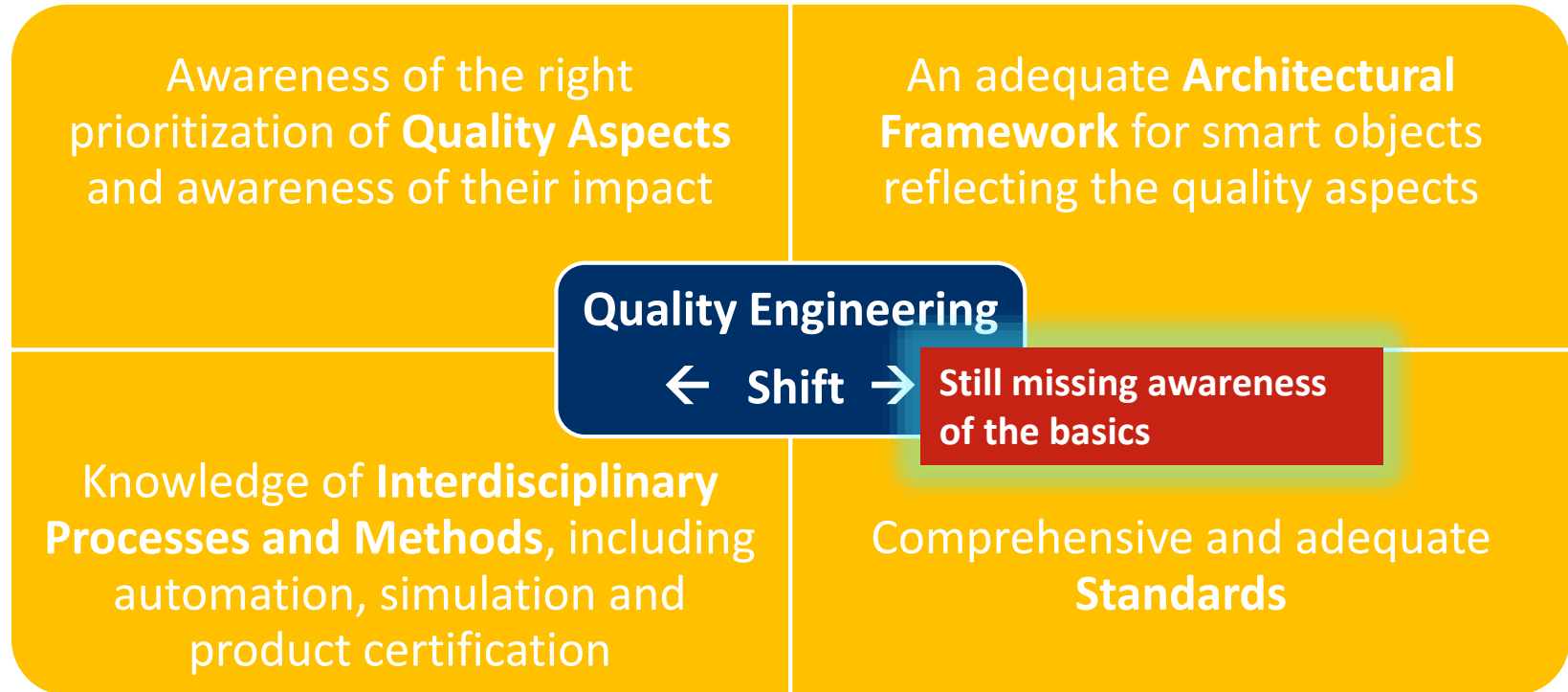
- in order to integrate domains
- in order to integrate lifecycle and business processes
- in order to establish a common glossary

Missing skills and missing awareness

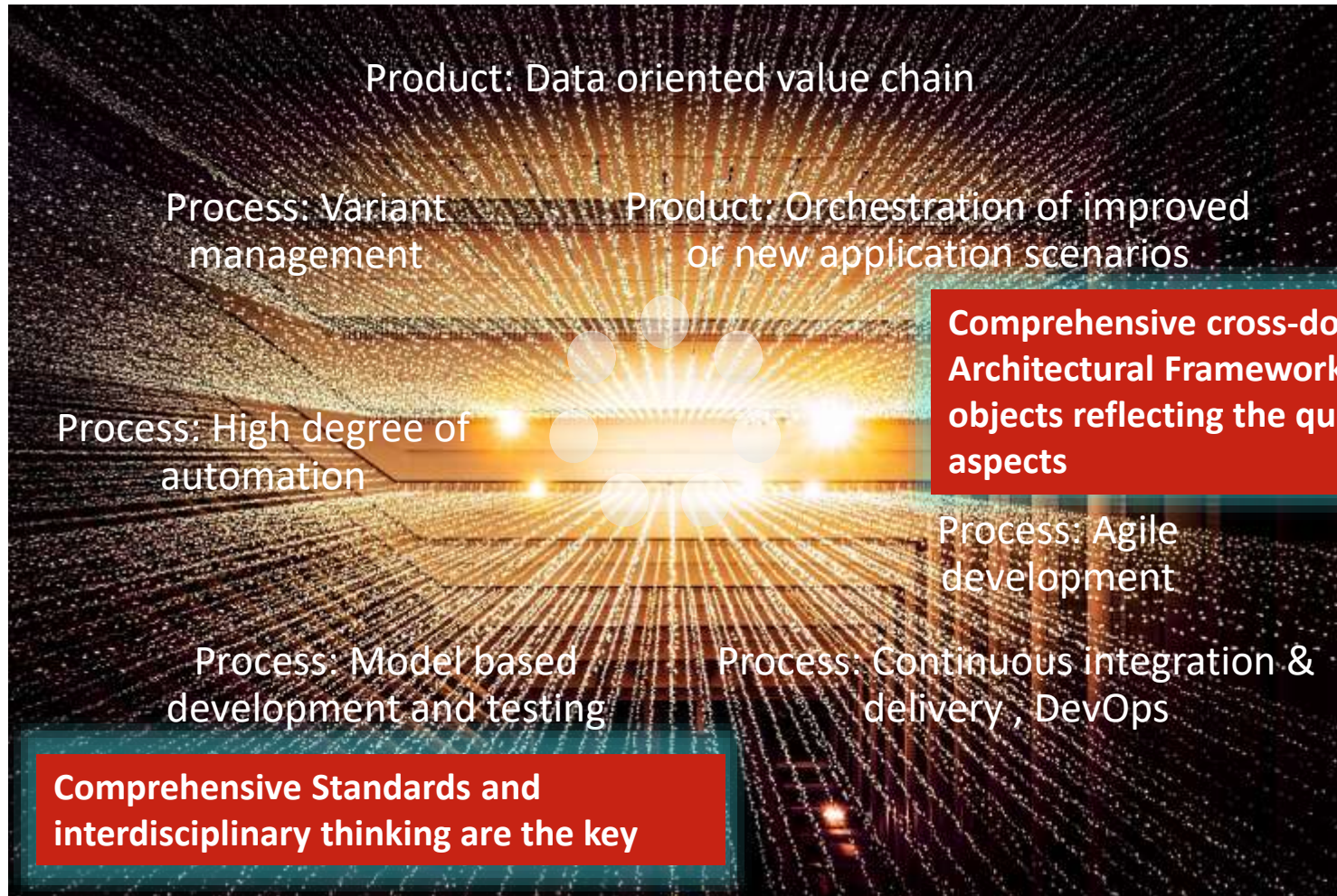
- in order to find (adequate) solutions
- in order to apply proper prioritization
- in order to look for a solution

- Internet of Things and AI – A Phantom Menace?
- **Tackeling the Challenges - Quality Engineering and Skills**
- Tackeling the Challenges – Test Automation
- Conclusion

Quality Engineering as Key Factor



Constructive QE – Key Aspects



Analytical QE – Key Aspects

Test objectives prioritized according to the quality aspects

Methods: Simulation and product certification

Essential test targets: IT security, interoperability and performance



Risk analysis

Missing awareness of the right prioritization of Quality Aspects and their impact on architecture and lifecycle

Test automation including test automation architecture

Test and monitoring spreads over the complete lifecycle

Quality Aspects – Change your Prioritization

Functional

Performance

Interoperability,
Connectivity, Coexistence

Usability

Robustness

Safety and Security, Ethics

Reliability



Ethics and the discussion in society and politics has even not yet started

Shift from pure localized functional quality aspects during development ...

... to end to end quality

... to activities covering the full lifecycle incl. operations and maintenance

Testing AI – A Paradigm Change

Deterministic Scenarios



Test oracles for AI systems are not easily available

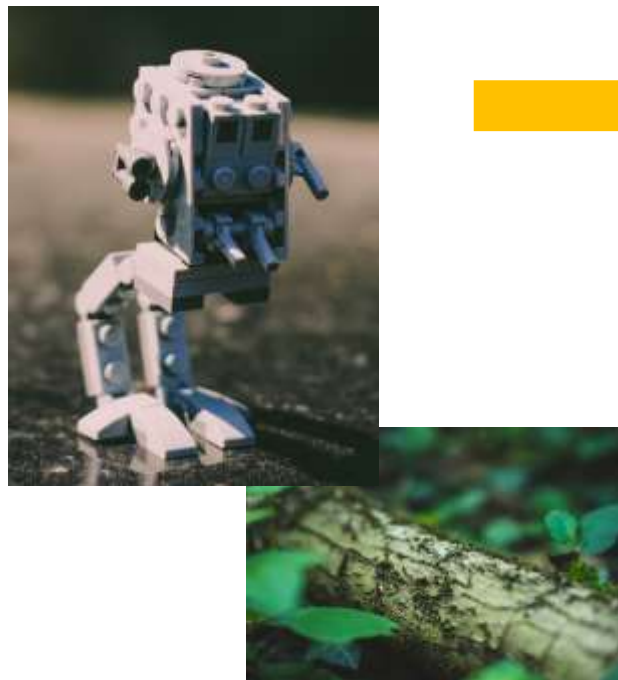
Probabilistic Scenarios (Condition Based)



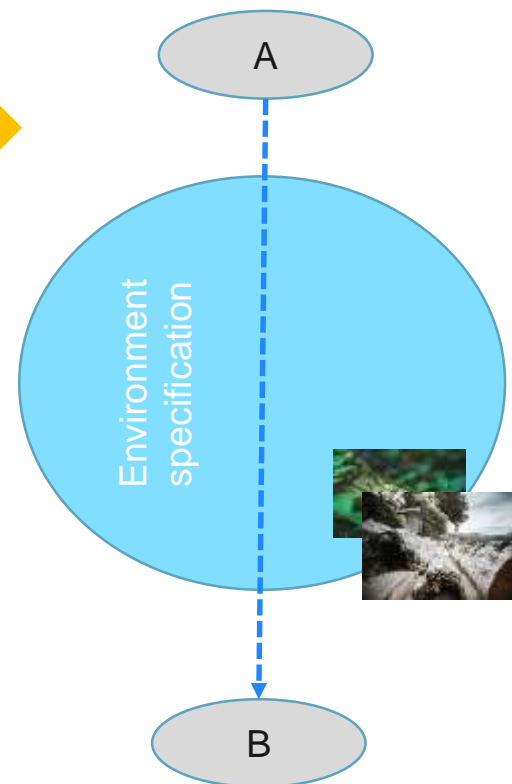
Black Box par excellence

Testing AI – A Paradigm Change

Deterministic Scenario



Probabilistic Scenario



Testing AI – Ethics as Quality Characteristic

German Bundeswehr

Rules

1. Asimov's Laws
2. Geneva Convention
3. Mission Objectives



Imperial Forces

Rules

1. Asimov's Laws
2. [REDACTED]
3. Mission Objectives

Ethics



(functional) Behaviour) & Effectiveness

→ Quality

Testing AI – A Paradigm Change



Extended Quality Characteristics

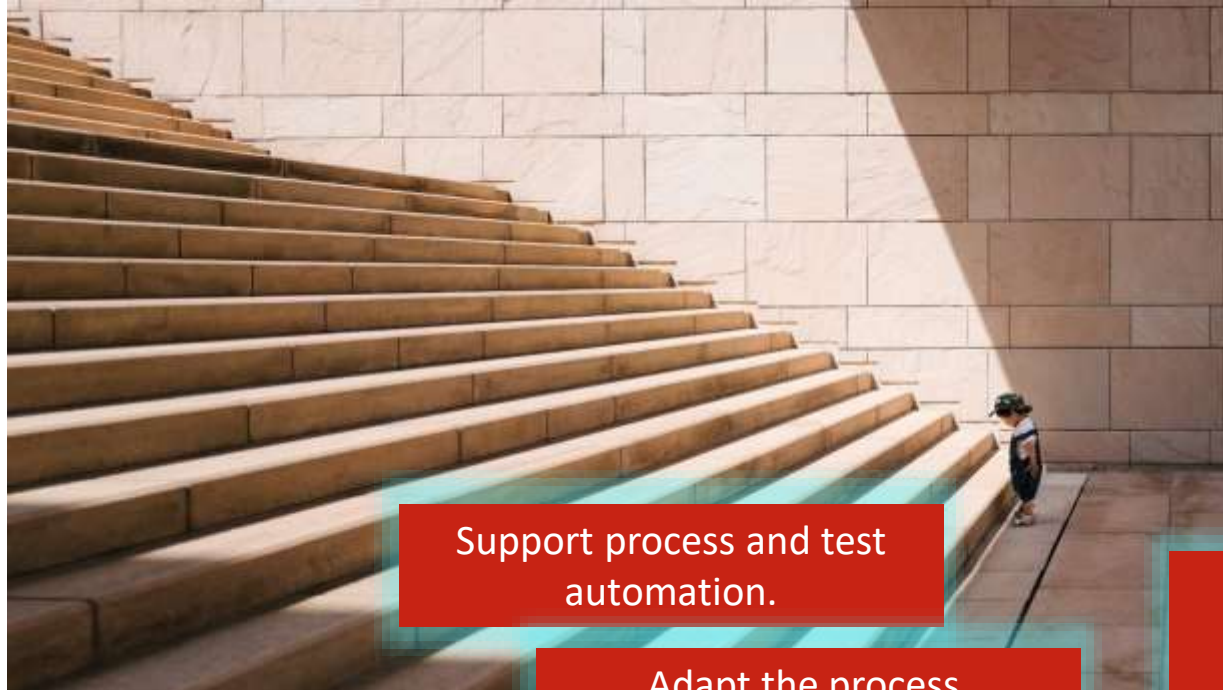
- Complexity
- Scalability
- Continuous learning

Test Approaches reloaded

- Simulation
- Product Certification



Will AI change the Software Testing Process?



Support process and test automation.

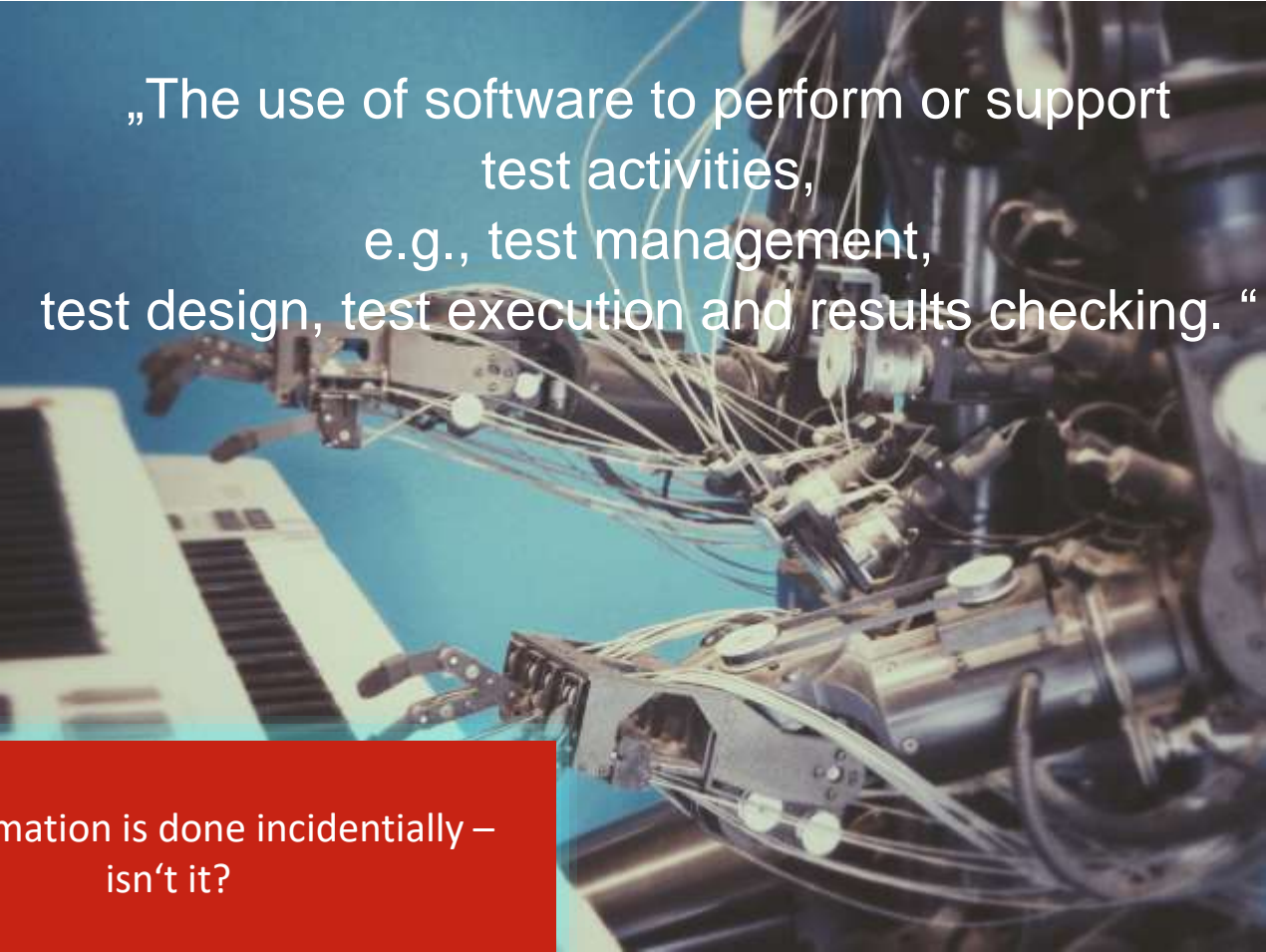
Adapt the process.

It definitely has the potential!

But we are we are right at the beginning of this journey.

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Testautomation – a Definition

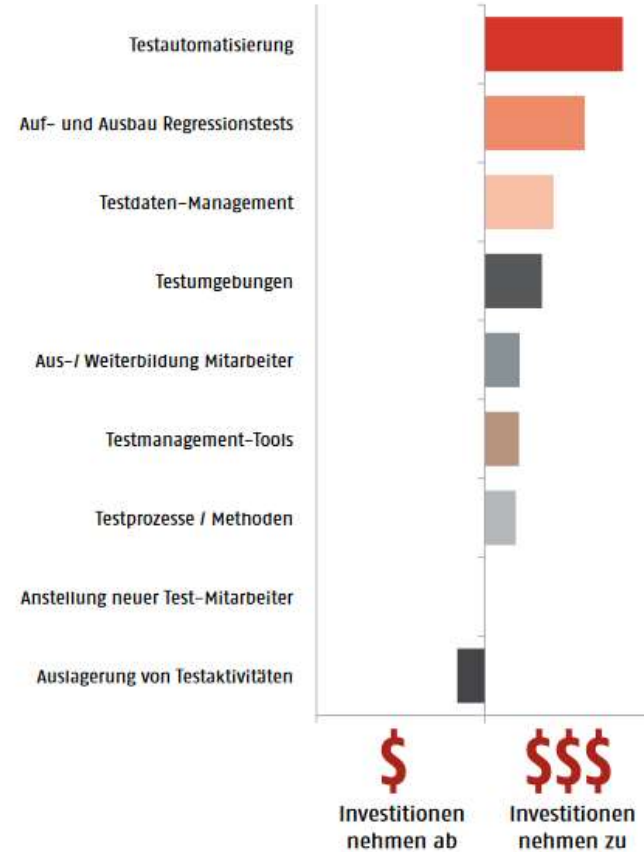
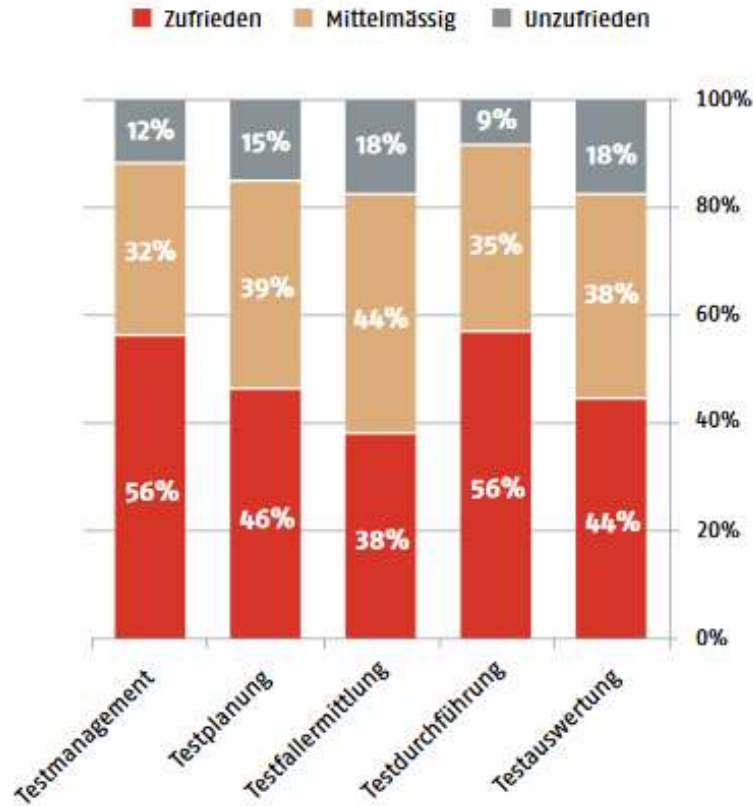


„The use of software to perform or support test activities, e.g., test management, test design, test execution and results checking.“

Testautomation is done incidentally – isn't it?

• [1]

Surveys ...



Can all Testing Activities be automated? When?

Test Analysis



Analyse Test Basis
Derive Test
Conditions

In the Future
AI can help! 

Test Design



Test Design
Technique
Tool-Application
Model-Based
Testing

Test Execution



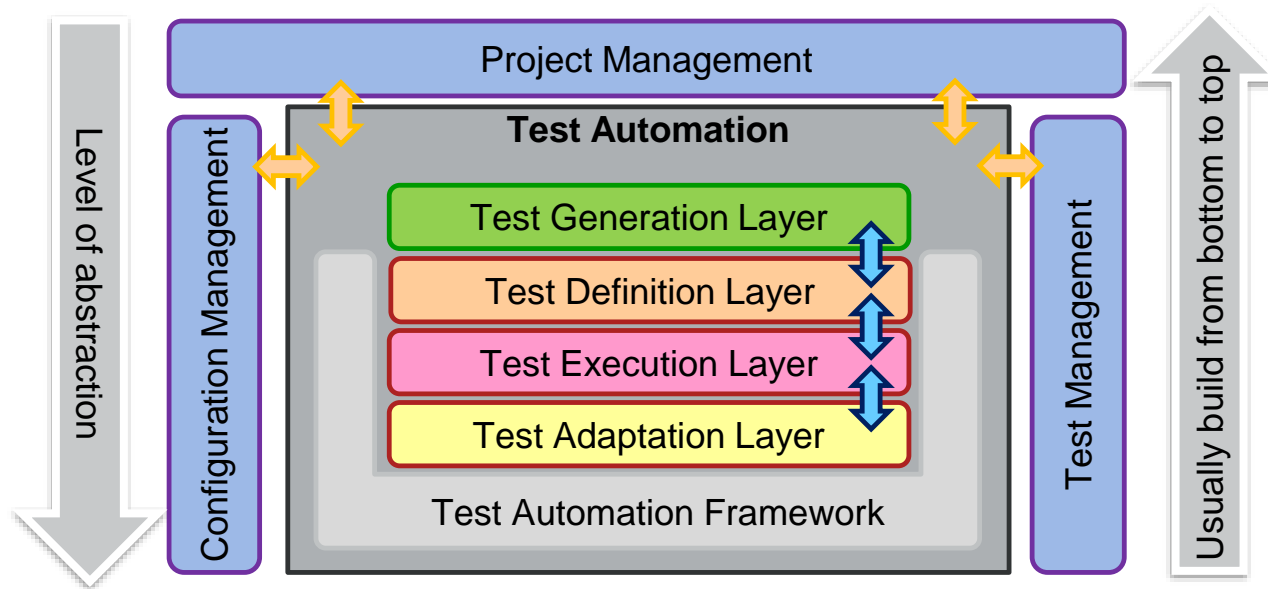
Capture&Reply
Structured Scripting
Data/Keyword-
Driven
Behavior-Driven

Test Evaluation



Test Coverage
Test Completion
Criteria
Reporting
Trend Analysis

(Generic) Testautomation Architecture



Planning is essential ...

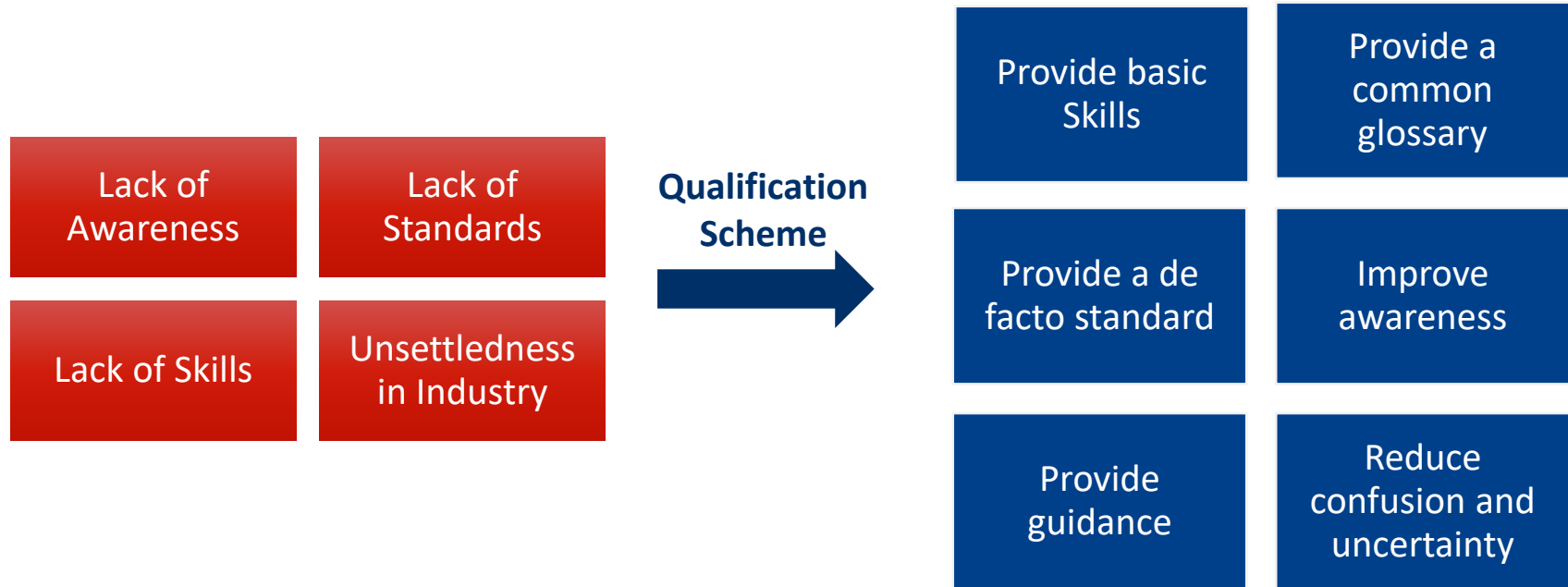


Take Aways

- Test automation is not a panacea
- Test automation is more than developing scripts
- Choosing the right tests is a key to success
- Maintainability is a key to success
- Traceability is important for daily work (test progress)

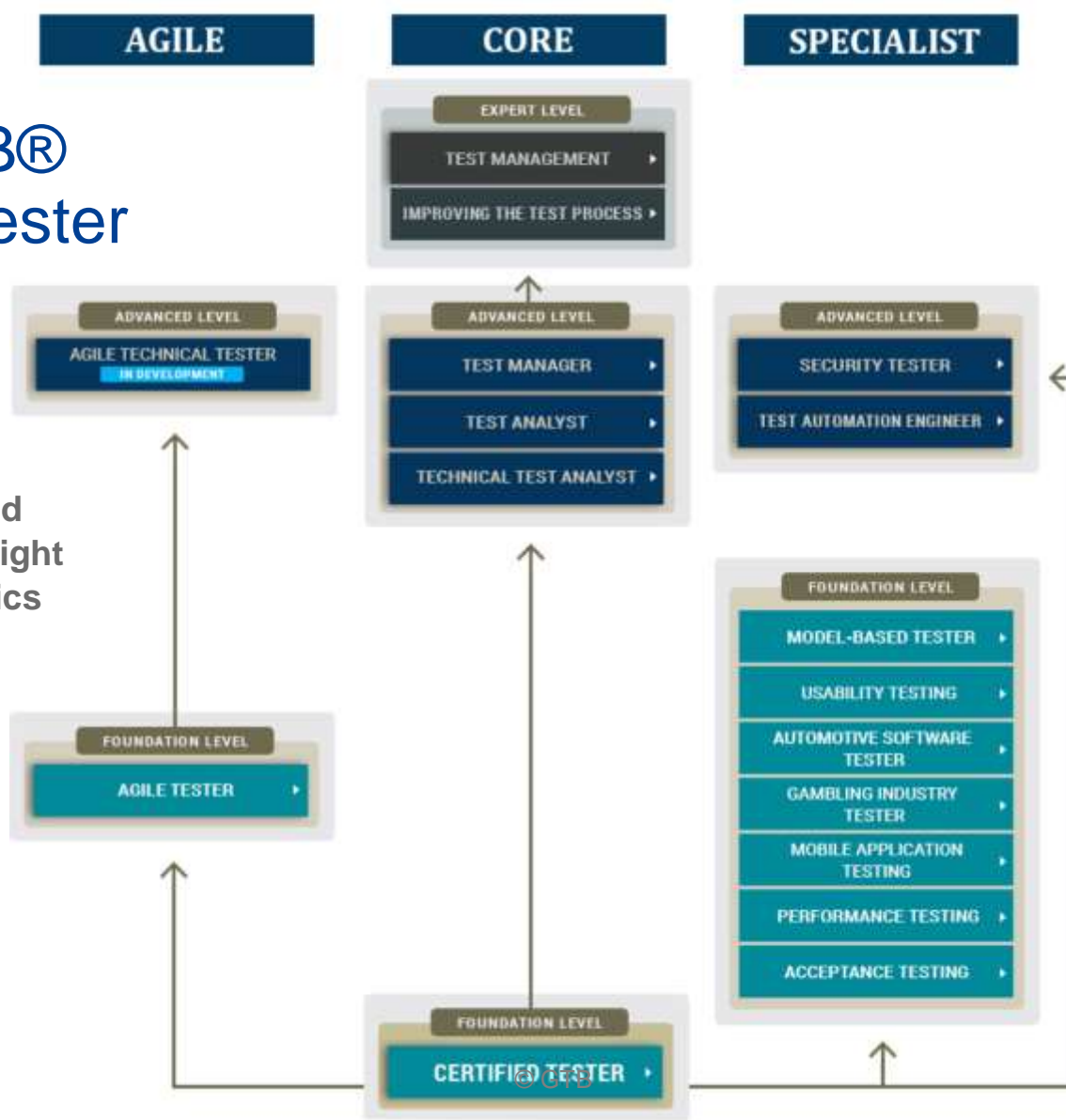
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Major Challenges ... and how GTB can help



The ISTQB® Certified Tester

For a deeper and
future proof insight
into testing topics



- GTB Test Data Specialist
- GTB/ASQF Certified Professional for IoT

Quelle:
<https://www.istqb.org/>

Conclusion – Not only for the Testing Community

IoT, AI et al is not completely new , but ...

... has enourmous potential
for new business processes

... challenges the whole
system lifecycle ...

... requires comprehensive
thinking, interdisciplinary
processes and adequate
methods



... in order to manage these challenges we have to change our paradigms ...

... quality engineering instead
of pure testing and proper
prioritization of quality
aspects

... (process and) test
automation

... establish standards,
methods and skills and a
common glossary

Thanks!
Questions ?!

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Vielen Dank für Ihre Aufmerksamkeit!



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Conversion to Automated Tests

Maintainability

Test Environment

Learnability

Ease of Use

Test Monitoring

... includes among others ...

- Selection of the proper automation approach
- Analysis: Automation of the right tests
- Migrate manual tests to automated tests
- Availability and Acceptance of tools
- Test execution time

Conversion to Automated Tests

Maintainability

Test Environment

Learnability

Ease of Use

Test Monitoring

... means analyzability, modifiability, stability and testability.

- Maintenance of the system and the test automation solution
- Corrective vs. adaptive (vs. preventive vs. optimizing) maintainability
- Logical vs. technical maintainability
 - Abstraction increases logical maintainability
 - Effort for technical maintenance should be minimized

Conversion to Automated Tests

Maintainability

Test Environment

Learnability

Ease of Use

Test Monitoring

... must be prepared for automation.

- Complexity and heterogeneity
- Automation of setup, initialization and shutdown
- Scalability
- Simulation
- Variant management

Conversion to Automated Tests

Maintainability

Test Environment

Learnability

Ease of Use

Test Monitoring

... describes the effort required to use a system effectively and efficiently.

- Needed expert knowledge discourages
- Setup and initialization of the test environment
- Maintenance and development of new test cases
- Piloting & training

Conversion to Automated Tests

Maintainability

Test Environment

Learnability

Ease of Use

Test Monitoring

... measured by the effort and complexity required to operate the tool

- On a daily use basis.
- Avoid errors by manual steps
- Avoid repetitive work
- Support the defined test process

Conversion to Automated Tests

Maintainability

Test Environment

Learnability

Ease of Use

Test Monitoring

... is monitoring of product risks, error conditions, tests, coverage and confidence in the software.

- Continuous traceability
- Supports the test evaluation
 - exit criteria
 - trend analysis
 - reports
- Handling of mass data (due to automation)