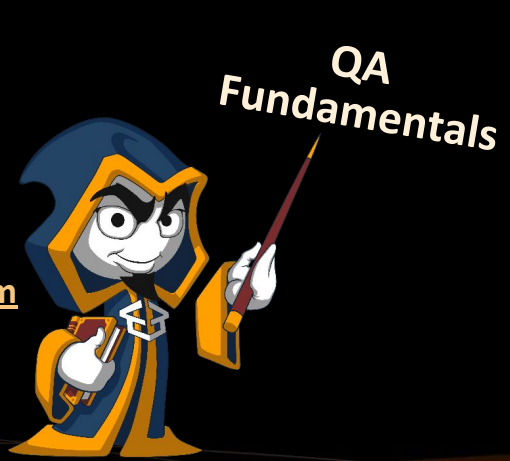
Test Levels and Test Types

Functional and Non-Functional testing



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   - Change related testing
   - Risk-Based Testing
   - Functional Testing
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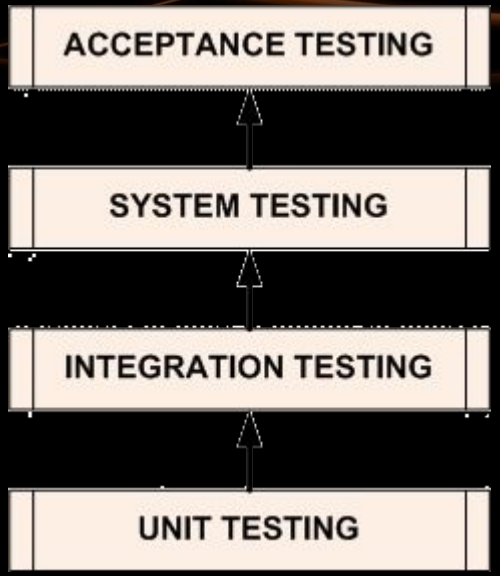

Test Levels

Component Testing

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- Component testing:
  - Testing separate components/units of the software
- Software units (components):
  - Modules, units, programs, functions
  - Classes – in Object Oriented Programming
- Unit tests focus on aspects internal to the component itself

Component Testing (2)

- Individual testing
  - Components are tested individually
  - Isolated from all other software components
- Isolation
  - Prevents external influences on the components
  - Interaction with neighbours is not performed

Integration Testing

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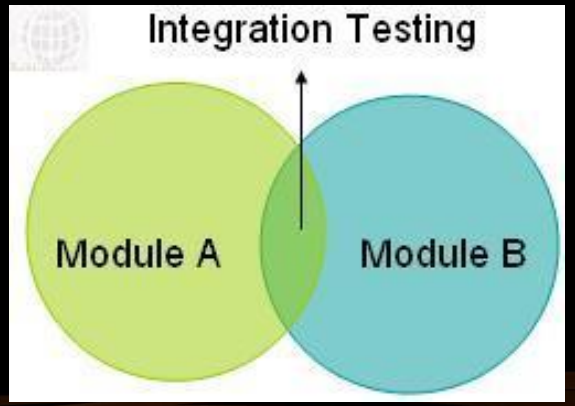
- Supposes that components are already tested individually
- System integration testing:
  - Testing the integration of systems and packages
  - Testing interfaces to external organizations/3rd parties
- Expose defects in the interfaces and interaction between integrated components



Integration Testing Approaches

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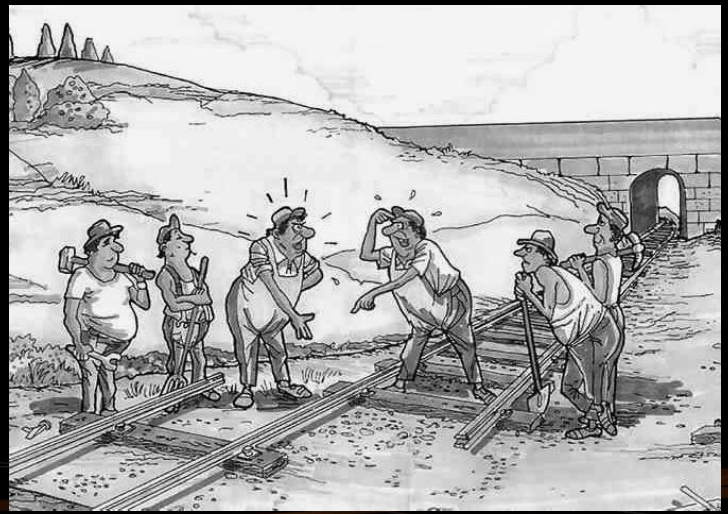
- The Big Bang approach
  - All components or modules are integrated simultaneously, after which everything is tested as a whole.
  - Disadvantage: difficult to trace the cause of failures



Integration Testing Approaches (2)

- The Incremental approach
  - All components are integrated one by one and a testing is carried out after each step.
- Different Incremental approaches:
  - The Top-Down approach
    - The high level logic and flows are tested first - the low level components are tested last.
  - The Bottom-Up approach
    - The most complex / high level functionalities are tested last.

System Testing

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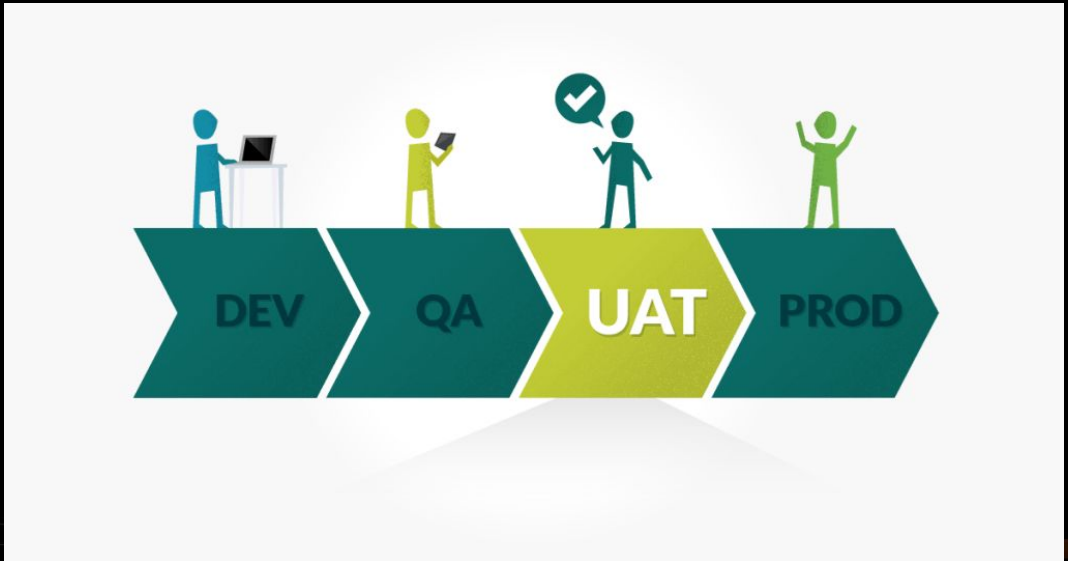
- In System testing the behavior of the whole system/product is tested as defined by the specification requirements.
- Is a higher level testing than the Unit and Integration testing.
- Test the system from the perspective of the end user / customer.
- Performed by testers.

Acceptance Testing

- Also known as User Acceptance Testing (UAT).
- The End user / Customer is actually involved in the testing.
- Performed on a production like environment.



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Test Types

Structural Testing

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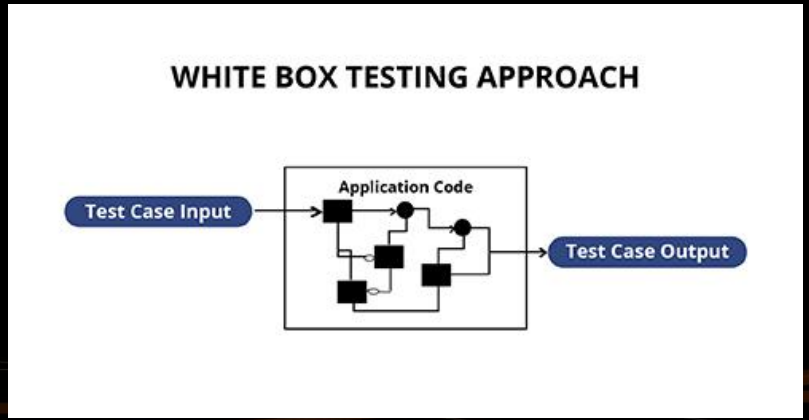
- Often referred to as ‘white-box’ or ‘glass-box’ testing
- Uses information about the internal code structure or architecture
- Tools can be used to measure the code coverage of elements, such as Statements or Decisions / Branches



Testing Related to Changes

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- Re-testing:
  - After a bug has been detected and fixed, the software should be re-tested.
  - To confirm that the original defect has been successfully removed after applying the fix.
  - Also known as Confirmation testing.

Testing Related to Changes (2)

- Regression Testing:
  - Performed after modifications of the code.
  - Testing for newly introduced faults as a result of the changes made to the system.
  - May be performed at all test levels.
- The reason for Regression testing is that changed or new code might affect untouched functionalities.
  - Testing only code, that is changed, is not enough!

Risk-Based Testing

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- Prioritization Of Tests Based On Risk And Cost
- Two main types of risk:
  - Product (quality) risks - The primary effect of a potential problem is on the product quality
  - Project (planning) risks - The primary effect is on the project success

Functional Testing

- Functional testing verifies the system's input–output behavior.
- Black box testing methods are used.
- The test cases are based on the functional requirements.
- The main goal is to exercise the functionality and verify the expected behaviour.

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Non-Functional Testing

Non-Functional Testing

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- Testing Non-functional Software Characteristics.
- “How well" the system should carry out its functions.
- Non-functional characteristics:
  - Reliability
  - Usability
  - Accessibility
  - Efficiency
  - Security
  - etc.

Performance, Load and Stress Testing

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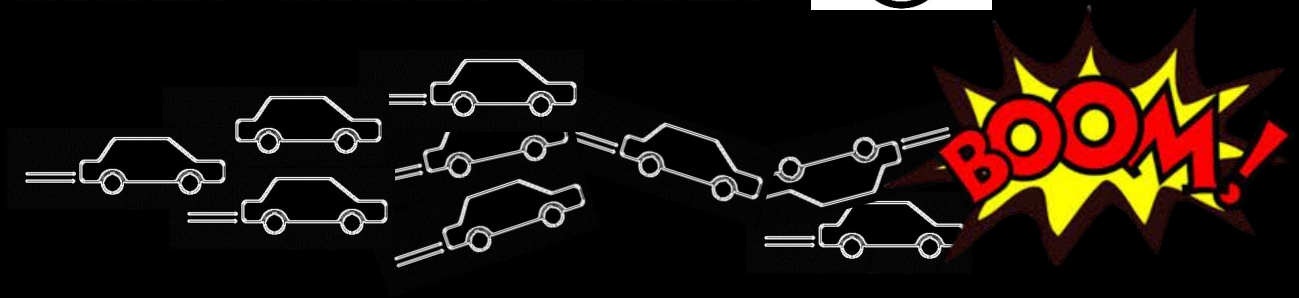
- Performance testing

- Load Testing

- Stress Testing



Performance, Load and Stress Testing

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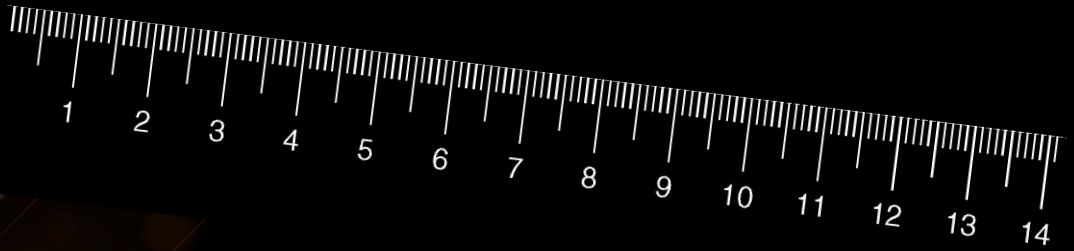
- What can we learn from the different test types?
  - Performance / Load / Stress tests help us determine or validate the speed, scalability and stability of the system



Performance, Load and Stress Testing

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- The difference lies in the questions the different test types are supposed to answer
  - Performance Testing – How fast is the system?
  - Load Testing – How much load can the system handle?
  - Stress Testing – Under what conditions will the system fail?

Goals of Performance Testing

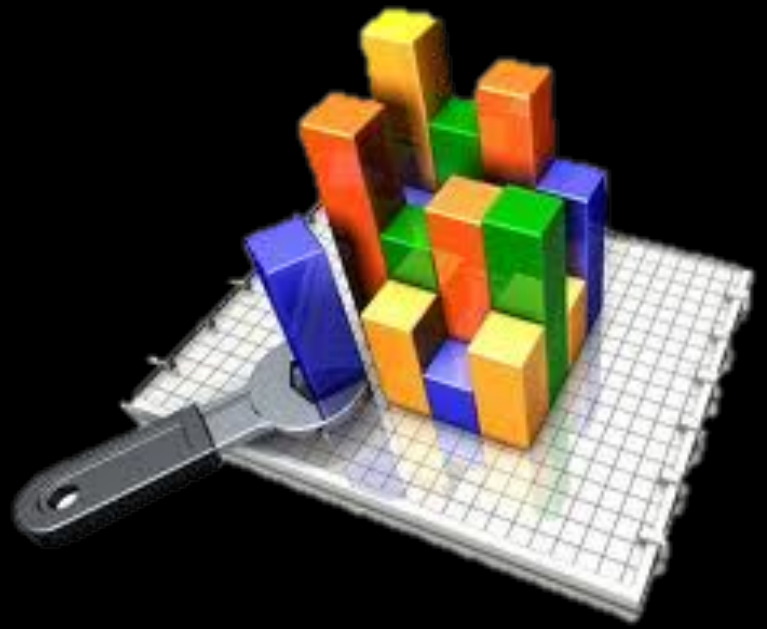
- The goal of performance testing is to:
  - Determine compliance with performance goals and requirements
  - Establish a baseline for future regression testing
  - Eliminate bottlenecks

Goals of Load Testing

- Load Testing aims to identify the need of improving the applications:
  - Performance
    - Do we need to reduce the time needed to execute a request ?
  - Scalability
    - Can the system handle the anticipated number of concurrent users during peak load in production?
  - Stability
    - Does the application suffer from memory leaks when under load for extended periods of time?

Load Testing Metrics

- The best source of information during load tests are:
  - Average Response times
  - Peak Response times
  - Error Rates
  - Requests per second
  - Concurrent Users Count



Goals of Stress Testing

- The goals of Stress testing is to ensure the software does not crash in conditions of insufficient computational resources (such as memory or disk space).
- It involves testing beyond normal operational capacity, often to a breaking point, in order to observe the results.

How useful is Stress/Load/Performance Testing ?

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- For most projects verifying that they pass Google's performance guidelines is enough
- You can check this with Google PageSpeed Tools

Security Vulnerability Testing

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Security Testing in the Software Development Life Cycle

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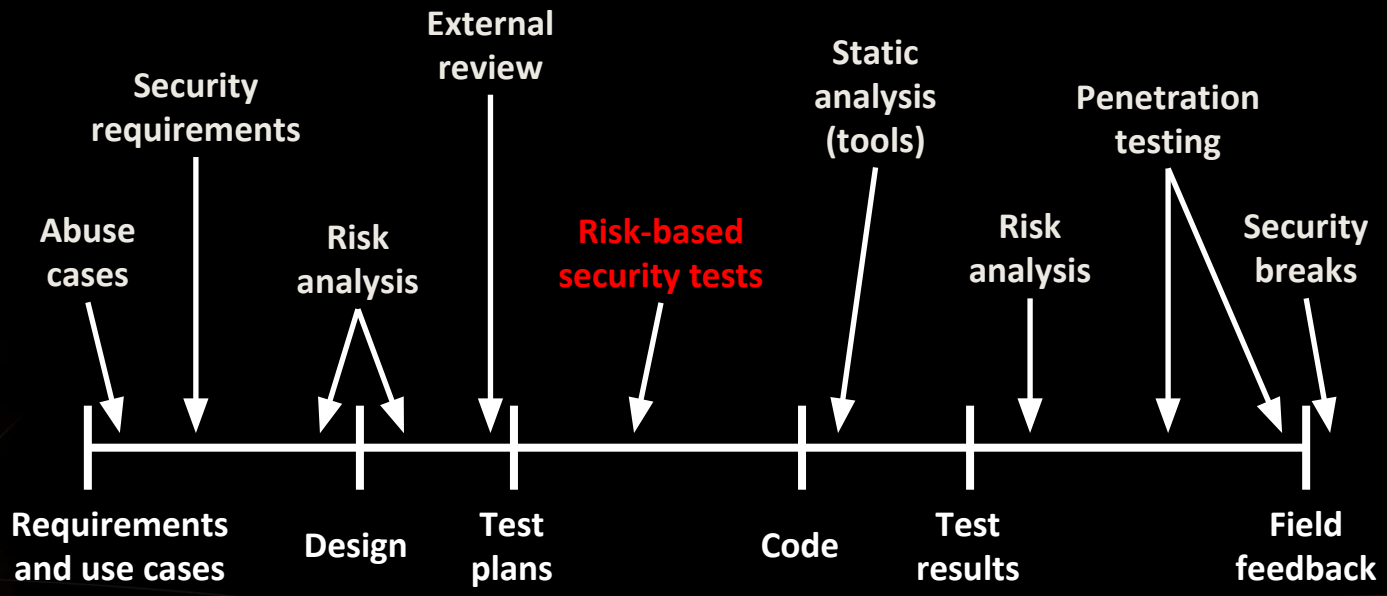
- Software Development Life Cycle, With Security In Mind



Security Testing Techniques

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- Penetration Testing
  - Simulating an attack from a malicious source
    - Includes network scanning and vulnerability scanning
  - Simulating an attack from someone familiar with the system
    - Simulate an attack by having access to source code, network, passwords

Threats you need to be aware of

- SQL Injection
  - Exploits Database Layer Security Vulnerability
  - Unexpected Execution of User Inputs

Threats you need to be aware of

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- Cross Site Scripting
  - Injecting Malicious Client Side Script into Web Pages
    The malicious code along with the original webpage gets displayed in the web client

Threats you need to be aware of

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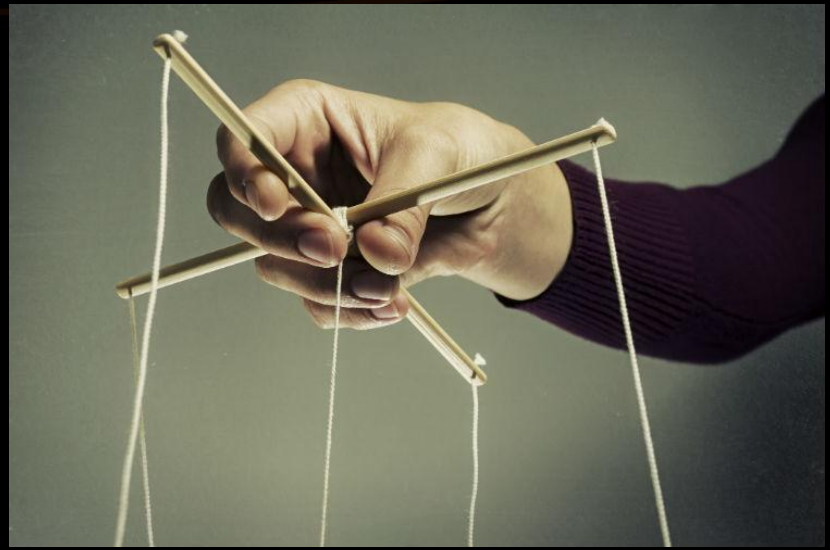
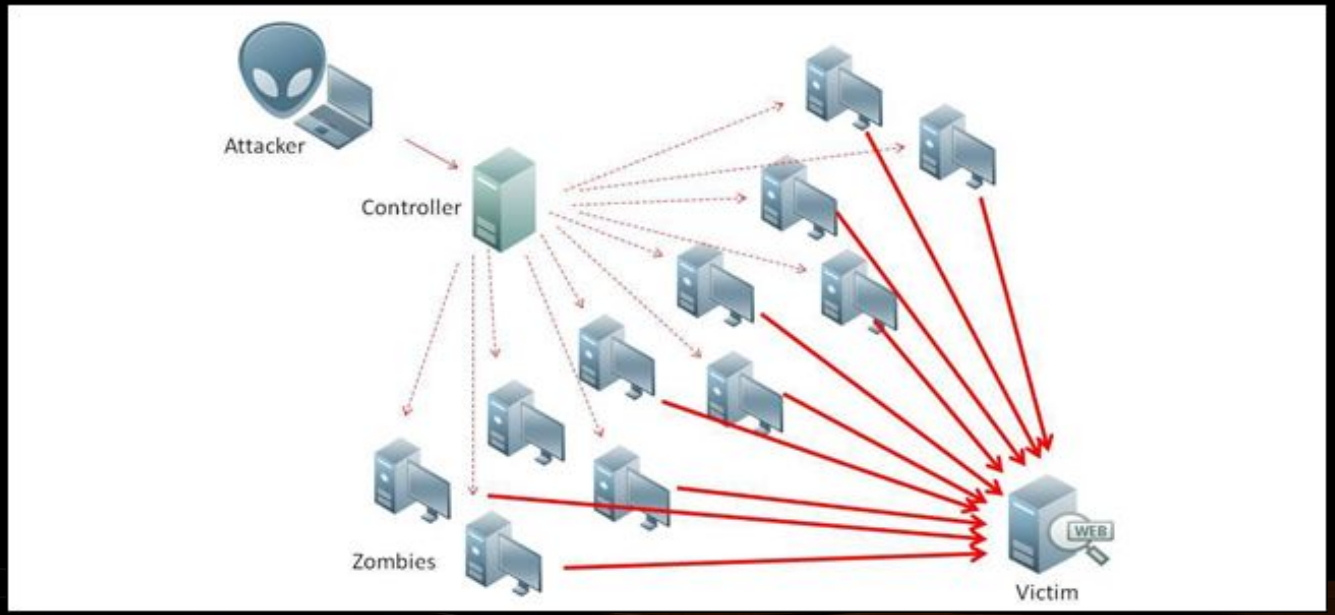
- Parameter Manipulation
  - Cookie Manipulation
  - URL Manipulation
  - HTTP Header Manipulation



Threats you need to be aware of

- Denial of Service Testing
  - Flooding a target machine with enough traffic to hinder normal operations



Threats you need to be aware of

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- Password Cracking
  - Collecting Passwords from the Stored or Transmitted Data
  - Using Brute Force and Dictionary Attacks
  - Identifying Weak Passwords

Threats you need to be aware of

- Social Engineering
  - Psychological Manipulation of People
  - Extracting confidential information

Summary

- Test Levels
- Test Types
- Functional and Non-functional testing
- Don’t forget the non-functional aspects of your application under test
- The more people you get involved into the security of a product the more secure it becomes.

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