



MCS

## Web Application Testing

Dr. Awais  
Majeed

Introduction

Testing Levels

Testing Web  
Application –  
Challenges

Test  
Approaches

Test Scheme

# Web Application Testing

Dr. Awais Majeed



# Outline

## Web Application Testing

Dr. Awais  
Majeed

Introduction

Testing Levels

Testing Web  
Application –  
Challenges

Test  
Approaches

Test Scheme

- 1 Introduction
- 2 Testing Levels
- 3 Testing Web Application – Challenges
- 4 Test Approaches
- 5 Test Scheme

- Web applications pose new challenges to quality assurance and testing
- Diversity of software components is one of the major reasons
- Testing is one of the most important instruments in the development of Web applications to achieve high-quality products that meet users' expectations
- Testing is an activity conducted to evaluate the quality of a product and to improve it by identifying defects and problems
- If we run a program with the intent to find errors, then we talk about testing (Myers 1979).
- We say that an error is present if the actual result from a test run does not comply with the expected result.
- The expected result is specified, for example, in the requirements definition

- This approach assumes that requirement definition is complete
- In case of Web applications it is not possible, as requirements are defined over a period of time
- Consequently the goals, concerns, and expectations of the stakeholders are the basis of testing
- Each deviation from the value typically expected by users is also considered an error.
- A single test case describes a set of inputs, execution conditions and expected results, which are used to test a specific aspect of the object under test (IEEE standard 610.12-1990).

- Behaviour is not the only aspect that needs to be tested to meet user requirements
- It is also important to test the application whether it meets the quality requirements
- Six principal categories of characteristics are
  - functionality
  - reliability
  - usability
  - efficiency
  - maintainability and
  - portability



MCS

# Test objectives

## Web Application Testing

Dr. Awais  
Majeed

### Introduction

#### Testing Levels

#### Testing Web Application – Challenges

#### Test Approaches

#### Test Scheme

- The main objective of testing is to find errors rather than showing their absence
- A test run is successful if errors are detected, giving an insight into the problems

- **Unit tests**

- test the smallest testable units (classes, Web pages, etc.), independently of one another.
- Unit testing is done by the developer during implementation.

- **Integration tests**

- evaluate the interaction between distinct and separately tested units once they have been integrated.
- Integration tests are performed by a tester, a developer, or both jointly.

- **System tests**

- test the complete, integrated system.
- System tests are typically performed by a specialized test team.

- **Acceptance tests**

- evaluate the system in cooperation with or under the auspice of the client in an environment that comes closest to the production environment.
- Acceptance tests use real conditions and real data.

- **Beta tests**

- let friendly users work with early versions of a product with the goal to provide early feedback.
- Beta tests are informal tests (without test plans and test cases) which rely on the number and creativity of potential users.



## Errors in the content

- Finding errors in the content is costly i.e. often requires proofreading
- Meta-information about the content's structuring and semantics or a reference system that supplies comparative values are often a prerequisite to be able to perform in-depth tests.

## Hypertext structure

- Ensure that pages are accessible through a hyperlink
- All links have to point to existing pages, i.e., they mustn't be broken
- Broken links represent frequent errors when statically pre-defined links become invalid



## Presentation & aesthetics

- Presentation requirements are soft and difficult to test i.e. aesthetics
- Tester should be able to clearly and objectively distinguish acceptable (and desired) behaviour from faulty behaviour

## Multi-platform delivery

- A large number of platforms and devices pose another challenge
- Even if all devices are available, tester has to run each test case on each type of device
- Use of simulators/emulators is not satisfactory as well



MCS

# Challenges of Web Application Testing ..

## Web Application Testing

Dr. Awais  
Majeed

Introduction

Testing Levels

Testing Web  
Application –  
Challenges

Test  
Approaches

Test Scheme

## Multi-linguality and usability

- The major challenge is to recognize cultural interdependencies and consider them adequately in the test
  - i.e., different lengths of text messages in different languages which may result in layout difficulties

## Multi-disciplinarity of team

- Teams often tend to avoid using a methodological approach to testing
- Often knowledge about methods, technologies, and tools has to be acquired in the course of a project
- Different points of view with regard to testing have to be consolidated.

- Various approaches are used for software project management
- Agile approaches (extreme programming etc.) are being increasingly used in Web projects
- Agile approaches focus on collaboration while conventional approaches focus on planning and project management

## Planning

- defines the quality goals, the general testing strategy, the test plans for all test levels, the metrics and measuring methods, and the test environment.

## Preparing

- This step involves selecting the testing techniques and tools and specifying the test cases (including the test data).

## Performing

- This step prepares the test infrastructure, runs the test cases, and then documents and evaluates the results.

## Reporting

- This final step summarizes the test results and produces the test reports.

- Team-based approach to problem solution with joint effort
- Same applies to testing i.e., it is an integrated development activity.
- Extreme programming (XP) practices influencing testing and quality assurance are:
  - **Pair programming:** accelerates the exchange of knowledge between various roles and within the team. It also helps to detect errors early.
  - **An on-site customer:** clarifies and takes action about requirements. Customer and tester collaboratively develop functional tests

- Extreme programming approaches ...
  - **Continuous integration:** ensures that small steps help minimize the risk of changes, and walks through all tests to continuously verify that the entire system is faultless.
  - **Test-first development:** Tests are written before the code ensures that the “developer pair” thinks about the “what” before it implements the “how”.
    - Automated test can help in integration



## Test dimensions

- Every test has a defined goal, i.e.,
  - to check the correctness of an algorithm
  - to reveal security violations in a transaction, or
  - to find style incompatibilities in a graphical representation.
- Tests are described by required quality characteristics
  - Correctness, security, compatibility





MCS

# Test Dimensions ...

Web  
Application  
Testing

Dr. Awais  
Majeed

Introduction

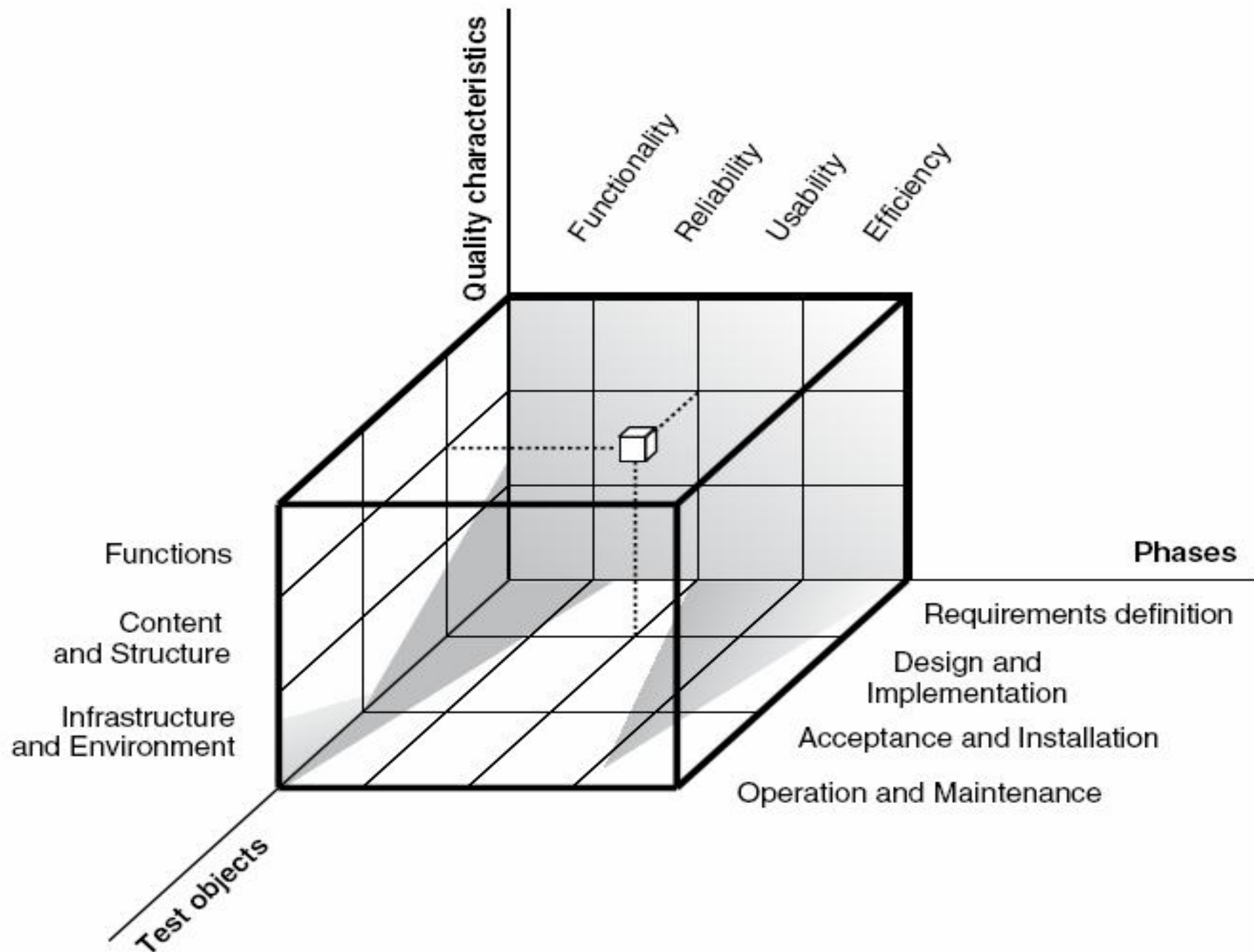
Testing Levels

Testing Web  
Application –  
Challenges

Test  
Approaches

Test Scheme

- Tests are also based on test objects i.e.,
  - what needs to be tested Algorithms, transactions, representations.
- Test objects are tested for required quality characteristics or objects are identified that affect a particular quality aspect
- Test objects and quality characteristics form 2 dimensions
- 3rd dimension specifies at what phase or time of the software lifecycle the combination of the above two needs to be tested.



		Functions	Content and Structure	Infrastructure and Environment
Functionality	Suitability	Reviews and inspections, Test-driven development	Checklists, Lexical testing, Style guides, Reviews	
	Accuracy	Capture/Replay, Test-driven development	Static analysis, Link testing, Lexical testing, Reviews	Static analysis, Link testing
	Interoperability	Cross-browser and cross-platform compatibility testing	Test printing, Checklists, Reviews, Compatibility testing	Cross-browser and cross-platform compatibility testing
	Compliance	Compatibility testing, Style guides, Test-driven development	Checklists, Compatibility testing, Style guides, Reviews	Cross-browser and cross-platform compatibility testing
	Security	Analysis of common attacks, Reviews and inspections		Analysis of common attacks, Forced-error testing, Ethical hacking

		Functions	Content and Structure	Infrastructure and Environment
Reliability	Maturity	Endurance testing		Endurance testing
	Fault Tolerance	Forced-error testing, Stress testing		Forced-error testing, Low-resource testing, Stress testing
	Recoverability	Forced-error testing, Fail-over testing		Fail-over testing, Forced-error testing, Low-resource testing

		Functions	Content and Structure	Infrastructure and Environment
Usability	Understandability	Usability studies, Heuristic evaluation	Static readability analysis, Usability studies	
	Learnability	Usability studies, Heuristic evaluation		
	Operability	Usability studies, Heuristic evaluation		Heuristic evaluation
	Attractiveness		Publicity testing	

		Functions	Content and Structure	Infrastructure and Environment
Efficiency	Timing Behavior	Load and Stress testing, Monitoring		Load and Stress testing, Monitoring
	Resource Utilization	Endurance testing	Load testing	Endurance testing, Monitoring

# References and Further Reading

- Chapter 7, “Testing Web Applications”.

Reading Assignment (Evaluation through Quiz)

**“*Data Grows Up: The Architecture of the Facebook Platform*”, from the Book “Beautiful Architectures” by Diomidis Spinellis & Georgios Gousios.**

Available through LMS.