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# What Exactly are the Techniques of

Software Verification and Validation

#### **Areas Covered**

**Software Verification and Validation** 

When Combined Together Are

Abbreviated as V & V

#### What does these Two Provide

**Verification Ensures that:** 

**Every Step in the Process of Building the Software Delivers the Correct Product** 

**Validation Ensures that:** 

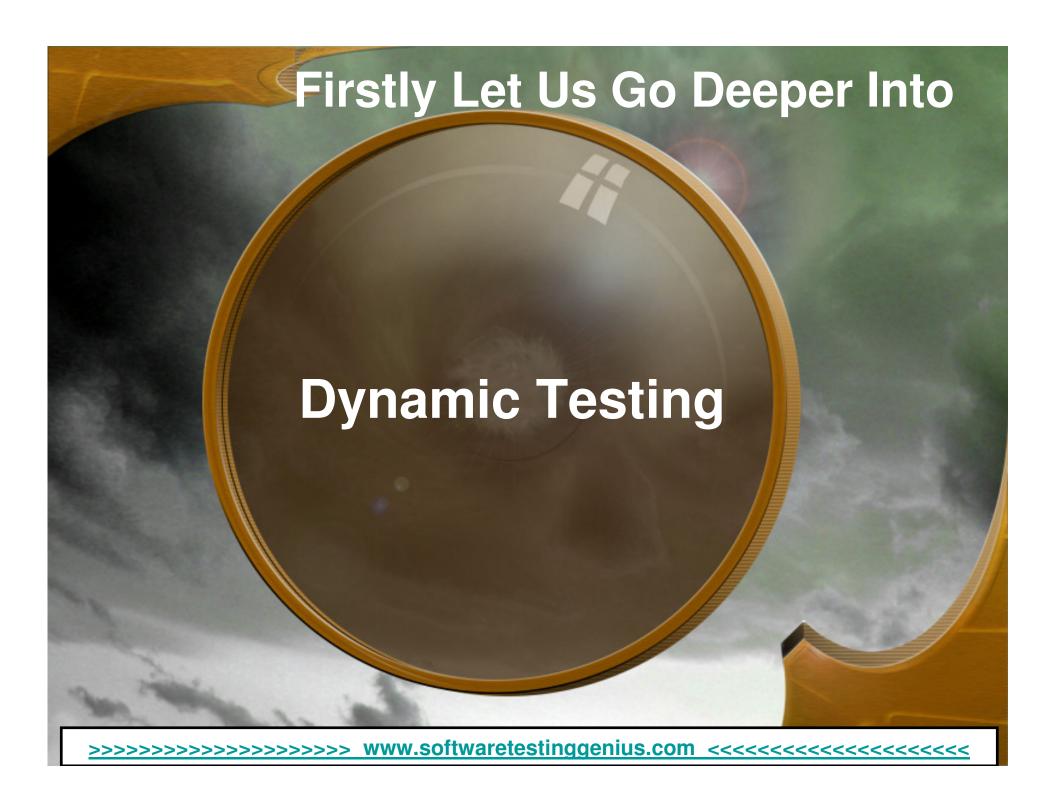
Software Being Developed or Changed Satisfies Functional and All Other Requirements



### Major Categories of Verification

There are Two Major Categories of Verification Testing:

- Dynamic Testing
- Static Testing



What Does Dynamic Testing Do?

- Involves Execution of a System or Component
- Selection of a Group of Test Cases Consisting of Test Data
- Finding out Output Test Results out of Input Test Cases

#### **Sub Categories of Dynamic Testing**

- Functional Testing
- Structural Testing
- Random Testing

Functional Testing: A Type of Dynamic Testing

- Involves Identification & Testing of all Functions of the System as Defined in Basic Requirements Documents
- It is a Black Box Testing Not Expecting that the Tester should have any Knowledge of the Basic Code & Implementation of the System

Contd.....

**Functional Testing: A Type of Dynamic Testing** 

 It uses Test Cases Designed to Investigate Certain Feature of the System

Structural Testing: A Type of Dynamic Testing

- It is a White Box Testing Expecting Full knowledge of the Implementation of the System
- Information of the Internal Structure of the System is Used to Design Tests for Checking the Function of Individual Components

Contd.....

Structural Testing: A Type of Dynamic Testing

 Like Functional Testing, it also uses Test Cases Designed to Investigate Certain Feature of the System

Random Testing: A Type of Dynamic Testing

- Uses Free Selection of Test Cases out of a set of All Possible Test Cases
- Uses Randomly Decided to Detect Faults which Go Undetected by Other Systematic Testing Techniques

Contd....

Random Testing: A Type of Dynamic Testing

- Exhaustive Testing is a Form of Random Testing, Involving Input Test Cases having Every Possible Set of Input Values
- Although We do Exhaustive Testing at Every Stage of Life Cycle, Complete Verification of the System, is not Possible & Realistic



#### **Attributes of Static Testing**

- Does not Involve Operation of the System or Component
- Involves Manual as well as Automated Testing Techniques

#### **Sub Categories of Static Testing**

- Consistency Techniques
  - : Meant for Doing Analysis of Consistency
- Measurement Techniques
  - : Meant for Doing Measurement of Some Property of the Program

**Consistency Techniques of Static Testing** 

**Ensures Correctness of Program Properties Like:** 

- **# Correct Syntax**
- # Correct Parameter Matching Between Procedures

Contd.....

**Consistency Techniques of Static Testing** 

**Ensures Correctness of Program Properties Like:** 

- **# Correct Typing**
- # Correct Requirements and Translation of Specifications

**Measurement Techniques of Static Testing** 

**Measures the System Properties Like:** 

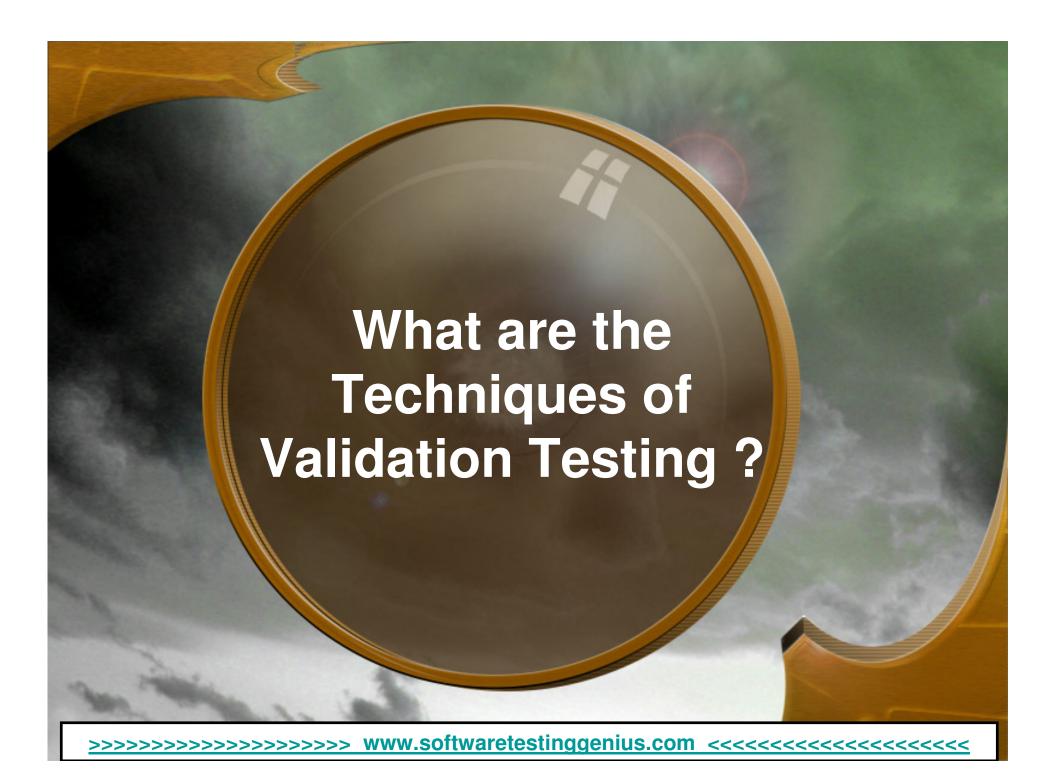
- **# Being Error Prone**
- # Being Understandable
- # Being Well Structured



### When Does Validation Come into Picture

Validation comes Into Picture at the End of the Development Cycle

- It Views the Complete System Exactly Opposite of Verification
- It Focuses on Smaller Sub-Systems



## Formal Methods: A Technique of Validation Testing

- Besides being a Verification Technique it is a Validation Technique as well
- Involves use of Mathematical and Logical Techniques to: Express, Investigate, & Analyze the Specification, Design, Documentation and Behavior of Hardware as well as Software

Fault Injection:
A Technique of Validation Testing

Is an Intentional Activation of Faults by Either Hardware or Software to Observe the System Operation under such Faulty Situations

Hardware Fault Injection:
A Technique of Validation Testing

Also known as Physical Fault Injection since Faults are Injected into the Physical Hardware

Software Fault Injection:
A Technique of Validation Testing

- Involves Injection of Errors into the Computer Memory through some Software Techniques
- It is a sort of a Simulation of Hardware Fault Injection

Dependency Analysis:
A Technique of Validation Testing

Involves Identification of Hazards and Subsequently Proposing Methods to Reduce the Risk of the Hazards

Hazard Analysis:
A Technique of Validation Testing

Involves using Instructions to Identify
Hazards, Their Root Causes, and Possible
Countermeasures

Risk Analysis:
A Technique of Validation Testing

Goes Beyond Hazard Analysis by Identifying the Possible Consequences of Each Hazard and Their Probability of Occurrence

#### Pros & Cons of Verification & Validation

- Verification and Validation are Quite Time Consuming Processes
- They Involve Planning from the Beginning, the Development of Test Cases, Actual Testing, and Analysis of Testing Results
- Best Practice is to have Persons Dedicated to V & V and made to operate with the Designers

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