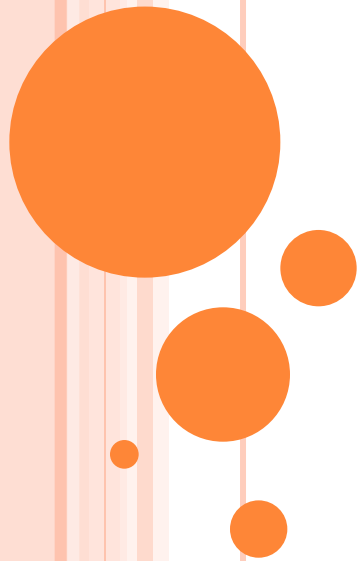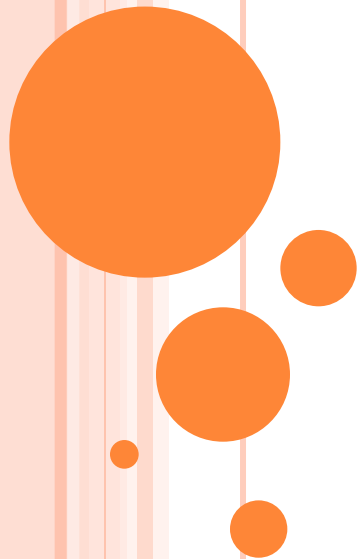# Software Engineering

LECTURE-35

SOFTWARE TESTING AND QUALITY ASSURANCE

TOPICS COVERED

- Functional and usability issues: functional testing, usability testing, navigation testing, form testing, and page content testing.

- Configuration and compatibility testing

- Reliability and availability testing

- Performance testing: scalability testing, load testing, and stress testing.

- Security testing

- End-to-end transaction testing

- Database testing

- Post implementation testing
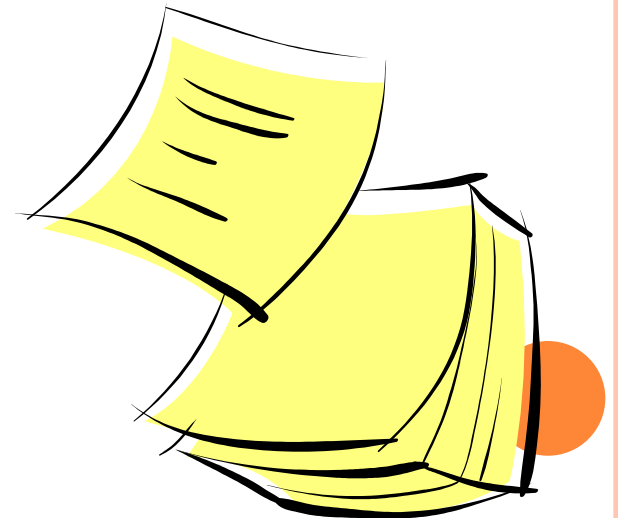
READING ASSIGNMENT

- Louise Tamres, "Introducing Software Testing," First edition, Addison Wesley, 2002.
  - Chapter 7: Testing Web Applications

OBJECTIVES

- Learn what to test in web applications.
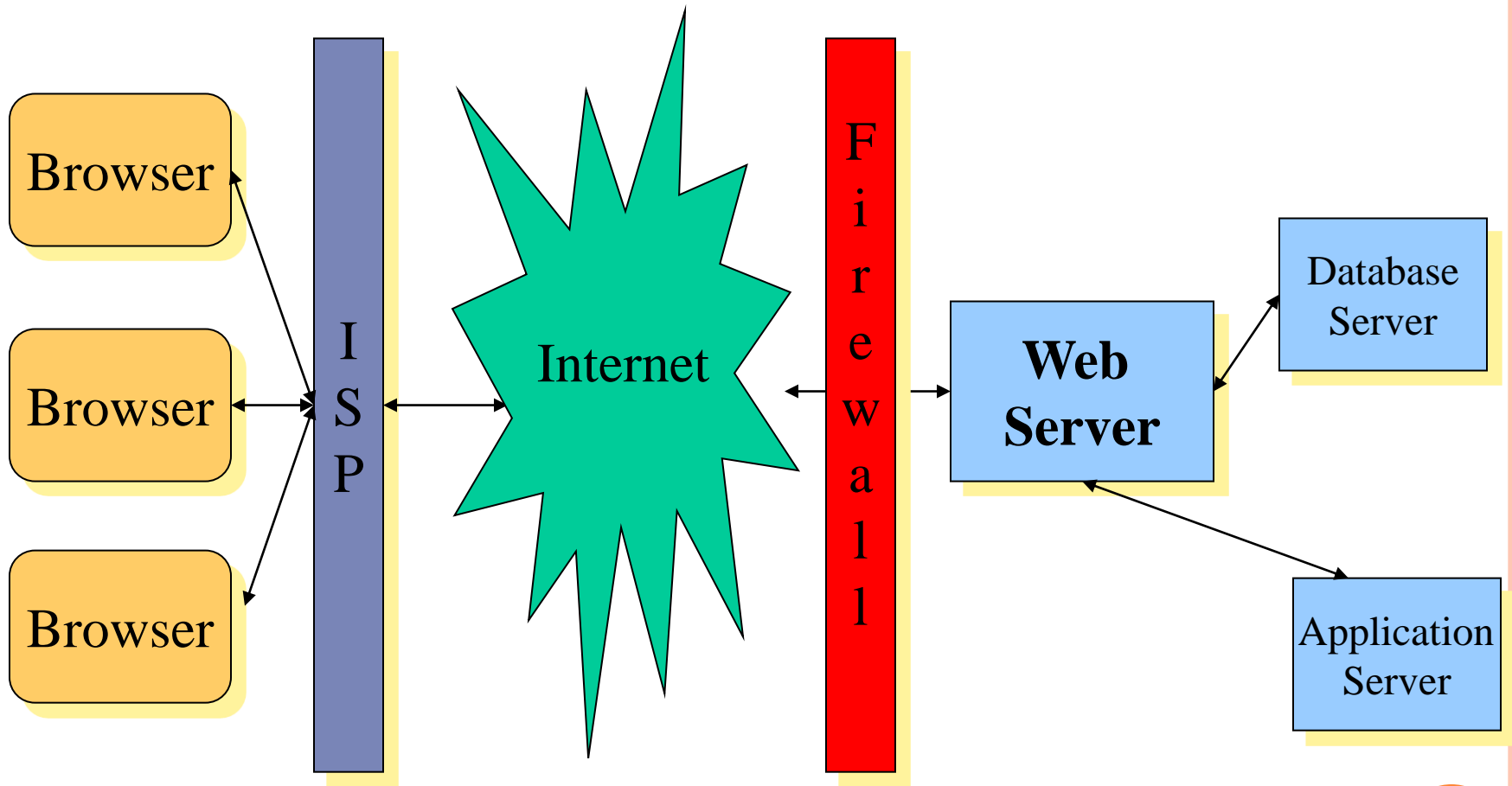- Learn how to test in a web application.

INTRODUCTION

- Web-based applications present new challenges, both for developers and testers. These challenges include:
  - Short releases cycles
  - Constantly changing technology
  - Possible huge number of users during initial website launch
  - Inability to control the user's running environment
  - 24-hour availability of the website
- Any difficulty in response time, accuracy, or ease of use will make the user to click on a competitor's site.

TOPOLOGY OF A WEB SITE

Browser

Browser

Browser

ISP

Internet

Firewall

Web Server

Database Server

Application Server

THE NEED FOR WEB TESTING

- Is the site content meaningful?
- Is this application easy to use?
- How about browser compatibilities?
- How reliable is our technology?
- Do the Servers have enough power?
- How many visitors are we expecting?
- Are the machines fast enough?
- How much activity can the site handle?

FUNCTIONAL AND USABILITY ISSUES

- The first tests for a website should focus on the site's intended behavior by assessing the following issues:

  - Functionality

  - Usability

  - Navigation

  - Forms

  - Page content
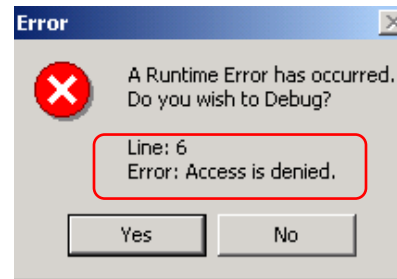
WHY IS FUNCTIONALITY TESTING IMPORTANT?

i **The page cannot be displayed**

The page you are looking for is currently unavailable. The Web site might be experiencing technical difficulties, or you may need to adjust your browser settings.

Please try the following:

- Click the **Refresh** button, or try again later.
- If you typed the page address in the Address bar, make sure that it is spelled correctly.
- To check your connection settings, click the **Tools** menu, and then click **Internet Options**. On the **Connections** tab, click **Settings**. The settings should match those provided by your local area network (LAN) administrator or Internet service provider (ISP).
- If your Network Administrator has enabled it, Microsoft Windows can examine your network and automatically discover network connection settings.
  If you would like Windows to try and discover them, click **Detect Network Settings**

Error

A Runtime Error has occurred.
Do you wish to Debug?

Line: 6
Error: Access is denied.

Yes   No

Missing image

FUNCTIONAL AND USABILITY ISSUES: FUNCTIONAL TESTING

- **Functional testing** involves making sure features that most affect user interactions work properly. These include:
  - Forms
  - Searches
  - Popup windows
  - Shopping carts
  - Online payments
- Functional testing evaluates the content of dynamically generated pages and verifies many behind the scene (connections to database)

FUNCTIONAL AND USABILITY ISSUES: USABILITY TESTING

- **Usability testing** assesses the website's user friendliness and suitability by gathering information about how users interact with the site.
- The key to usability testing is to study what a user actually does.
- Usability testing steps:
  - Identify the website's purpose
  - Identify the intended users(keywords,who are user)
  - Define tests and conduct the usability testing(environment,activities,feedback,observe,report)
  - Analyze the acquired information

FUNCTIONAL AND USABILITY ISSUES: NAVIGATION TESTING

- Good navigation is an essential part of a website, especially those that are complex and provide a lot of information.

- Most users expect the following:

  - Easy and quick access to the information they want

  - Logical hierarchy of pages

  - Confirmation of where they are at any point

  - Facility to return to previous states or the homepage

  - Consistent look and layout of every page

  - Uncluttered pages

FUNCTIONAL AND USABILITY ISSUES: FORMS TESTING

- Websites that use forms need to be tested to ensure that each field works properly and that the form posts all data as intended by the designers.

- Testing forms include the following actions:
  - Using the tab key to verify that the form traverses fields in the proper order, both forward and backward
  - Testing boundary values
  - Checking that forms traps invalid data correctly, especially data and numeric formats
  - Verifying that the form updates information correctly

FUNCTIONAL AND USABILITY ISSUES: PAGE CONTENT TESTING

- Each web page must be tested for correct content from the user perspective.

- These test fall into two categories:
  - Ensuring that each component functions correctly
  - Ensuring that the content of each is correct
  - Mouse over text(caption)
  - Links
  - Tables and forms are present in correct way
  - Dynamic pages

CONFIGURATION AND COMPATIBILITY TESTING

- A key challenge in web applications is ensuring that the user sees a web page as the designer intended:
  - The user can select different browser software and browsers options.(proxy)
  - Use different network software and online service
  - Run concurrent applications
- **Compatibility testing** ensures product functionality and reliability on the supported browsers and platforms that exist on the customer computer.

CONFIGURATION AND COMPATIBILITY TESTING (CONT.)

- Guideline for testing web applications (by listing the platform and browser environments to be tested).

Table 7.5 Browser compatibility table

Platform / Browser	Netscape Communicator 4.5	Netscape Communicator 4.7	America Online 4.0	Internet Explorer 4.01	Internet Explorer 5.0	...
Windows 95						
Windows 98						
Windows NT						
Windows 2000						
Windows ME						
Mac OS X						
iMac						
Macintosh 8.1						
Linux				not applicable	not applicable	
...						

RELIABILITY AND AVAILABILITY

- A key requirement of a website is that:
  - It is available whenever the user requests it, often 24 hours a day, every day.
  - The number of users accessing a website simultaneously may also affect the site's availability.
- To assess availability, the tester must build tests around anticipated usage spikes which can include:
  - For store applications: promotional campaigns and sales
  - For business cycles: month-end and quarter-end dates
  - For banking applications: direct deposit dates
  - During maintenance: required downtime for backups, upgrades, and other operations.
  - Load balancing

PERFORMANCE

- Performance testing evaluates system performance under normal and heavy usage.
- Website performance is crucial to the success of any web application.
- Performance tests:
  - Scalability testing
  - Load testing
  - Stress testing

PERFORMANCE: SCALABILITY TESTING

- **Scalability** concerns the website's ability to handle the volumes and types of activities that can occur after launch.

- The following types of scenarios affect scalability:
  - How closely the test environment matches the production environment
  - Millions of users accessing the site during launch
  - Activity spikes due to marketing promotions

PERFORMANCE: LOAD TESTING

- The purpose of load testing is to model real world experiences, typically by generating many simulations users accessing the website.

- Load testing may need to be repeated at least once.

PERFORMANCE: STRESS TESTING

- **Stress testing** consists of subjecting the system to varying and maximum loads to evaluate the resulting performance.

- Stress testing can be automated. Tools can report the following type of information:

  - Number of requests, transactions and kilobyte/second

  - Round trip time (time from the user makes a request to the time that the users receives the result)

  - Number of concurrent connections

  - Degradation of performance

  - Types of visitors to the site and their number

  - CPU and memory usage of the application server

SECURITY TESTING

- Security is a primary concern when communicating and conducting business especially sensitive and business critical transactions over the internet.

- Regardless whether the application requires the user to enter a password to access the website, the tester must check for internet threats.

END-TO-END TRANSACTION TESTING

- **End-to-end transactions** follow the workflow to the customer from beginning of the visit until the customer leaves the site.

DATABASE TESTING

- Database testing is an essential part of the web testing.

- Key issues include:
  - Data integrity (no data corruption)
  - Data validity (accurate information provided to the customer and accurate information passed back to the database)
  - Data manipulation and updates (updating the number of books sold, books available, ...)

POST-IMPLEMENTATION TESTING

- **Post-implementation** testing verifies the behavior of the application in the production environment.

- It is not feasible to duplicate the test environment to match the production environment.

- Post-implementation testing takes place in a "production maintenance window".

KEY POINTS

- Testing web applications present new challenges.
- Functional and usability tests focus on the site's intended behavior:
  - Functional testing asserts whether the main features function correctly.
  - Usability testing evaluates whether a site is user friendly by observing users as they interact with the site.
  - Testing a form ensures that each field works properly.
  - Navigation testing ensures that the user can accomplish the desired tasks by verifying access to pages, images, links, and other page components.
  - Testing page content ensures that the information provided by the website is correct.

KEY POINTS (CONT.)

- Configuration and compatibility testing make sure that the application functions correctly across the various hardware and software environments.

- Reliability and availability testing assesses whether the website is accessible whenever the users request it by testing around anticipated peak usage such as marketing promotions and high-activity cycles.

KEY POINTS (CONT.)

- Performance testing ensures that the website server responds to browser requests within defined parameters. As part of performance testing:
  - Scalability testing assesses the website's ability to meet the load requirements.
  - Load testing evaluates how the system functions when processing many simultaneous requests from a multitude of users.
  - Stress testing subjects the system to varying loads.
- Security testing aims to check for internet threats or protect sensitive information.

KEY POINTS (CONT.)

- End-to-end transaction testing tests all parts that make up a particular transaction by following a customer's workflow from entering to leaving the site.

- Database testing verifies the integrity, validity and manipulation and updates of the data.

- Post-implementation testing verifies an application's behavior in the production environment.