Lucerne University of
Applied Sciences and Arts

HOCHSCHULE
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Informatik

Software Architecture and Techniques

Validate Quality Attributes

of

Software Architecture

Marcel Baumann, tangly llc

Truths (1/3)

- Architecture is requirements + -ility attributes fulfillment
- Do user and customer define requirements?
- Do stakeholders define -ility attributes (*see ISO/IEC 25010*)?
- Remember validation and verification
  - Build the right product
  - Build the product right

Truths (2/3)

- All solutions should be source code based and under version control – *git* -
- All solutions should be integrated in the CI/CD/CD pipeline
- Avoid metric driven development – *this is an anti-pattern*

Truths (3/3)

- ATAM is dead – *too slow, too expensive* – architecture driven design is also dead
- Manual reviews are obsolete
  - Pull request reviews are slow, expensive and therefore should be replaced by better approaches
  - Agile teams shall be co-located and do pair work

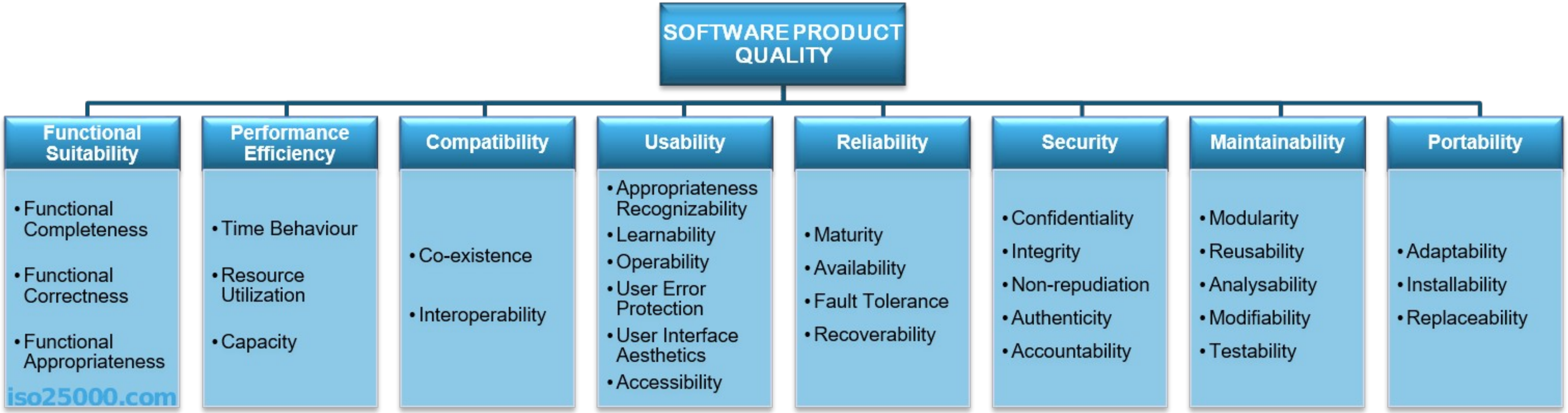
    or virtually integrated using high-quality communication tools and no time difference

Non-Functional Requirements

- Context
- Why
- Mandatory Value (Minimum) – *Below minimal value means you have failed*
- Optimal Value (Optimum)
- Maximal Value (Outstanding) – *Above maximal value means you have wasted resources*

ISO/IEC 25010

Systems and software Quality Requirements and Evaluation (SQuaRE)



Some -ility Attributes

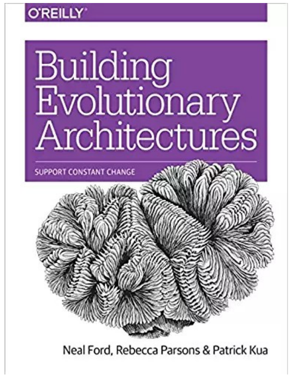
Accessibility, accountability, accuracy, adaptability, administrability, affordability, agility, **auditability**, autonomy, availability, compatibility, composability, configurability, **correctness**, credibility, customizability, **debugability**, degradability, determinability, demonstrability, dependability, **deployability**, discoverability, distributability, durability, effectiveness, efficiency, **usability**, extensibility, failure transparency, fault tolerance, fidelity, flexibility, inspectability, installability, integrity, interoperability, learnability, **maintainability**, manageability, mobility, modifiability, modularity, operability, orthogonality, **portability**, precision, predictability, process capabilities, producibility, provability, recoverability, relevance, **reliability**, repeatability, reproducibility, resilience, responsiveness, reusability, robustness, **safety**, scalability, seamlessness, self-sustainability, serviceability, sustainability, tailorability, **testability**, timeliness, **traceability**

Fitness Functions (1/2)

- Fitness functions are the unit tests for non-functional requirements

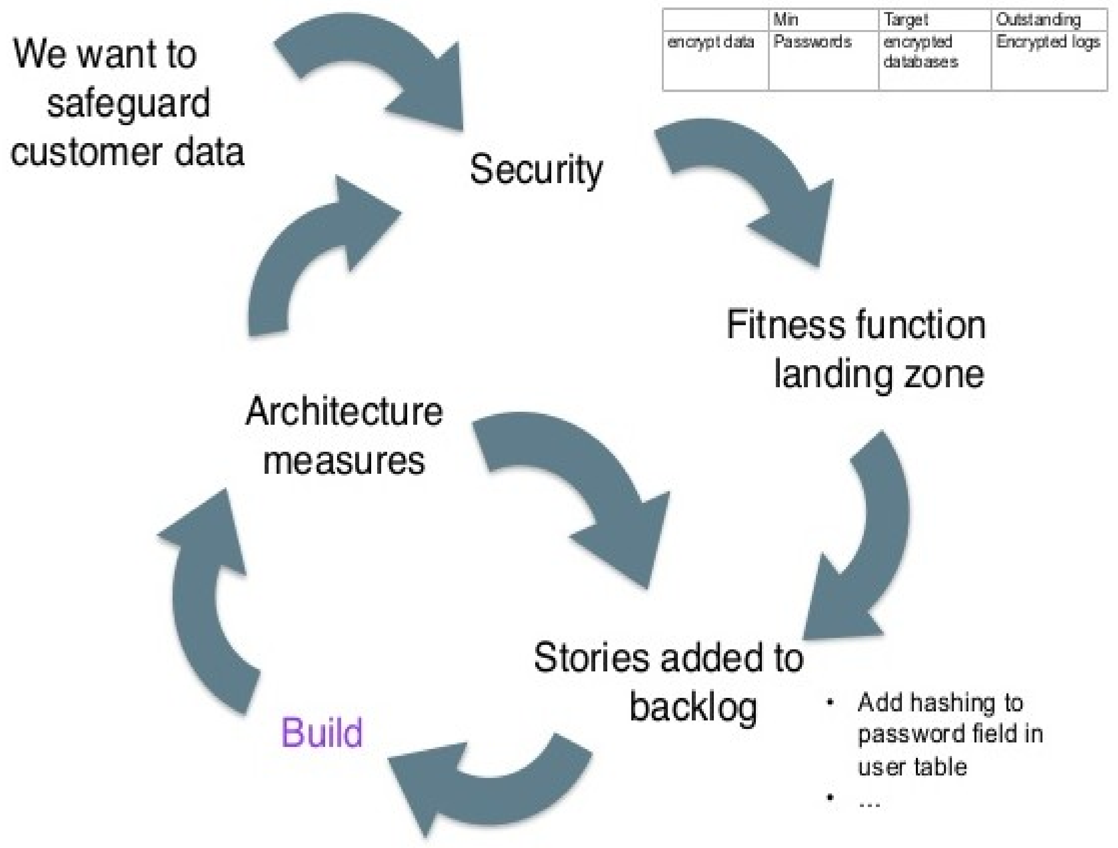
An architectural fitness function provides an objective integrity assessment of some architectural characteristic(s).

We can also think about the systemwide fitness function as a collection of fitness functions with each function corresponding to one or more dimensions of the architecture.


O'REILLY
Building Evolutionary Architectures
SUPPORT CONSTANT CHANGE
Neal Ford, Rebecca Parsons & Patrick Kua

Fitness Functions (2/2)

Double loop architecture is a process that you can use to ensure that your architecture continues to satisfy the business needs of your product.


We want to safeguard customer data
Security
Fitness function landing zone
Stories added to backlog
Add hashing to password field in user table
...
Build
Architecture measures

	Min	Target	Outstanding
encrypt data	Passwords	encrypted databases	Encrypted logs

Example Fitness Functions

- Static code analysis
- Unit test frameworks
- Penetration testing tools
- Load testing tools
- Monitoring tools
- Logging tools

```
describe "Resiliency" do
        describe "New Deployment" do
                it "has less than 1% error rate for new deployment" do
                        expect(new_deployment.get_error_rate()).to < .01
                end
        end
        describe "Network Latency" do
                it "has less than 5% error rate even if there is network 
latency" do
                        expect(network_tests.get_error_rate()).to < .05
                end
                it "completes a transaction under 10 seconds even if
                  there is network latency" do
                        expect(network_tests.get_transaction_time()).to < 10
                end
        end
end
```

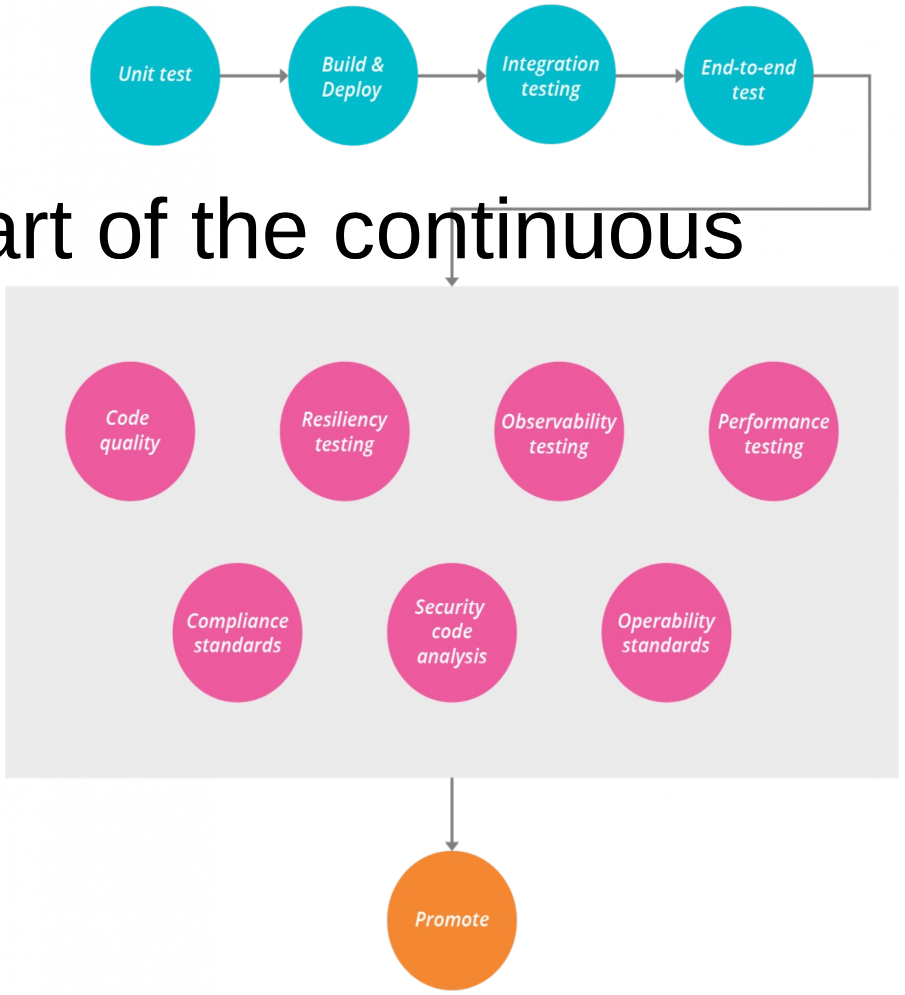
Assumptions

Architecture, like business capability and infrastructure, can be **expressed in code** through the use of appropriate fitness functions.

Fitness functions are **code** and can be executed as part of CI/CD pipeline or part of the monitoring infrastructure.

Fitness Functions

- Fitness functions are part of the continuous integration CI pipeline
- Often Realtime
- Quality Gate Function



Combining Fitness Functions

- Atomic + triggered
  - ArchUnit rules
- Holistic + triggered
  - Combined Security and Scalability Functions
- Atomic + continual
  - Test REST endpoints verbs and error messages
- Holistic + continual
  - Test resilience when cloud latency changes through infiltration (Netflix)

Functions Examples

- Your code quality must be above 90% to be promoted to the next stage – *Quality Gate in SonarQube*
- UAT versioning must not deviate more than two versions from production
- No secrets may be committed in plain text - *OSWAP*
- You must always have a security testing stage
- You must never deploy with another application's service account
- You must always have two approvers before production

Fitness Functions

- Fitness functions are also part of the production environment
  - Mean Time between Failure
  - Maximum Time to Recover
  - Response Time
  - Latency in your network
  - Resource usage

Code Quality

- Modifiability
- Manageability
- Adaptability
- Legibility

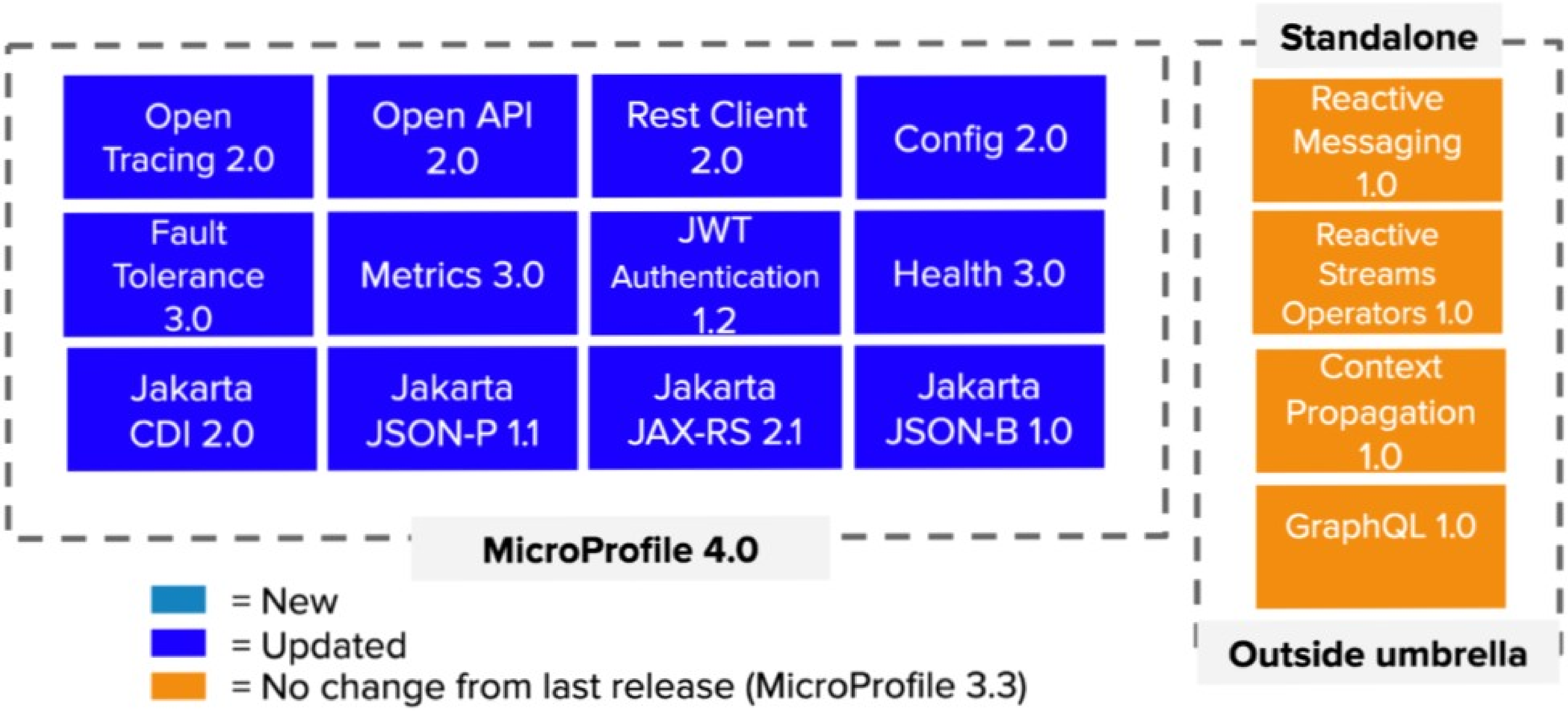
Resilience and Operability

- Stability
- Resiliency
- Availability
- Recoverability

Performance and Security

- Scalability
- Stability
- Response time
- Security

Micro Profile



Exercises (1/2)

- Discuss your architecture quality
  - Which criteria to measure it? *Prove it with facts!*
    - *e.g. use VisualVM as a simple tool to measure Java applications*
  - Should you improve it?
  - How can you improve it? What should change in your team?
- Select architecture questions and discuss how you solved them in your application
  - e.g. logging, creation of objects, persistence, error handling

Exercises (1/2)

- Read article “Modern Java EE Design Patterns”
- Select -ility criteria, define associated fitness functions and show how to implement them
- Reflect how ArchUnit can implement a subset of fitness functions
- Workshop preparation
- Coding Dojos

Exercises (2/2)

- Check your project – *as described during first week of lecture* –
  - Refactoring project and presentation (history in git)
  - Architecture portfolio and participation in exercise coaching – *e.g. pattern example or a solution to an architecture dimension such as logging in your project -*
  - Test automation (TDD, ATDD, CI/CD) concepts and examples