Software Testing

Software Testing

- Testing is the process of executing a program with the aim of finding errors.
- To make our software perform well, it should be error free.
- If testing is done successfully, it will remove all the errors from the software.

Software Testing

- All the tests should meet the customer requirements
- To make our software perfect, testing should be performed by a third party
- All the tests to be conducted should be planned before implementing it
- It follows the Pareto rule of 80-20
  - 80% of errors come from 20% of application components
- Start testing with small parts and extend it to large parts

Types of Software Testing

Functional Testing

- Unit Testing
- Integration Testing
- System Testing
- Interface Testing
- Regression Testing
- User Acceptance Testing

Non-Functional Testing

- Documentation Testing
- Installation Testing
- Performance Testing
- Reliability Testing
- Security Testing

Types of Performance Testing

- Load Testing
- Stress Testing
- Endurance Testing
- Spike Testing
- Scalability Testing
- Volume Testing

Unit testing

- It focuses on the smallest unit of software design.
- In this, we test an individual unit or group of interrelated units.
- It is often done by the programmer by using sample input and observing its corresponding outputs.

Integration testing

- The objective is to take unit tested components and build a program structure that has been dictated by design.
- Integration testing is testing in which a group of components is combined to produce output.
- Black Box testing:
  - It is used for validation.
  - In this we ignore internal working mechanism and focus on what is the output.
- White Box testing:
  - It is used for verification.
  - In this we focus on internal mechanism i.e. How the output is achieved.

Regression testing

- Every time a new module is added leads to changes in the program.
- This type of testing makes sure that the whole component works properly even after adding components to the complete program.

Smoke testing

- This test is done to make sure that software under test is ready or stable for further testing
- It is called a smoke test as the testing an initial pass is done to check if it did not catch the fire or smoke in the initial switch on.

User acceptance testing

- Alpha Testing:
  - This is a type of validation testing.
  - It is a type of acceptance testing which is done before the product is released to customers.
  - It is typically done by QA people.
  - Example:
    - When software testing is performed internally within the organization
- Beta Testing:
  - The beta test is conducted at one or more customer sites by the end-user of the software.
  - This version is released for a limited number of users for testing in a real-time environment
  - Example:
    - When software testing is performed for the limited number of people, who are not part of the organization.

System testing

- This software is tested such that it works fine for the different operating systems.
- It is covered under the black box testing technique.
- In this, we just focus on the required input and output without focusing on internal working.
- In this, we have security testing, recovery testing, stress testing, and performance testing

Load Testing

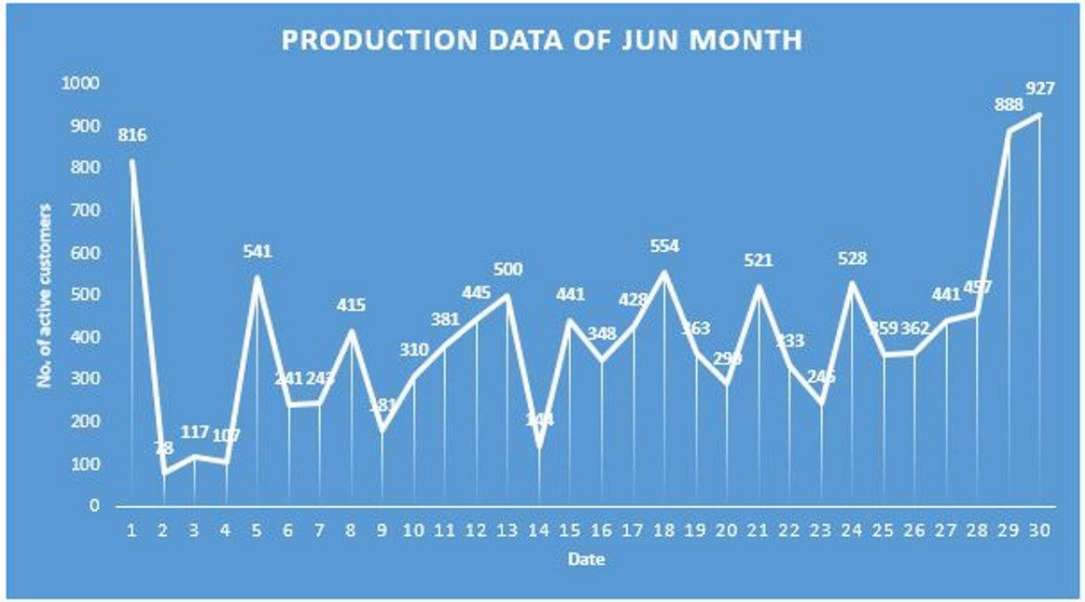
Load testing

- Load Test is a type of non-functional test which verifies the performance of an application or system under a peak load condition.
- Load Test also validates the resource usage, stability and reliability of the software system under peak load.

- Peak Load is the highest load identified during a day, a month or a year depends upon the production data selection criteria.

Load testing

- This graph shows the number of active customers per day in the month of June.
- The highest number of active customers is 927 on 30th June.
- Hence 927 is the peak load for the load test.



Load testing for new applications

- Since a new application does not have any production data, so peak load needs to be predicted.
- The client or project business analyst (BA) confirms the expected peak load on the application.
- A performance tester can use the expected peak load to prepare the workload model for the load test.

Purpose of Load Test

- To Identify whether the application can handle the peak load
- Observe the behaviour of the application in terms of response time
- To check whether the resources (CPU, Memory and Disk) do not breach the defined performance limit
- To identify if there is any bottleneck

Load Test is also conducted in a regression manner to identify the performance issue due to the weekly, fortnightly or monthly code releases.

Approach

- NFR document has some separate set of NFRs for the load test.
- These NFRs are related to the count of peak user load, response time, transactions per second etc.
- A performance tester designs the workload model using these NFRs and executes the test.
- Ideally, the duration of the load test is 1 hour (excluding ramp-up and ramp-down period)

A sample load test graph

- This load test graph has a steady state of 1 hour along with 10 minutes ramp-up and 10 minutes ramp-down period.
- Therefore the test will run for 1 hour and 20 minutes.
- After completion of the test, a performance tester verifies the result against the defined load test NFRs.

Stress Test

Stress test

- Stress Test is a type of non-functional test which verifies the performance of an application or software system at futuristic load.
- The futuristic load is a predicted load which should be handled by an application in the future with existing software and hardware.
- The defined load for a Stress test is always more than a Load Test.

How to calculate the future load?

- The future load is calculated with the help of historical data.
- The business analyst predicts the numbers by referring to previous years statistics.
- He calculates the figure by using some mathematical formulae.

Typical future load analysis

- This graph shows the historical as well as predicted data.
- The historical data lies from the year of 2010 to 2018 and the year 2019 shows futuristic load.
- As per linear equation calculation, the predicted load is 100 for 2019.
- Hence 100 is the user load for the stress test.

For new applications

- Since a new application does not have any historical data, the load test fulfils the purpose of the stress test.
- If the project has a long term goal for a new application and wants to test it beyond the predicted peak load then the successive tests of load test will be considered as stress tests.
- These successive test should have a higher user volume than load test.

Purpose of stress test

- To Identify whether the application can handle the future load
- Note the response time at future load
- To check whether the behaviour of resources (CPU, Memory and Disk). They should not breach the defined performance limit
- To identify if there is any bottleneck
- Note down the error percentage

Approach

- NFR document has a separate set of NFRs for the stress test.
- These NFRs are related to the count of future user load, response time, transactions per second etc.
- In the absence of future load, conduct the test at 125%, 150% or 200% of peak load and analyse the behaviour of the application.
- A performance tester designs the workload model using defined or calculated NFRs and executes the test.
- Ideally, the duration of the stress test is 1 hour (excluding ramp-up and ramp-down period).

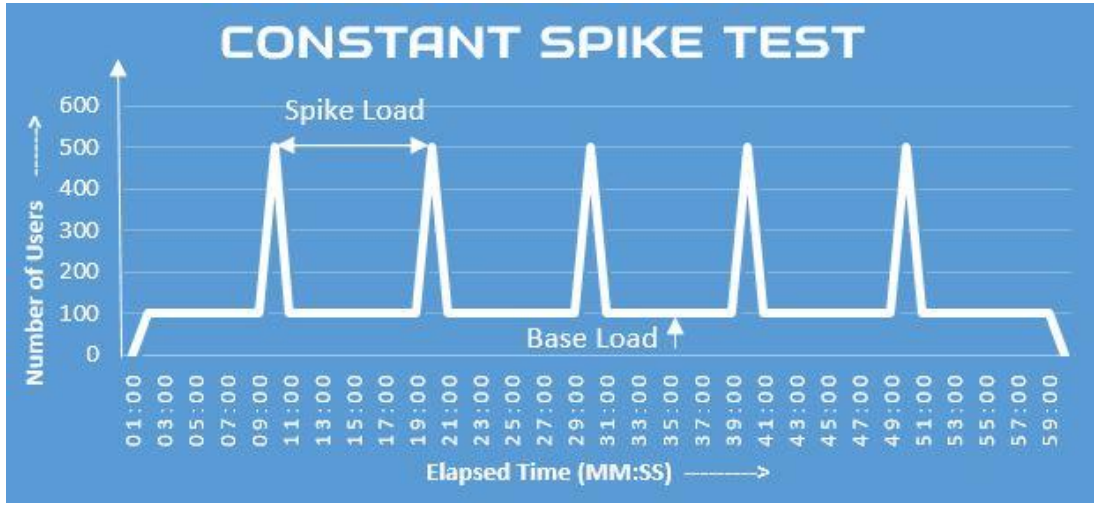
Spike Test

Spike test

- Spike Test refers to a performance test which simulates a sudden high load on the server for a shorter period of time.
- This is a type of non-functional test which helps to identify the behaviour of an application or software system when an unexpected huge load arrives.
- The outcome of the spike test concludes whether the application can able to handle a sudden load or not.
  - And, if it is then how much load?

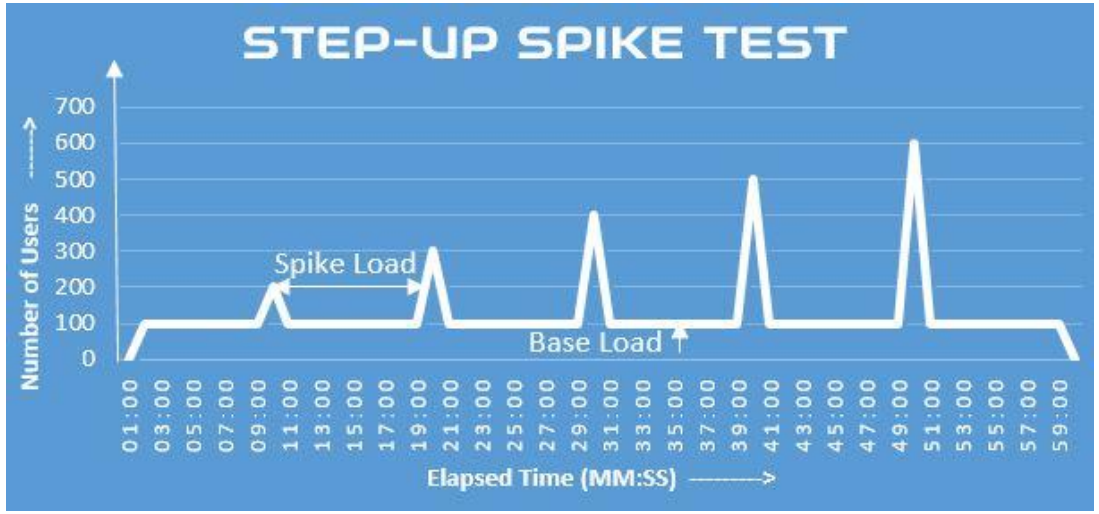
Types of spike test

- Constant Spike Test:
  - A constant spike load applies to the server after a certain interval of time.
  - In this type of spike test, all the spike have same height i.e. the same load.



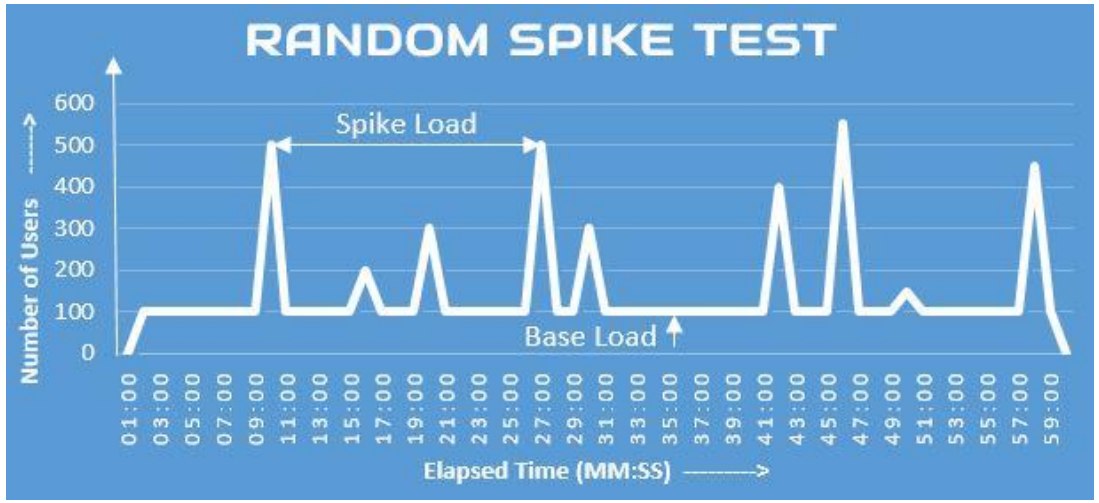
Types of spike test

- Step-up Spike Test:
  - A gradually increase spike load applies to the server after a certain interval of time.
  - In this type of spike test, response time should measure at each spike and analyse how much it deviates from baseload response time?



Types of spike test

- Random Spike Test:
  - A random spike load applies to the server at random interval.
  - Such a test is conducted for an application that frequently gets spikes in the production environment.



How to calculate Spike Load?

- The business analyst analyses the historical data and checks if any of the sudden spikes appeared in the past.
- As per his analysis, he suggests the number of users for spike load.
- He may also predict the numbers by analysing the company’s requirement.

How to calculate Spike Load?

- For example, if a company has a plan to conduct a flash sale or one-minute sale then he needs to calculate the spike load as per the registered and active user count.
- Although there are multiple methods to calculate the spike load which a business analyst must aware.
- This is not a task of performance tester.
- A performance tester has a responsibility to design the workload model as per spike test requirement.

For a new application

- This is an optional test for a new application.
- Still, if the business wants to test the application with spike load then a performance tester can design the step-up spike test and note down the behaviour of the application.

Purpose of spike test

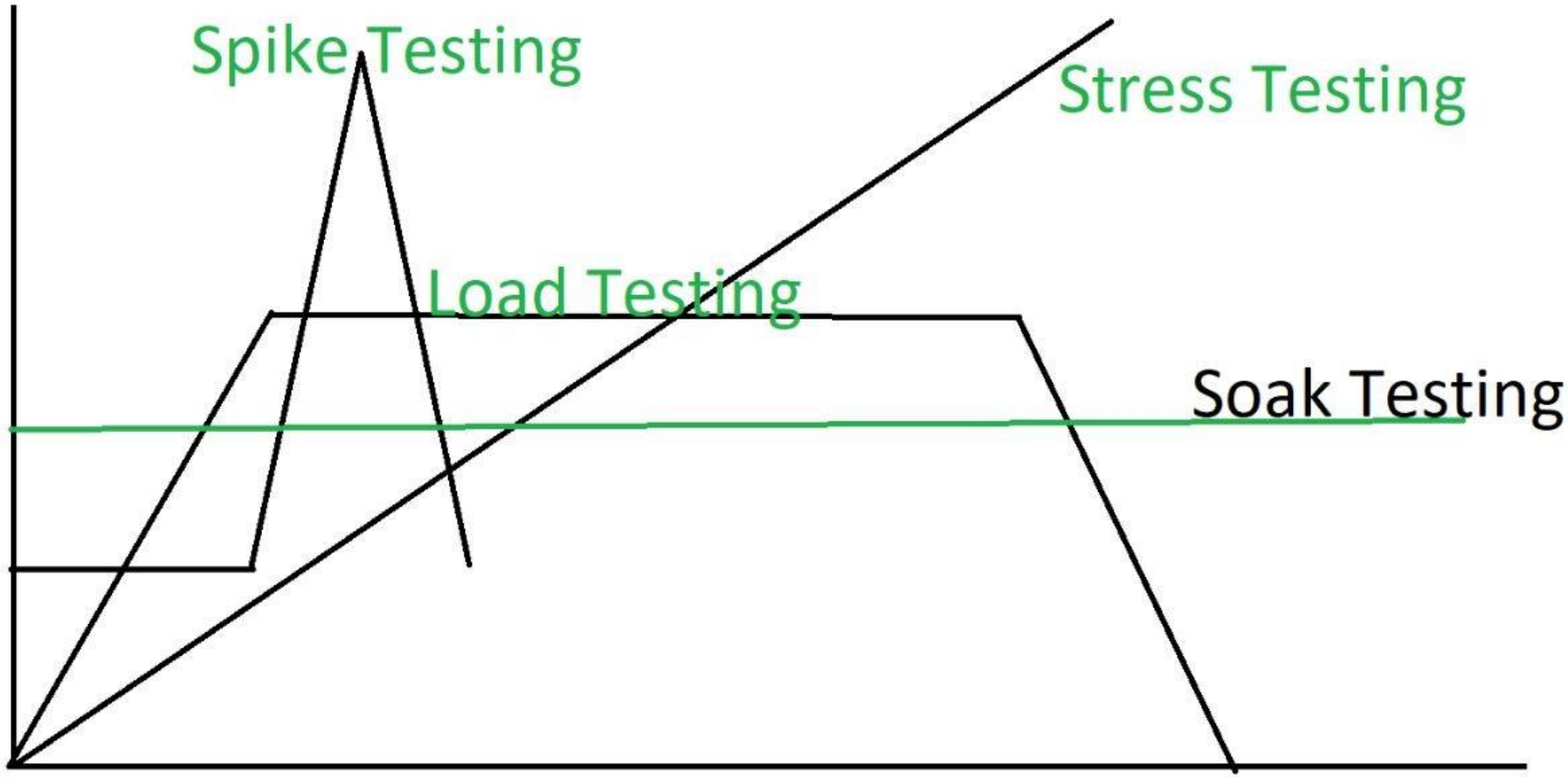
- Verify the sustainability of the application at the sudden huge load
- Identify the deviation in the response time during spike load
- Check the failure percentage of the transactions
- Identify the type of error like 500, 504 etc.
- Note the recovery time of the application in case application is down during spike
- Identify if there is any bottleneck
- Check whether the resources (CPU, Memory and Disk) do not breach the defined performance limit even during the spike period

Soak or endurance test

- Soak Test is a type of non-functional test which helps to identify the memory leakage into the software system.
- In the soak test, a significant load is applied on the server for an extended period of time.
- Generally, the test duration of the soak test is in between 8 to 24 hours, but it may vary as per project requirement.
- A longer period performance test with an average load provides information about the behaviour of Garbage collector and memory management.

Purpose of Soak test

- Verify the sustainability of the application
- Check if there is any spike in the response time
- Identify the memory leakage
- Check the behaviour of Garbage Collector
- Identify if there is any bottleneck
- Check the type of error due to the prolonged duration of the test and get the error percentage
- Check whether the resources (CPU, Memory and Disk) do not breach the defined performance limit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Stress Testing
Load Testing
Soak Testing