Testing Process Models

Process Model of a Test Factory

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“A proposal of a process model to create a Test Factory” by:

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Abstract

- Software testing is being outsourced to “Test Factories”
- Test Factories must implement an organizational model that includes a defined testing process model
- This research presents a testing process model to manage a Test Factory
According to Wikipedia, **Software Quality Assurance (SQA)** consists of a means of monitoring the software engineering processes and methods used to ensure quality.

SQA strives to minimize the cost of guaranteeing quality throughout the development process.
SQA & Testing

- Validation ensures the right functions are performed
- Verification ensures the correct performance of these functions
- Testing is part of validation and verification
  - Inspections
  - Technical review
  - Unit testing
  - Integration testing
- All are SQA activities
Outsourcing Testing

- Software reliability is demanded by customers
- Complex systems require efficient SQA activities – including more testing
- Companies that do not have the testing resources are beginning to outsource testing
- These organizations have been termed “Test Factories”
Test Factories

- Designed to correctly perform validation and verification activities
- Dedicated resources and infrastructure for complex testing
- Can help reduce software development costs
- Lack organizational model to manage the testing process
“If we have a well-defined organizational model which allows the creation of Test Factories, outsourcing testing-related activities could be managed efficiently.”

A well-defined organizational model includes:
- Organizational structure
- Process model

Software testing can be organized in various ways:

- Developers as testers
- Independent test teams
- Integrated test teams
- QA/QC
- Outsourcing & Test Factories
Testing Process Models

- Testing process improvement increases client satisfaction, reduces defect rates, and increases fulfillment of quality objectives
- There are numerous testing process reference models
- Capability Maturity Model Integrated
- Developed by the Software Engineering Institute (SEI) at Carnegie Mellon University
  - Works organizations to continually improve software-intensive systems
  - Helps organizations to develop or acquire the right software, defect free, within budget and on time, every time

WHAT to do

- Not HOW and WHO should do it
- A benchmark of the maturity of an organization’s processes with industry state of practice
- It helps integrate once separate organizational functions
- Set process improvement goals and priorities
- Provide guidance for quality processes
- Provide a point of reference for appraising current processes
- **CMMI does not fully support testing process improvement**

Testing Maturity Model

Developed at the Illinois Institute of Technology by professors Bob Carlson and Ilene Burnstein and their graduate students

It provides a guideline for test process improvement

Compliments Capability Maturity Model

Six levels of maturity

1. Initial
   - Rush to code from requirements
   - No clear separation between design and code phases
   - No attempt is made to use well known design techniques or methods

2. Phased
   - Clear separation between the requirements phase and design is phase

3. Systematic

- Defined design process with a methodical approach to design and the incorporation of design activities in the project plan
- Process can be taught and mastered, highly repeatable

4. Integrated

- Defined design process integrated with development and testing processes
- Portion of the code can be automatically generated and is consistent in structure
- Can be consistently maintained

5. Managed

- Design process managed by measures
- Large scale reuse and use of components leads to a high level of consistency
- Minimize the knowledge gap between management and software development staff

6. Optimal

- Systems are based on composition of designs
- Methodology is repeatable across people
- Process lends itself to self-analysis seeking corrections, efficiency, and improvements to the product
• Developed and promoted by the TMMi Foundation
• Compliments CMMI
• Based on TMM
• Guideline and reference framework for test process improvement

Test Process Improvement model
Develop by Sogeti, an IT service provider
Supports the improvement of test processes
Offers insight into the maturity of the test processes within your organization
Helps define gradual and controllable improvement steps

- 20 key areas for improvement

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- Each key area is given a maturity level ranging from A to D

- A Test Maturity Matrix established the relations among areas

- A set of checkpoints and improvements are made after the assessment
- Integrated with CMMI level 3 engineering processes
- Includes and defines all practices related to testing
- Same structure as CMMI
- Proposes 5 specific goals and related practices

What's Lacking

- The 4 models discussed are helpful to create a Test Factory, but not complete.
- No model examined integrate organizational structure and a well-defined process model.
- The authors proposed a process model of a Test Factory.

Proposed Process Model

- 3 categories of testing processes
  - Management
  - Technical
  - Support
- Each process was defined by identifying these elements:

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Proposed Process Model

Management
- Testing Requirement Development
- Testing Planning
- Testing Design

Support
- Quality Assurance
- Control and Monitoring
- Configuration Management
- Measurement and Analysis

Technical
- Testing Execution
  - Validation Tests
  - Verification Tests
  - Acceptance Tests
- Testing Report

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Testing requirement development

- Inputs: Analysis document, requirement document, specification of client needs
- Outputs: Contract between the organization and the Test Factory, testing requirements
- Description: If the feasibility study and project scope are agreed upon, a contract is signed and testing requirements are captured and managed

Testing Planning

- Inputs: Analysis document, testing requirement document
- Outputs: Test plan
- Description: A test plan is developed and maintained. In addition to the normal elements of a test plan, it includes sections of the project plan which are necessary manage the testing phase.
Testing Design

- Inputs: Analysis document, design document, testing requirement document, test plan
- Outputs: Test plan, Test design specification, test procedure specification
- Description: Establish the information to execute testing effectively and efficiently including test plan tasks, schedule, risk, resources, and cost

Testing Execution

- **Inputs:** Test work package including artifacts to be tested, project documentation and testing documentation.
- **Outputs:** Result reporting.
- **Description:** Test cases and scripts and data are required to prepare and execute tests. A result report is prepared after execution. This is comprised of verification tests, validation tests and acceptance tests.

- **Verification Tests**
  - **Inputs:** Artifacts to be tested
  - **Outputs:** Result reporting
  - **Description:** Inspections, walkthroughs and technical reviews are performed to review the artifacts. Checklists can be used as a simple and useful verification tool.

Validation Tests

- **Inputs:** Project documentation and testing documentation

- **Outputs:** Result reporting

- **Description:** Unit tests, integration tests, system tests, regression tests, stress tests, performance tests and usability tests are executed to check the system.

Acceptance Tests

- **Inputs:** Requirement document and testing document
- **Outputs:** Result reporting
- **Description:** Acceptance tests are executed by the customer or end user to ensure the system meets the client’s needs.

Testing Report

- Inputs: Result reporting
- Outputs: Result summary reporting
- Description: Testing results are analyzed and evaluated and a brief report is drafted. This process controls and manages incidents.
Quality Assurance

- **Inputs:** Test work package
- **Outputs:** Result audit reporting
- **Description:** Verification that the activities defined in the current process have been carried out and that the appropriate intermediate or final product is obtained.

Control and Monitoring

- Inputs: Test plan, result monitoring reporting
- Outputs: Result monitoring reporting
- Description: To control and monitor the state of the projects in regards to schedule, costs, resources, milestones, commitments and risks. This is a continuous process.

Configuration Management

- Inputs: Any element involved in the project
- Outputs: Information about the change
- Description: Changes in the configuration items must follow a formal process of change. The impact is assessed and the change is accepted or rejected.

Measurement and Analysis

- Inputs: Project and process specifications
- Outputs: Measurement reporting
- Description: To control the processes implemented in the organization. Information collected is measured and analyzed based on set indicators. A measurement report is drafted.

The proposed model has been implemented at several companies in Spain.

The proposed process model was adapted for each implementation to include:

- Justification for using a Test Factory
- Metrics to measure the performance of the model
- Methodological guides to be considered when testing

Conclusion

- Test Factories is one way to structure testing in organizations.
- Successfully managing a Test Factory requires a customized management model that includes:
  - A process model
  - An organizational structure
The proposed model defines:
- The processes required to manage a testing factory
- Key elements to develop a contract for outsourcing testing activities

The proposed model has been implemented in several companies but the results were not presented in this article.
Future of Software Testing