

V-Test Management

00- Agenda

Chapter V- Test management

- V/01 Test organization
- V/02 Test planning and estimation
- V/03 Test progress monitoring and control
- V/04 configuration management
- V/05 Risk and testing
- V/06 Incident management

Test Organization

Test Management as a part of the Test Process

- Test management is **project management** of test projects
- Testing is a task covering the complete software development process
- The test management activities are needed throughout the entire test process:

Activity

Test conception

Test planning

Test control

Test acceptance

Work product

Test plan (static)

Test plan (dynamic)

Status reports, control action

Product release

Test Organization

Test teams should be independent

Advantages

- **unbiased**, not personally attached to test object
- They may question facts on the test basis and verify assumptions made while designing tests

Drawbacks

- Increased **communication** efforts, “Having the last word on”- Conflicts
- Developers loose sense of responsibility

Test Organization

Other ways of setting up test teams

- Developers test their **own** programs
- Testers are also members of the development team
- Testers are also members of the **project team** or line organization
- Specialists for individual tasks
- **External** test teams

The above order reflects the degree of independence

Test organization

Profiles of Test Personnel

- Testing requires persons with a wide variety of skills and qualifications
- The following roles within the test process will be explained in detail:
 - Test manager
 - Test designer
 - Test automation engineer
 - Test administrator/ Test system administrator
 - Tester
 - Technical Expert
- Note: additional roles may be specified, e.g. database administrator, load tester

Test organization

Test leader (also : test manager or test coordinator)

- Plans, monitors and controls the test project
- Special skills required :
 - Software test and quality management
 - Test planning and test control
 - Experience as a **project leader**
 - **Management** abilities

Test organization

Test designer

- Designs the necessary **test cases** and sets up in which **order** test case execution will take place
- Special skills required :
 - **Development** and **testing** knowledge
 - **Software Engineering** knowledge
 - knowledge about specification techniques (methods)
 - knowledge of functional requirements

Test organization

Test automation engineer

- Evaluates the possibilities for test automation and implements them
- Special skills required
 - Experience as a tester
 - Know-how in test design and test automation
 - Programming skills
 - Excellent skills in operating the applied test tools

Test organization

Test system administrator

- Set up and operates the test **environment**
 - Is responsible to meet the requirements on the test system
- Special skills required :
 - **System administration** (or access to a system administrator)
 - **Knowledge of development and testing tools**
 - Database systems, if applicable
 - Networks, if applicable
 - Installation and operation of system software (e.g. operating systems)

Test organization

Software tester

- **Executes** test in accordance with the test case specifications
- Special skills required :
 - Basic knowledge of Software
 - Basic testing knowledge
 - Operation of the used testing tools
 - Experience in conducting tests
 - Knowledge about test objects

Test organization

Technical expert

- Support the test team where necessary
- Special skills required :
 - **Database** administration or database design
 - Experts of **user interfaces**
 - **Networking** experts
- Depending on the type of problem or on the test environment, further test experts may become part of the test team
- Sometimes special skills are required which do not relate directly to testing, e.g. usability experts, security experts, etc.

Soft Skills

- In addition to their technical skills, test team members require the following

qualification and experience :

- Team members : (political and) **diplomatic instinct**
- **Willingness** to question seemingly obvious facts
- **Persistence**, strong standing
- Exactness and creativity
- Skillful handling of complex situations
- **Fast learning** skills

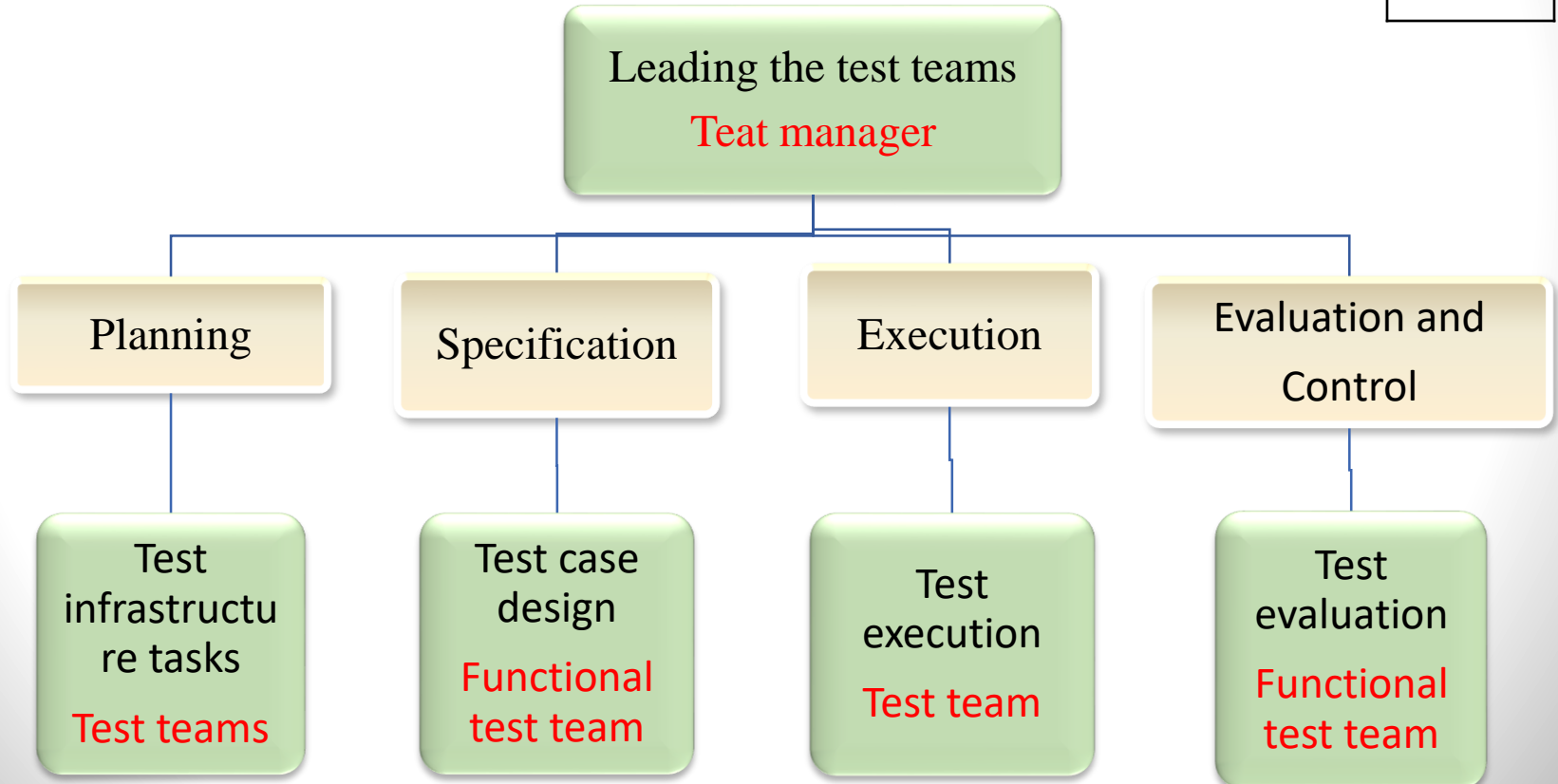
V-Test Management

01- Test organization

Organizations of the test teams

- Use an appropriate organization for each individual project

What
Who



V-Test Management

01- Test organization

Tasks of the leader/1

- Organization the test team
 - Test planning (in accordance with the corporate quality plan)
 - Test cycle planning
 - Test strategy incl. decision on test automation
 - Test measurement and control
 - Introduction of an adequate incident management system
 - Introduction of a configuration management system
 - Result/ progress reporting for the company management
-
- This is not a particular task of the manager, configuration management is needed in all phases of the product development.

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Tasks of test leader: Test management

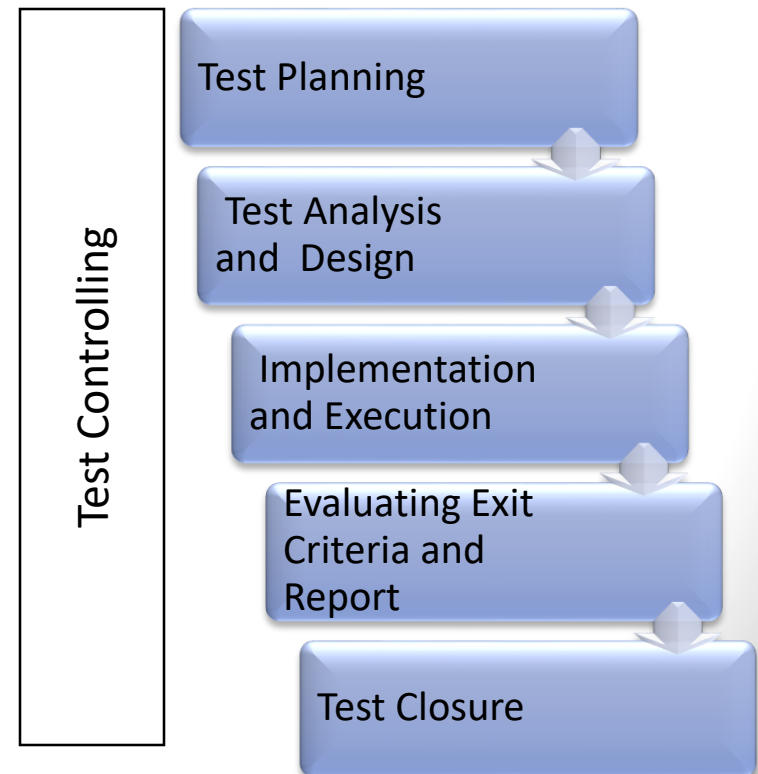
- Writing the test plan (German: Testkonzept)
 - Creates a document which holds methods, resources and time tables for the test activities

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Tasks of the test leader: Test planning/ Test cycle planning

- **Test approach:** Implementation of a test strategy for a specific project
- **Test cycle:** a cycle through the fundamental test process regarding a particular test object
- Activities of the test process (reminder):
 - Test planning and controlling
 - Test specification
 - Test execution
 - Test evolution and reporting
 - Test closure

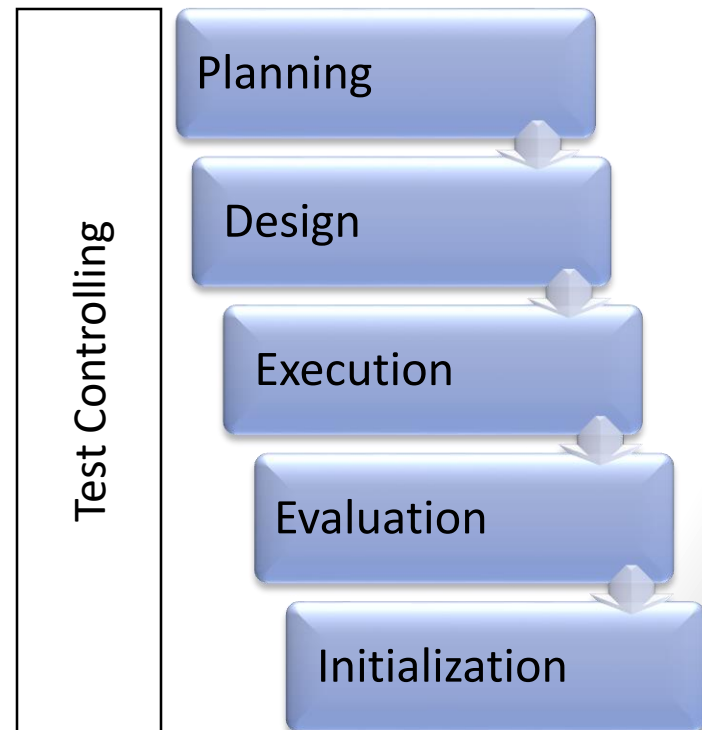


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Tasks of the test leader: Test planning/ Test cycle planning

- Test planning
 - Planning of the test process:
shall be made up during the **early phase** of the project. The results shall be put in a document (**static test plan**)
- Test cycle planning
 - Detailed planning of a test cycle:
Static test plan will be **detailed** to describe a specific test static test cycle. Details depend on the particular project situation (e.g. development progress, test results, available resources)
- Task of the test manager:
Initiating, controlling and supervising tests and test cycle

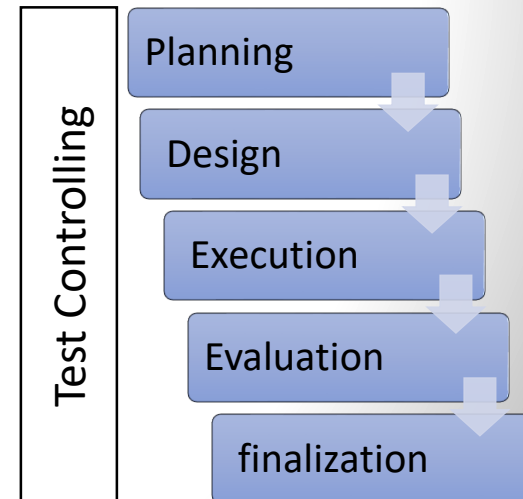


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Tasks of the test leader: Test planning / Test cycle planning

- Test planning starts at the beginning of a project
- Milestones, budget and priorities of the various test activities need of the various test activities need to be addressed, risk need to be understood
- Project development needs to be taken into account
 - During the project, delays may occur and test planning needs to be adapted
- Select tools to be used and decide on test automation
 - Different tools and automation degrees for different test levels

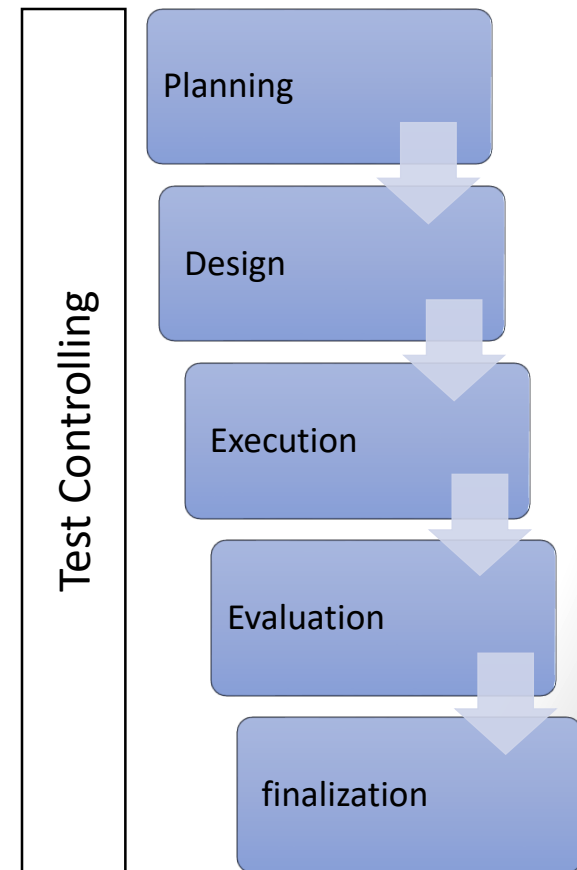


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Tasks of the Test Leader: Test planning/ Test cycle planning

- **Resources** must be planed
 - These are sparse and usually need to be assigned individually
 - During test cycles, delays might occur in such a way that planning of testing resources has to be revised
- **Project development** needs to be taken into account
 - During the project, delays may occur in such a way that the overall time table is in jeopardy
 - In this case, planned tests might have to be scraped in order to meet the milestones
 - This is very often the first measure taken when time becomes tight.

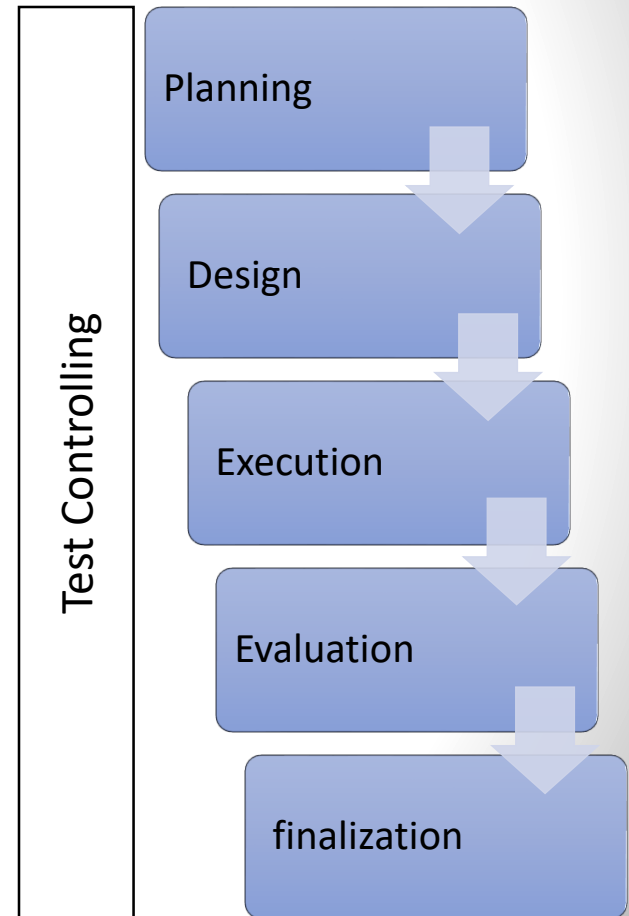


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Tasks of the Test Leader: Test planning/ Test cycle planning

- Evaluation of previous tests should be taken into account
 - Actual results to test activities, e.g. depending on the number of errors found in the first test cycle, the second test cycle will be shorter or longer
- Control of the ongoing test activities is done using metrics stated and agreed upon in the test plan

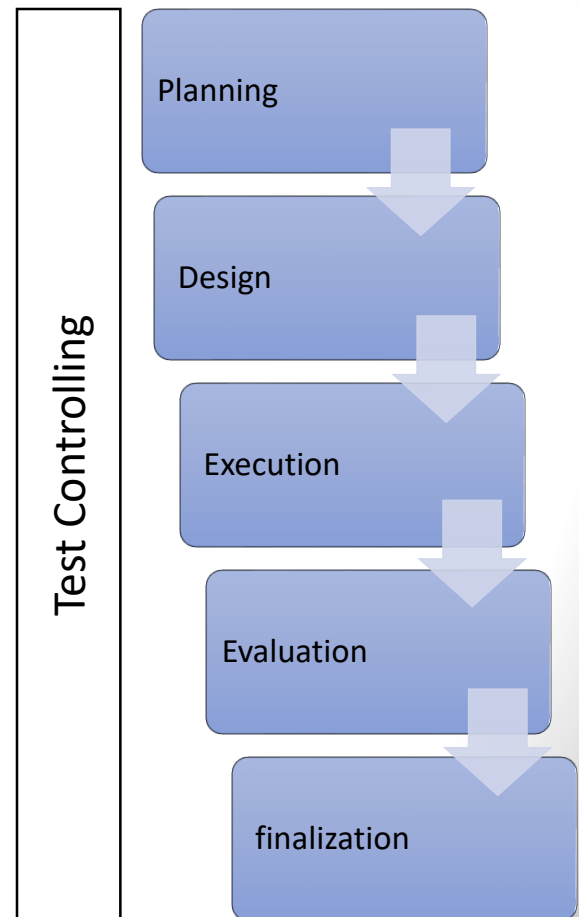


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Tasks of the Test Leader: Test Specification

- The main goal of testing is to find as many relevant errors with as little effort as possible!
- **All tests** documented in the test plan are **specified**, i.e. it is stated, how each test case is furnished and how it should be executed. This process is **initiated** by the test leader
 - test cases are made up of single steps
 - test cases should be derived with help of personal knowing the
 - functional requirements of the software!
 - test cases should be designed keeping their repeatability in mind

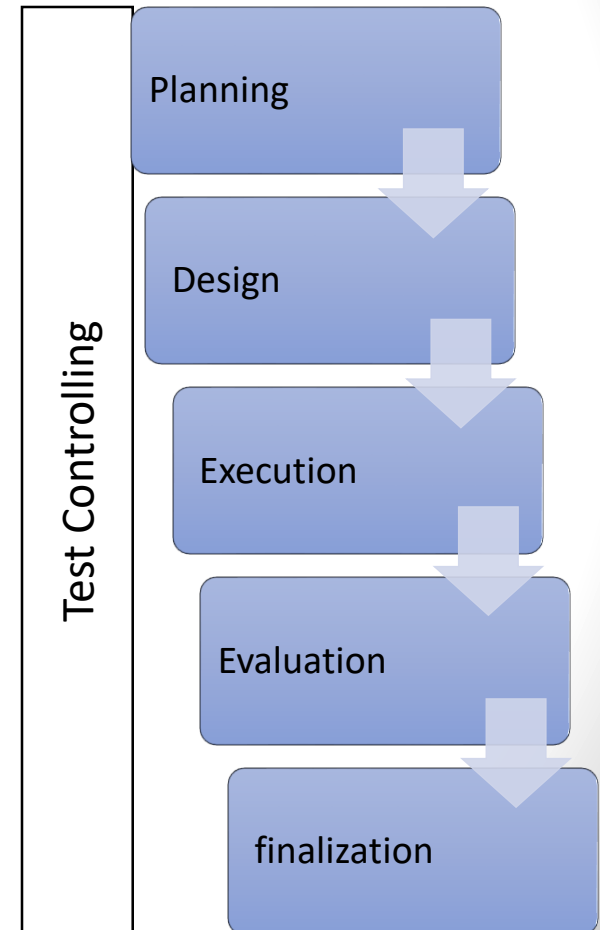


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Tasks of the leader: Execution and control

- Comparison of expected and actual results within the project
 - Every test cycle needs to be adjusted to the test plan
 - Did delays or changes occur?
 - Are the results within the range of expectancy? – Number of detected errors, time for corrections, resets, etc.
- All deviations are to be reported and to be taken into account
 - Corrective measures have to be taken on a regular basis regarding the test plan and current test activities, e.g.:
 - Adjust dates for planned tests
 - Adjust resources for test execution
 - perform additional/ skip test cycles
 - Change priority of test cycles

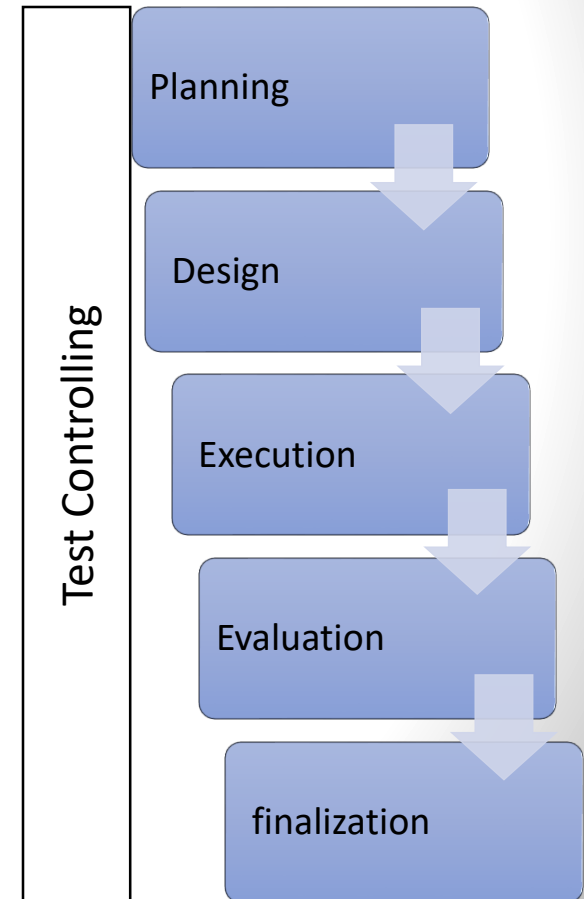


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Tasks of the Test Leader: Evaluation

- Test management brings **transparency** into the progress of testing and supplies indicators for the project management.
- **Reports** generated during test execution (e.g. error reports, summaries by error classes, statistics), the error tracking and reports to the customer are an important for the project leader and the company management (e.g. as a basis for time and resources planning).
- Using tools and templates will increase quality and may reduce the work load

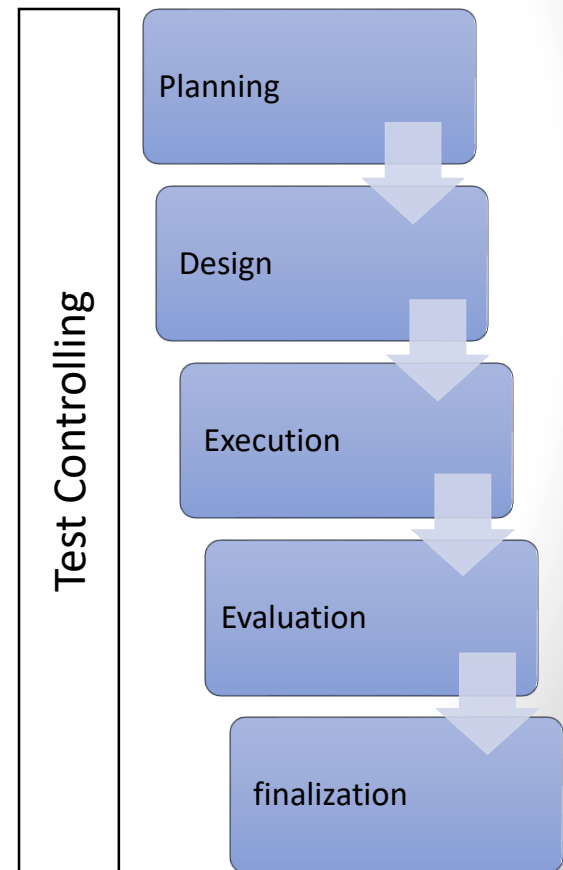


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Tasks of the test leader: Evaluation

- Test management includes acceptance of the project results, meaning: the product has to meet the defined requirements and specification
 - The project manager, in accordance with the test manager, decides on the acceptance of the test objects (e.g. transfer to the next test level)
- A test **summary report** ensures the completion on the test activities



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01- Test organization

Tasks of the tester- Overview

- Assists in implementing test planning activities
- Test execution
- Test reporting
- Assists in implementing test automation

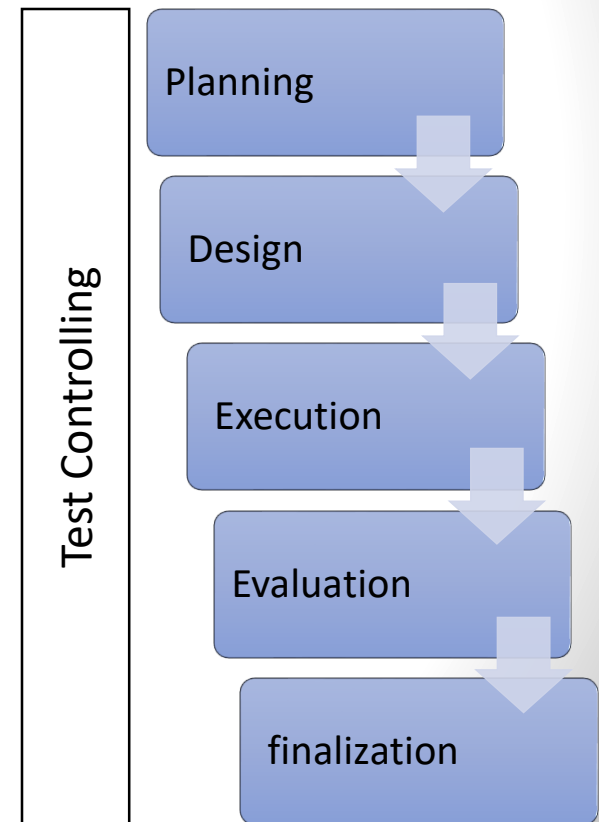
Tester is used as a generic term and may include various roles other than the test managers

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Tasks of the tester/1

- Assist in implementing test planning activities:
 - review/check test plans
 - analyze and evaluate test basis (documents, specifications)
 - produce test specifications
 - work out and select test cases and test data combinations
 - formulate expected results
 - prepare, configure and administer test environment (together with network and system administration)



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Tasks of the Tester/2

- Test execution (manual testing)
 - Implement testing at all test levels
 - Execute tests and record results in a test protocol
 - Evaluate test results

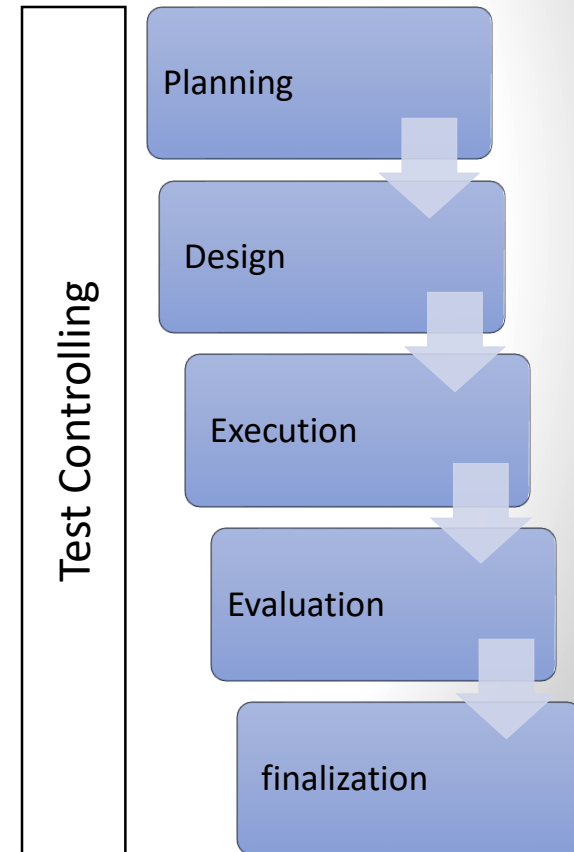
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01- Test organization

Tasks of the tester/3

- Assists in the implementation of the test automation
 - Create test scripts
 - Create/ operate test tools in the area of test automation
 - Perform test automation activities, control capture –reply-runs
 - Analyze and evaluate results
- Test post processing
 - Create a test protocol
 - Trace deviation notes
 - Perform retests
 - Prepare acceptance documentation

Tester may be supported by a developer or a test automation expert



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01- Test organization

Summary

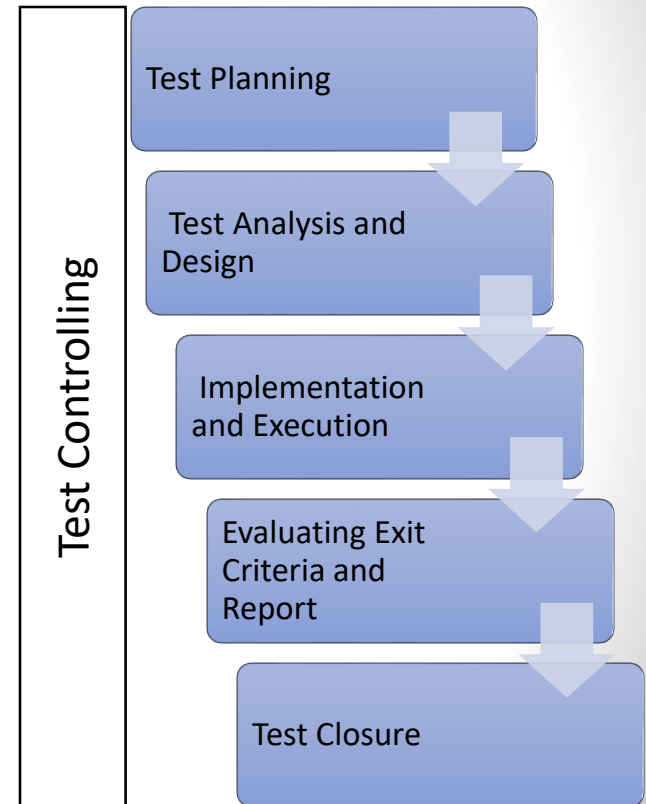
- The **effectiveness** of finding defects **increase** with the **independence** of the test team. Independence comes in various degrees
- The test manager sets up the **test team** at an early state and
 - Plans all tests
 - Creates a test strategy
 - Organizes deviation management
 - Controls test execution
 - Evaluates test results
- The **test manager reports** to the company management and to the project leader
- The **testers supports** the test preparation activities, executes the tests, creates deviation messages and test results documentation. He also assists in the implementation of test automation

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02- Test planning and estimation

Test planning Activities

- Test planning is project planning
 - All tasks and activities have to be planned in advance
 - For the different tasks defined, resources should be allocated (personnel, budget, tools, test environment, etc.)
 - Summarizing test activities in a test plan and coordinating them with the project plan
 - Defining the level of quality (e.g. testing depth) for the various test levels
 - Test planning is a continuous activity, it needs to be controlled on an ongoing basis
 - Feedback from test activities might impose adjustments on the test plan in order to deal with changing risks



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02- Test planning and estimation

Test planning is part of the overall quality planning

- Test planning is an important part of quality assurance, but not the only part
- Structure and contents of a quality plan can be found in IEEE 730 (with further information in IEEE 983)
- Elements of a quality assurance plan according to IEEE 730: planning and description of
 - Project organization
 - Documents covering the development life cycle
 - Standards, methods and conventions as well as a mechanism to ensure, that they are followed
 - Reviews and audits during the software development life cycle
 - Testing
 - Error documentation, remedies

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02- Test planning and estimation

Test plan (static) (German: Testkonzept)

- After defining the role of testing within the QA-activities, the test process starts with its planning phase
- First step of planning is the creation of a static test plan
 - The test plan covers all phases of the testing process
 - Rules are laid down regarding test objectives, resources, testing activities, milestones, etc.
- The (static) test plan is later on extended to cover results from the detailed planning phase
 - As during project planning more information becomes available planning can be done in more detail
 - The test plan gets a dynamic extension, which will be adjusted during project life cycle, if necessary
 - A proven structure for a test plan is given in IEEE 829

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02- Test planning and estimation

Test plan according to IEEE 829

1. Introduction
2. Assumptions
3. Test items
4. Features to be tested
5. Features not to be tested
6. Approach
7. Item pass/fail criteria
8. Suspension/ resumption criteria
9. Test deliverables
10. Testing tasks
11. Environments needs
12. Responsibilities
13. Staffing & training
14. Schedule
15. Risk & contingencies
16. Approves

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02- Test planning and estimation

Activities to be performed

- Test planning starts at the beginning of the development project and is adjusted throughout the project life cycle
- Test planning also covers creating and updating the test plan.

This following activities are explained in more detail:

- Test strategy
- Resource planning
- Priority
- Tool support

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02 - Test planning and estimation

Activities to be performed – test strategy

- Test strategy describes the **test levels** to be performed and the **testing intensity** within those levels
- Test strategy also state **entry and exit criteria** for each test level, including the **metrics** to measure these criteria
- Because testing a system a in full id not feasible, a test a strategy is needed. Testing with all possible test data combination, internal states and timing constraints is practically impossible
- Risk assessments help to focus testing activities on those areas which bear the highest risk of failure.

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02 - Test planning and estimation

Activities to be performed – resource planning

- The main goal of resource planning is to estimate the efforts of team members, including their time requirements, tools, support activities etc. These **estimations** become part of the (dynamic) test plan.
- The test plan also has a detailed **time table** including milestones, assignment of people to activities. This plan is an instrument to manage the overall task of test execution with all its activities.

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02 - Test planning and estimation

Activities to be performed – test planning

- Manage time: many projects experience intense **time problems** towards their final phases. This may lead to decisions on reducing test activities or skipping tests completely.
- **Prioritize tests:** Since releasing a product without sufficient testing bears a high risk. It is necessary to prioritize test activities. This should be done in such a way, that the most important test cases are executed **early**. This way, **critical parts** of the programs are tested even if the test activities have to be aborted prematurely
- **Select tools:** Deciding on which tools should be used for testing, are the available tools sufficient or are additional tools needed
- **Document:** Defining the level of detail, structure and templates for the test documentation.

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02 - Test planning and estimation

Test exit criteria

- Exit criteria, which include the end of a testing phase, are be set up for every test level. Metrics are needed to control these exit criteria.

Example

- Code coverage:
 - X% of program code have been executed
 - X% of all functions / all menu selections have been covered.
- Risk coverage:
 - Test case of a predefined risk class(e.g. the highest risk level) have all been executed successfully.

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02 - Test planning and estimation

Test exit criteria

- **Test abortion due to time , cost or quality reasons**
 - Test activities are stopped when delivery day is reached or the test budget is exhausted. Very often this is reality in projects, often this costs a lot of time and money later on
 - If minimum quality is not met, testing may be aborted or not even start (too many critical errors)
- **Error finding rate**
 - Number of new errors discovered per hour falls below a predefined value, e.g. testing can be stopped, if less than one error per hour is discovered
 - The **economics** of testing have to be taken into account. Beyond certain error discovery rate it might be a better option to release the software application to production and concentrate only on fixing failures reported by the customers.

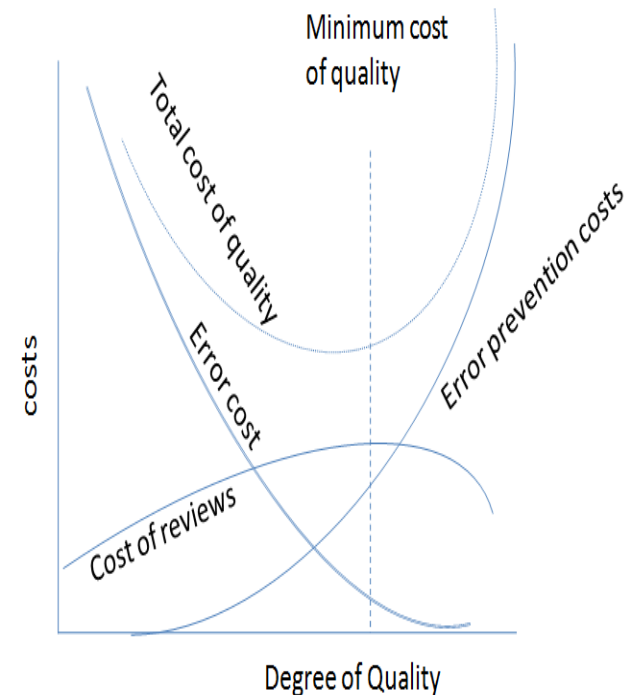
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02 - Test planning and estimation

Test exit criteria

- **Economies of testing**

- An increasing degree of quality means lower cost of error, but high error preventions costs
- Cost of review initially increase, then decrease (less reviews are performed during the late project phase)
- Total quality cost decrease initially, then increase again - quality costs are lowest where the curve is in its minimum
- If it is necessary to supply a certain **minimum quality** to be able to stay in business, this can mean:
 - Test have to be continued although error prevention costs rise more than error cost decrease.



Source: Qualitative data from about 20 Diaz&Hilterschid projects

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02 - Test planning and estimation

Test approaches / test strategy

There are a variety of different approaches of testing.

Approaches /strategies may be combined

- Preventive approach
 - Tests are designed as early as possible
- Reactive approach
 - First software / system design, than test design
- Analytical approach
 - Analysis is done prior to testing, e.g. risk based testing
- Heuristic approach
 - Testing is more reactive, e.g. exploratory testing.

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02 - Test planning and estimation

Test approaches / Test strategy

Other approaches / strategies:

- **Reuse approach:** Use test suite and tests from prior projects in order to make fast advances
- **Failure focused approach:** Error Guessing, fault attacks.
- **Check list based approach:** Usage of check lists from prior projects or from test planning
- **Consultative based approach:** external experts and technology guide the test process
- **Process- or standard-compliant approach:** Strategy ruled by software development standards, e.g. agile methods, industry standards
- **Model based approach:** Stochastic testing on the basis of statistical information on Failure rates, etc.

More approaches may be defined. In practice, various approaches are combined

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02 - Test planning and estimation

Test estimation – influencing factors (extract)

- Characteristics (e.g. complexity) of the product
- Quality of the test basis
- Requirements on reliability and safety of the product
- Complexity of the development process
- Stability of the organization, maturity of used processes
- Personnel involved, time pressure
- Methods to estimate test effort
 - Expert based estimation (also: task based approach)
 - Analogy based estimation
 - Ratio based estimation

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02 - Test planning and estimation

Expert based estimation /1

- Method
 - **Identify** all **tasks** to be performed (typically using a top down approach)
 - Get **estimation** on all tasks by their owners or by experts
 - **Add up** all values for the tasks. Include **correcting factors** (if there are experience regarding the accuracy of certain estimators)
 - Include **buffers** / additional positions to cover for **overlooked or underestimated tasks**

V – Test management

02 - Test planning and estimation

Expert based estimation /2

- Advantages
 - Estimation activities can be closely **linked to project planning**
 - Estimation creates a detailed data base which can be controlled and adjust throughout the project life cycle
 - Tasks may be assigned to groups(e.g. small, medium, large) and efforts are estimated for a group representative.
- Drawbacks
 - This method ins **extensive** and **expensive**.
 - This method requires a clear at an early stage on test strategy and test activities .
 - Experience shows that estimations are, in most cases, to low. This might be due to overlooking certain tasks or coarsely underestimating tasks
 - Build- in buffer are cut down during project planning activities
 - **Errors** regarding **project planning** are **inherited**.

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02 - Test planning and estimation

Analogy based estimation /1

- Method
 - Categorize the required testing tasks
 - Finding a **project** which has been executed in the past containing a testing task similar to the one specified
 - Use the real efforts for this task as a basis for the estimation
 - By using metrics (lines of code, number of modules, number of test case etc) as a basis, calculate the overall estimation value
 - Allow for correcting factors.

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02 - Test planning and estimation

Analogy based estimation /2

- Advantages
 - Method is simple and effective
 - With enough experience, quite accurate estimation values can be achieved
- Drawbacks
 - Need of experienced estimators and /or a detailed data base on actual project data for the tasks to be estimated
 - Criteria to categorize project may not cover all aspects a project
 - Often leads to discussions with management on the validity of the estimation.

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02 - Test planning and estimation

Ratio based estimation /1

Method

- Effort for testing activities are estimated on the basis of overall project activities
- The value for the **ratio (fraction)** needs to be determined based on **experience**
- Example: Spillner / Linz talk about a ratio of 50% testing activities compared to the overall project activities(see also: “Basiswissen Software test” , dpunkt verlog, 3 Auflog, S. 181)
- This method may also be used only for **part of the work** (e.g. estimations test management costs, estimating test efforts foe systems test)
- Ratio based estimation does not take into account regression test efforts, which can be substantial part in maintenance testing and change related testing

V – Test management

02 - Test planning and estimation

Ratio based estimation /2

Advantages

- Very **simple** and powerful estimation technique, which does not need too much input data

Drawbacks

- Not very accurate, since it does not take into account particular project facts
- A lot of experience and intuition is needed by the estimator in order to derive valid estimations
- Deciding on the ratio value may lead to difficult discussions
- Taken into account activities, which are already part of project planning estimations (e.g. **developers test effort part of the development** estimation or **part of the testing** estimations ?)
- Ratio varies widely between new development project and maintenance project.

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02 - Test planning and estimation

Summary

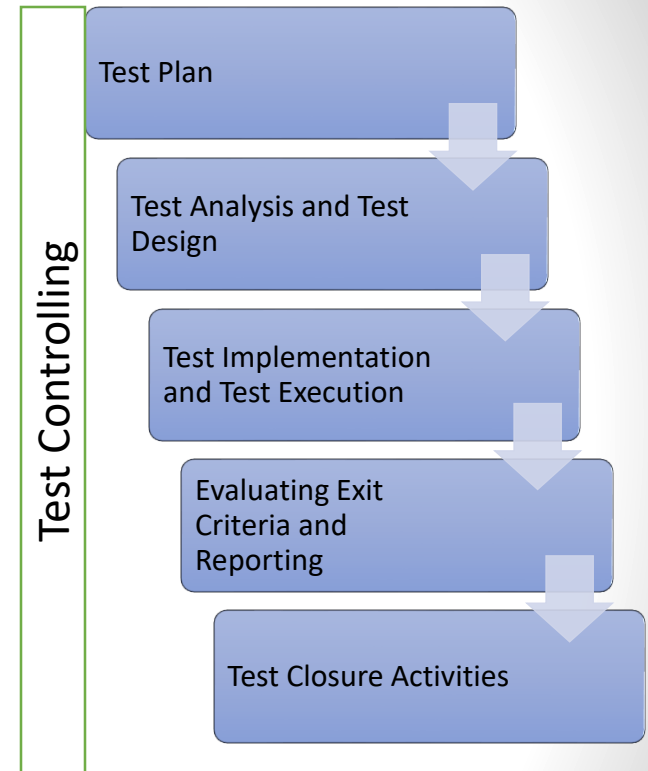
- Test planning is part of **corporate quality planning**
- The test plan is the basic element of all test planning activities. It should be created early in the project
 - Template of test plan: IEEE 829
- Test estimation can be done using various method. Three common method are:
 - expert based estimation
 - analogy based estimation
 - Ratio based estimation

V- Test management

03 – Test progress monitoring and control

Test planning, monitoring and controlling

- **Test planning:** test must be initiated
- **Test monitoring:** Control of test activities in order to detect deviations from the plan
- **Test controlling:** Correcting the direction of test activities when necessary
- Monitoring should be done based on measurable considerations
 - Error –based metrics(taken from the incident management system), e.g. defect detections rate, defects found/fixed, retest result.
 - Test case-based metrics (taken from the test manage system), e.g. coverage of test cases, coverage of requirements, good/bad ratio of test cases, code coverage, risk coverage
 - Cost-based metrics (e.g. taken from the project control system), e.g. cost of finding errors, regression test costs, cost of external resources.
- The result measured are to be reported regularly



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03 – Test progress monitoring and control

Test status report/1

- Information about test activities is consolidated for test reporting
- Sample for the contents of a test status report (as per IEEE 829)
 - Test object or test objects
 - Test level, test cycle, reporting period
 - Test progress (using metrics, e.g. number of documented defects, number of test cases executed)
 - Resources used / budget spent
 - Milestones reached (e.g. acceptance of test objects on particular test levels)
 - Defected report(number of defects uncovered, number of defects corrected)
 - Risk assessment(new / changed risks in relation to the to the previous report)
 - Forecast; Activities planned for the next reporting period
 - General evaluation/status (“traffic light”)

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03 – Test progress monitoring and control

Test status report/2

- Reporting frequency
 - At the beginning of a project/ in the preparation phase reporting cycles are longer (monthly, every 2 weeks)
 - The “critical” phase of test execution require short cycles(weekly, even daily)
 - Test closure report at the end of the project
- Evaluation of test reporting
 - Is progress made appropriate ?
 - Is test execution effective and efficient ?
 - Are activities in line with the test goals, are the test goals being reached?
 - How high is the level of confidence in the software based on current test progress?

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03 – Test progress monitoring and control

Test controlling

- Test controlling is a management task
 - The test manager belongs to the leading squad of the project
- Correcting measures as response to deviations from the plan
 - Test controlling incorporates all measures that are undertaken during testing
 - Adjustment of planned test activities and, where needed, initiating a new planning cycle in the project plan
- Test closure evaluation
 - Test exit criteria are also recorded with the test progress metrics
 - Test exit criteria that were reached are documented in the test report for approval.

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03 – Test progress monitoring and control

Test controlling measures

- Provide more resources
 - More human resource (overtime, increase size of test team)
 - More budget (get external specialists/consultants)
 - Tool deployment for automating tasks
- Reduce the work efforts
 - Leave out variations of test case
 - Simplify complex test object/omit test of selected objects
 - Reduce amount of test data
 - Leave out test case / test set
- Test controlling measures are reported to inform the project management / customer about changed risks of product deployment

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03 – Test progress monitoring and control

Summary

- Test progress monitoring is based on **measurable criteria** and provides the information needed to manage the test process
- **Deviations** from the plane require correction measures
- **Regular test reporting** informs the project and the company management about the testing progress

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04- Configuration management

Purpose

- A **large amount of data** / information/ result (artifacts) are produced during software development:
 - Requirements / specification / system design documents
 - Individual components, integrated modules, complete systems
- A large number of **participants** with different roles working on the variety of system components
- Configuration managements is responsible for the explicit naming of all artifacts and for their administration
 - **Successive versions numbers** are assigned
 - **Clearance** for further development is recorded
 - **Old versions** are saved for future control
 - **Access** to the artifacts is recorded

V-Test Management

04- Configuration management

General Remarks

- Configuration management has a supporting role within a project. All changes have to be recorded at a common place and communicated using a defined process
- Depending on the type and scope of a project, the expectations on configuration management might strongly vary- a specific configuration management plan has to be made
- IEEE 828 provides a standard for configuration management and configuration management plans
- **Configuration management is not a particular testing activity**, it is needed throughout all project phases
- Configuration management without an appropriate tool is only possible on very small projects

V-Test Management

04- Configuration management

Configuration Management(CM) refers to a set of measures that supplement software development:

- Change management follows all activities, e.g. change on the source code, for each change request
- Build management describes all steps leading to creating a software version to be delivered, concerning the software as a whole or individual sub-systems
- Release management enables the definitions of isolated versions for each artifact composing a complete version of the product to be tested , be delivered, etc.
- Versions management (as a part of CM) records all access information for each artifact: current version number, last change, last user, etc.

V-Test Management

04- Configuration management

Problems address by configuration management

- **Which is the current versions ?** Ambiguity which versions belong together might result in coding activities based of the specification.
- **What was changed when and who changed it ?** Concurrent changes of a file are possible: which changes can be overwritten?
- **Which version of the file was tested?** It is difficult to test and draw conclusions from tests when a definite declaration of the versions at hand is missing
- **Which artifact belong together?** Which versions were put together to create which release?

V-Test Management

04- Configuration management

Requirements on CM from the testing point of view

- Version control
 - Categorizing , saving and recalling different versions of an object (V1.0 V1.1 etc)
- Configuration management (release management)
 - Determining and administering all data in the corresponding versions that make up a sub-system
- Protocols comments and reasons for change made
- Keeping track of the status
 - Tracing defects and changes, recording problem reports and providing backtracking of activities

V-Test Management

04- Configuration management

Configuration Audit

- A configuration audit is introduced to check the effectiveness of configuration management activities
- The configuration audit will check :
 - Whether all single system components are included in the configuration management
 - Whether single configuration can be correctly identified

V-Test Management

04- Configuration management

Summary

- Configuration management is needed to **administer change** on test object and their respective **versions**
- Build- and release information is stored in order to reconstruct older releases
- Configuration management applies to the **complete software development process**, not only to the test process
- Configuration management is hardly possible without the **appropriate tools**

V – Test management

05- Risk and testing

Risk

- Risk (from: German Wikipedia)
 - A risk is a calculated prediction of a possible damage respectively loss in case of a negative outcome (danger) or a possible advantage respectively gain in case of a positive outcome (chance)
 - Risk is the probability of a negative outcome (mathematical), or the probability of a negative event happening multiplied by the amount of financial damage(economic)
- Risk (from: waltzing with bears, Tom DeMarco/Timothy Lister)
 - A possible future event that will lead to an undesired outcome(cause) respectively this undesired outcome itself(effect)
- Project- and product risk should be taken into account when planning and designing test cases, when prioritizing test cases, when choosing methods and while executing the tests

V – Test management

05- Risk and testing

Types of typical project risks

- **Organizational risks**
 - Qualification and availability of stuff
 - Personal problems between teams/team members
 - Insufficient cooperation between departments/ conflict of interests
 - Unrealistic project schedule estimates
- **Technical risks**
 - Wrong, incomplete or unrealistic requirements
 - New or uncertain technology, methods, tools, etc, for software development
 - Short falls in the quality of the work products
 - Availability of complex test environment
- **Environmental risks**
 - Shortfall in externally provided components (time, quality, cost)
 - Acceptance problems and other contract issues with vendors
 - Concurrent access to external resources
 - Changes regarding legal requirements

V – Test management

05- Risk and testing

Project risks

- Project risks influence the success of a project, they have to be managed
- Estimate probability and potential damage
- Implement appropriate measures to deal with the identified risks:
 - Risk mitigation (actively prepare measures to reduce probability and/or potential damage)
 - Risk control (prepare for measures necessary if risk becomes a problem, have time and money available)
 - Risk ignorance (hope, that the risk does not become a problem, pray, keep fingers crossed, etc.)
 - Risk transference (moving the risks to another area/ organization)
 - Risk avoidance (avoid the risky situation)
- The different ways cost different amounts of money

V – Test management

05- Risk and testing

Product risks

- Product risks result from problems regarding the supplied product
 - Insufficient functionality of the supplied product
 - Insufficient non- functional attributes
 - The product is not fit for its intended use, hence it cannot be brought into operation
 - The product causes damage to property
 - The product cause accidental bodily injury or death.
- Testing is done to reduce product risks
 - Risk= probability of occurrence x potential damage
 - Testing reduce the probability of error occurrence
 - For high potential damage more intensive tests are need

V – Test management

05- Risk and testing

Managing product risks /1

- Managing product risks using risk based testing
 - Identify, analyze and prioritize risks
 - Risk influence already taken into account during test planning
 - Select test methods to mitigate risks
 - assign test scope(depth) according to risk level
 - Adapt execution order of test casus (important test cases first, in order to find critical errors early !)
- Update the risk assessment worksheet on a regular bases
 - Risks may disappear (vendor did supply in time)
 - New risks may arise (customer orders additional functions)
 - Risks may change (influenza epidemic)

V – Test management

05- Risk and testing

Managing product risks /2

Benefits of risk based testing

- Test methods are chosen particularly to mitigate the indentified risks
- The scope of testing takes care of the indentified risks. In this way, test efforts are focused to address risk reduction potential
- Risk failure are discovered early, thus making it more economical to correct them
- Even in the case of a test abortions, it is ensure that the most important test cases have been executed(risk based prioritizations of tests)

V – Test management

05- Risk and testing

Summary

- Project and product risks endanger the success of the project, they have to be managed
- Risks can be organizational, technical or environmental risks
- Risk number = probability of occurrence times potential damage
- Risk management is project management for adults

V – Test management

06- Incident management

Finding errors* during testing

- Testers execute specified test cases and record the results
- Afterwards, they analyze the deviations between expected and actual results
 - Failures are identified (e.g. failures in documents, in code, in output data of a test object, in a help text)
- At this point in time, the task of the tester is finished for the time being
 - Tester waits for the corrected versions of the program to perform a retest
- The further tracking of the error is done using an incident management system(error / defect manage)

*Throughout this chapter error and incident are used synonymously

V – Test management

06- Incident management

Who does what? /1

- Tester
 - Executes test cases to discover errors
 - Records the result in a test protocol
 - Enters the defect(incident) into the database(problem report)
- Test manager
 - Evaluates the problem report
 - Assigns priority to the error(in accordance with project management, customer, etc)
 - Writes work progress report on the basis of current state of correctional work

V – Test management

06- Incident management

Who does what? /2

- Change Control Board(CCB)
 - Decides on changes of the requirements and their priorities
- Developer
 - Analysis failure, location error case
 - Corrects error cause in accordance with assigned priority
 - Performs all approved
- Note: these tasks are performed in an iterative manner
 - Tester
 - Test manager
 - Change Control Board(CCB)
 - Developer
 - Tester

V – Test management

06- Incident management

Structure of an incident report (error report)

- The incident report describe the failure, not its cause
- Template of incident report is found in IEEE 829 (Anomaly Report)
- Detail of an incident report may include:
 - Incident data
 - Unique error number (usually automatically generated)
 - Test object (name, version), test step
 - Test environment
 - Name of incident report author
 - Date of first occurrence
 - Classification of incident
 - Error class(also: error severity)
 - Error state (new error, retest etc.)
 - Priority(assignment of urgency)

V – Test management

06- Incident management

Structure of an incident report(error report)

- Details of an incident report may include:
- **Description**
 - Test case (provides all details about preconditions)
 - Error result/ failure mode (using description of actual and expected result)
 - Description of the deviations to enable resolutions(including reports, screen shots, applications error messages, etc)
 - Cross reference to related reports
 - Comments
 - Corrective measures taken
- **History Log**
 - Time and user to perform changes
 - Most systems automatically track changes in the life cycle of the incident/error

V – Test management

06- Incident management

Error class and error priority

- The severity of a failure is expressed by assigning an error class (synonymous: failure class)
 - Error classes used can be: critical error, major error, medium error, minor error. Three or four classes are usual
 - Basis for the classification can be the influence on the product usability(DIN 66271)
- The priority takes into account the effect of the failure
 - Impact on the program functionality
 - Impact on the project, on the customer
 - Possible to provide an immediate fix or correct the problem within the next release
- Priority rules the urgency of the correction

V – Test management

06- Incident management

Error state

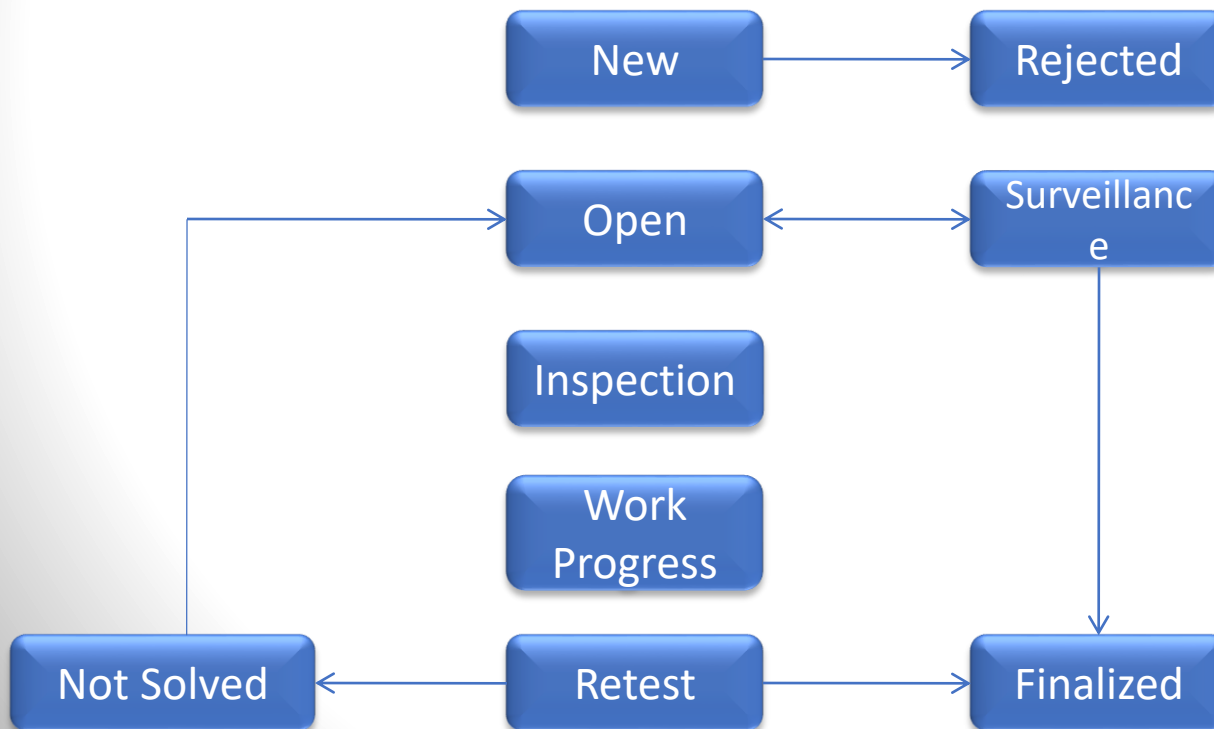
- The error state gives information on the progress of work that has been performed for this error
- Possible states include, but are not limited to:
 - New- tester entered error into the system
 - Open- problem report confirmed (by test manager or developer)
 - Rejected- problem report rejected (by test manager or developer)
 - Inspection- developer tries to identify the error
 - Surveillance- error cannot be reproduced, It is under surveillance
 - Work I progress- error is located and cleared for correction
 - Retest- developer has corrected the error cause
 - Finalized- tester has verified correction by performing a retest
 - Not Solved- tester disapproved the correction, error still there

V – Test management

06- Incident management

Error state

- Typical states and transitions for incident management work flow



Remark:

Number of states supported by tools varies widely (could be three, could be twenty)

V – Test management

06- Incident management

Error state

- Only a tester can make an error as finalized
- Usually, the test manager decides if an error is to be corrected or rejected – alternatively the change control board may decide on the correction of an error taking into account the cost of repair
- All changes (including commentaries) are to be recorded within the incident management system
 - Ongoing control on the status of error correction is ensured
 - Further test activities can be planned
 - Sometimes, additional test cases have to be generated in order to track down the cause of a failure

V – Test management

06- Incident management

Error reports analysis

- All error reports are analyzed in a systematic manner in order to assess progress of error correction activities, project plan conformance and software quality:
- Typical point of attentions are
 - Is a reduction in the number of newly found error visible? Or is the number increasing during the project life cycle
 - Are particular test object showing a high number of error ? Are any test object showing a lower than average number of errors?
 - How many severe error / high priority errors are still open?
 - How long does it take for an error to get fixed? What is the average time for errors to get fixed?
- Incident management tools offer a wide variety of reports on error statistics

V – Test management

06- Incident management

Summary

- Include management is the v of the deviations / errors found during testing
- Incident management is a process of its own consisting of a particular workflow
- For incident management powerful are available, which also cover the tasks of change management
- The expressions deviation management or error management are often used as synonym for incident management