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Quality Engineering

Vittal Kommireddy

Divisional Head of Quality Engineering (Consultant) at BNY Mellon

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Oops!! I missed that one…

Mars Climate Orbiter
$193 MM Loss

Crashed due software issue as **NASA** and Lockheed Martin engineers used **different metric system** for their calculations.

3200 Criminals Released Early
Bypassed Judicial System

In 2015, the **Washington State Authorities** noticed a **bug in the system** that has been functioning **for 12 years**. Due to this, when a new law was launched, "good time" **credits applied differently** and thus released prisoners ahead of schedule.

Heathrow Flight Delays
42,000 Lost Bags and 520 Cancelled Flights

Due to poor QA testing, their luggage management system **failed on real-time scenarios** like manually handling luggage, causing the system to shutdown and delete luggage details.

Windows Calculator bug
Incorrect Calculations

The bug existed in **most Windows versions until Windows 10**. Sqrt function in the calculator manages its values as floating-point numbers instead of integers, which caused precision errors when doing:- square root of 4 is 2 and on subtracting 2 it was not Zero and displayed different values in various machines.

Year 2038 Problem
Impacts Day-to-Day Functions in Computers

Year 2038 bug is caused by 32-bit processors and the limitations of 32-bit systems. Basically, on Jan-19-2038 the computers with 32-bit processors **won't be able to tell the difference between 2038 and 1970** hence now all the modern processors are 64-bit.

Gangnam Style video broke YouTube
Loss of Reputation

YouTube's counter before used 32-bit integer which had a limitation up to 2,147,483,647. When the famous Gangnam style video exceeded the maximum value, **this bug was exposed**. Today, YouTube uses a 64-bit integer with maximum count of 9.22 *quintillion.*

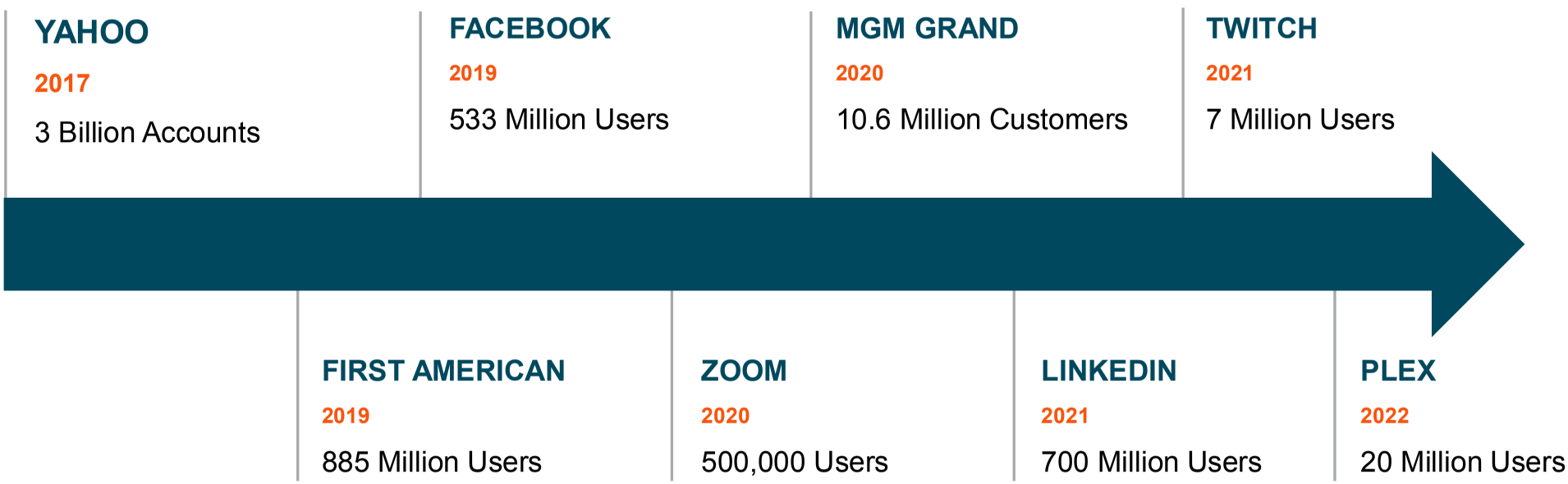
Road to Nowhere
Loss of Business

Some of the **common bugs** identified in **Apple** maps include **Statue of Liberty missing**, Islands in Pacific ocean are duplicated, no location data in Japan and even Apple's own apple store in Sydney was on the wrong side of the road.

8500 dead on paper
Grievances to Family

A software bug in patient database used at a Grand Rapids, MI hospital declared 8500 people dead causing Insurance Agents to knock on doors only to find they are alive. This caused by a **simple mapping error** in their patient database – "20" (dead) was assigned instead of "01" (discharged).

Top Data Breaches in Recent History



Data Breach Statistics

206 Days
Avg time to find a breach

45%
U.S. firms suffer a data breach

68
Documents stolen per second

$156
Avg worth of Gmail account records

22%
Data breaches involve phishing hits

$150.4B
Avg worldwide spending on data security

70 Days
Avg recovery time from a data breach

$4.35MM
Global avg cost of a data breach

What Good Looks Like – 8 highly desired features of a software

The common requirements that all software applications must satisfy to be successful

SECURITY

Mitigating risk of attack and ensuring confidentiality, integrity, authentication and authorization

PERFORMANCE

The speed with which the application performs the function

SCALABILITY

Ability to handle increasing and decreasing volumes of transactions, services and data

FUNCTIONALITY

Meeting business requirement and user expectation

USER EXPERIENCE

User's perception of an application's usefulness, usability and desirability

AVAILABILITY

Readiness to perform the actions when needed

ADAPTABILITY

Ease with which application's functionality can be changed or extended

ECONOMY

Minimizing the cost to build, operate and change without compromising its business value

What Good Looks Like – 8 highly desired features of a software

The common requirements that all software applications must satisfy to be successful

Focus of Discussion

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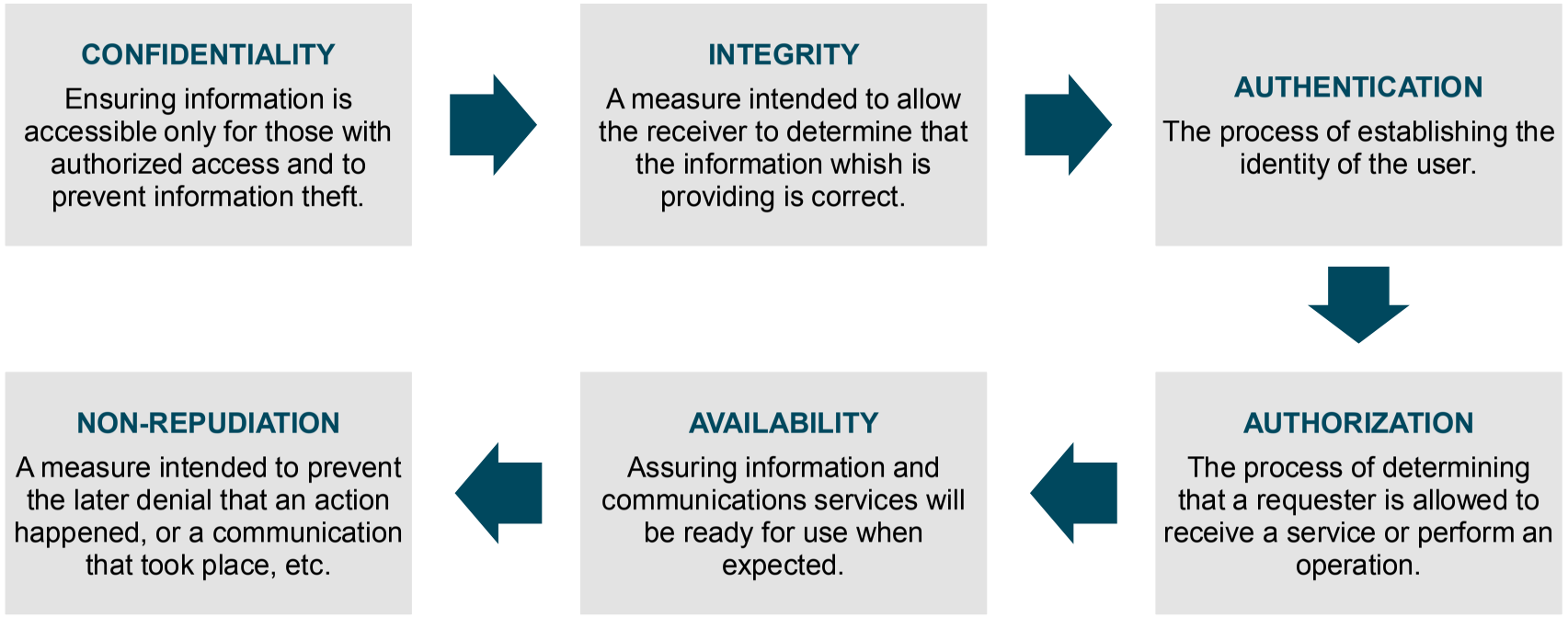
Assuring Security

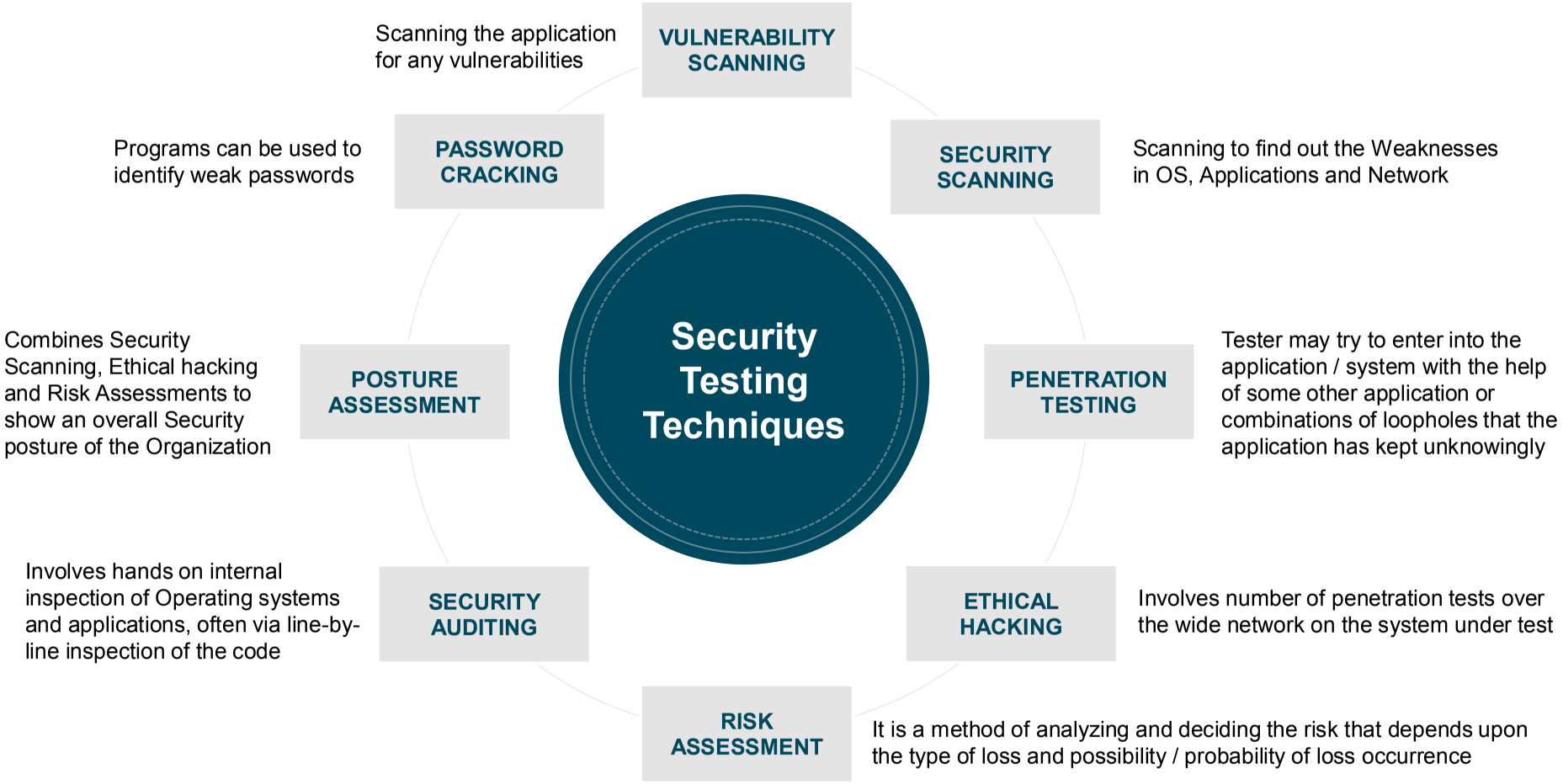
Security Testing

Security testing is a process to determine that an **information system protects data and maintains functionality**. Primary purpose of Security testing is to identify the vulnerabilities and subsequently repairing them.

Basic Concepts of Security Testing



Security Testing Techniques



Vulnerability Management

Identification

- Cyber Vulnerability Scans
- Pen Test Results
- Firewall logs

Analysis

- Analyze
- Categorize
- Identify Root cause

Risk Assessment

- Prioritize vulnerability
- Vulnerability Assessment Score card

Remediation

- Updating Operational procedures
- Develop Robust Config process
- Patching Software

Mitigation

- New Security Controls
- Replacing hardware / software
- Encryption
- Attack Surface management
- Continuous Security monitoring

Popular Scanning Tools

Solar winds NCM

ManageEngine Vulnerability Manager

Rapid7 Nexpose

Vulnerability Scanning with Web Security Scanner

E4A3FFF5.zip

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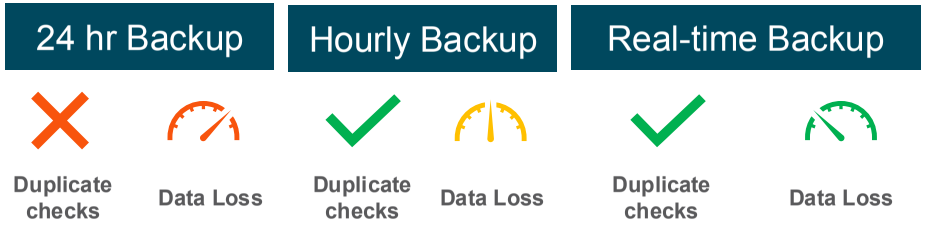
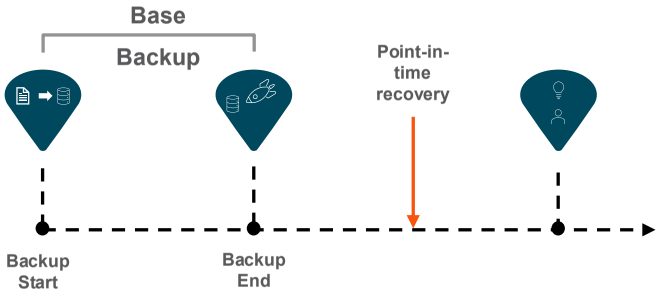
Point-In-Time-Recovery (PITR) Post Cyber-Threat

Point-in-time recovery (PITR) refers to recovery of data changes up to a given point in time. Typically, this type of recovery is performed after restoring a full backup that brings the server to its state as before.

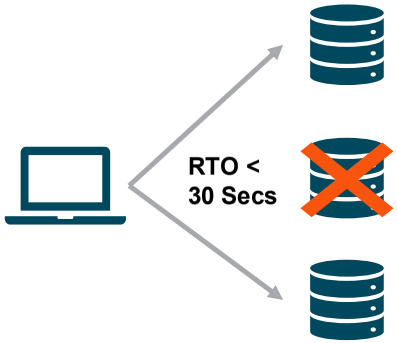


Recovery Point Capability (RPC) refers to the point in time to which data was restored and/or systems were recovered (at the designated recovery/alternate location) after an outage / attack



Recovery Point Objective (RPO) is the maximum time frame your organization is willing to lose data for, in the event of a major IT outage

Recovery Time Objective (RTO) refers to how quickly you can switch from your production source machine to your target backup machine, in the event of an emergency.



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Assuring Performance & Scalability

What is Performance Testing?

Performance testing is evaluating the behaviors of a system at various load & stress conditions through modifications in hardware & software. This helps the developer to build solutions to optimize and mitigate dependencies.

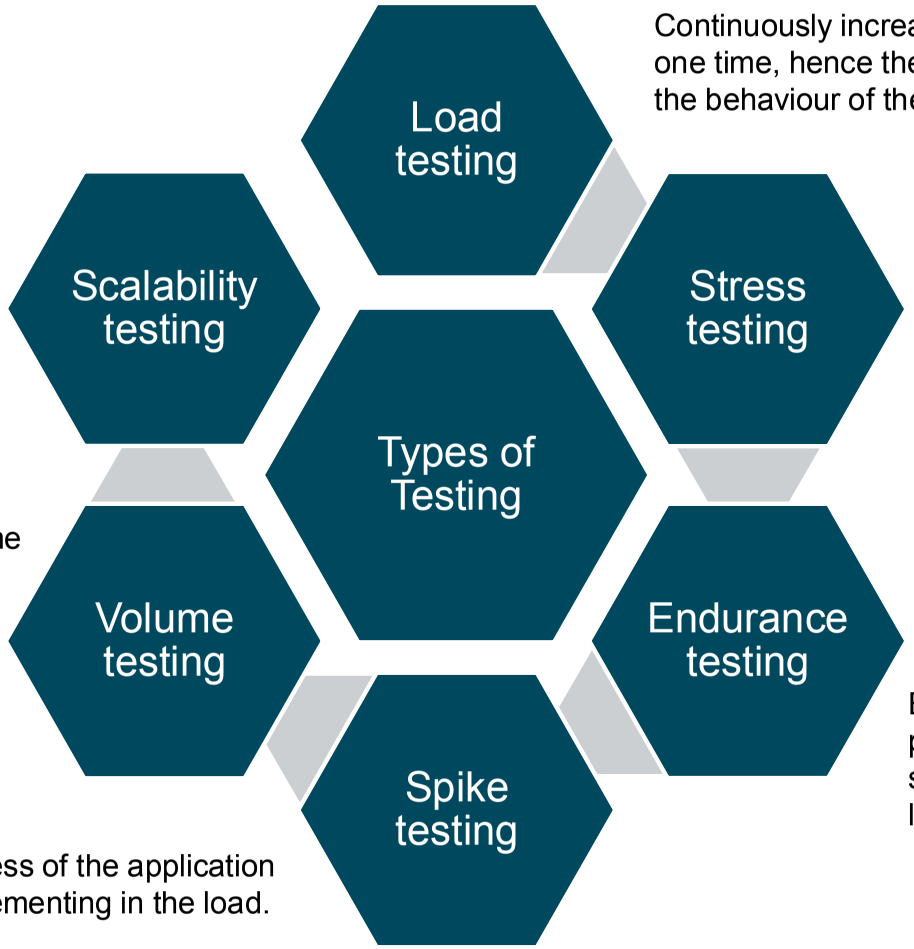
Parameters Considered for Performance Testing

Memory usage	Processor usage	DB logs	Memory pages	Long running Stored Procs
Response time	CPU interruption per second	Committed memory	Thread counts	Top waits, etc.

JMeter Load Testing

3447269F.zip

Types of Performance Testing



Continuously increase the number of active users at one time, hence the load on the system, and check the behaviour of the app under those conditions

Scalability testing checks the app's capability to scale up user traffic, a number of transactions, and data volume of the system, as well as to determine the peak of scaling.

An app may crash when hardware resources like CPU, memory, disk space, and others are insufficient. Stress testing aims at checking the stability of software out of bandwidth capacity.

Volume testing evaluates the volume of data that the system can handle

Endurance testing is usually performed to test the behaviour of a system with an expected load over a long period of time.

Spike testing evaluates the weakness of the application by extreme incrementing and decrementing in the load.

Performance Testing Metrics

CPU UTILIZATION

Percentage of CPU capacity utilized in processing the requests.

MEMORY UTILIZATION

Measures the utilization of the primary memory of the computer while processing any work requests.

RESPONSE TIMES

Total time between sending the request and receiving the response. Better the response time, better the performance of website/application.

AVERAGE LOAD TIME

Measures the time taken by a webpage to complete the loading process and appear on the user screen.

THROUGHPUT

Measures the number of transactions an application can handle in a second, or the rate at which a network or computer receives the requests per second.

AVERAGE LATENCY/WAIT TIME

Time spent by a request in a queue before getting processed.

BANDWIDTH

Measurement of the volume of data transferred per second.

REQUESTS PER SECOND

The number of requests handled by the application per second.

ERROR RATE

Percentage of requests resulting in errors compared to the total number of requests.

TRANSACTIONS PASSED/FAILED

Percentage of passed/failed transactions against the total number of transactions.

Performance Metrics (Sample)

1x = 50 users
2x = 100 users
3x = 250 users

63% **CPU utilization**	35% **Memory utilization**	9.42 secs **Response times**	1.23 secs **Average load time**
1.4K calls / min **Throughput**	42 ms **Average latency time**	200 mbps **Bandwidth**	30 Req/secs **Requests per second**
0.27% **Error rate**	98% **Transactions Passed/Failed**		

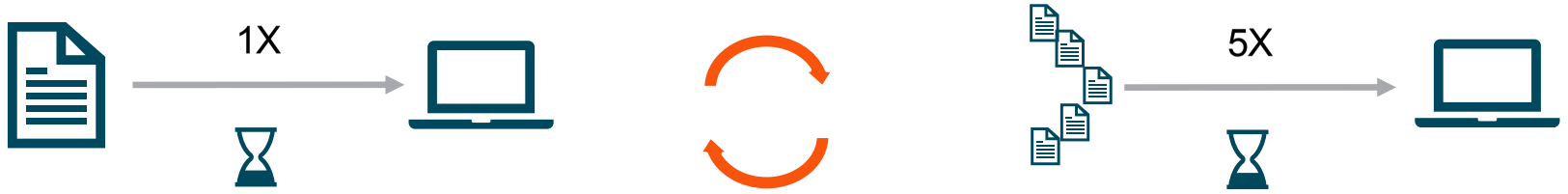
Performance Testing Cycle

PLANNING	ANALYSIS	DEVELOPMENT	EXECUTION

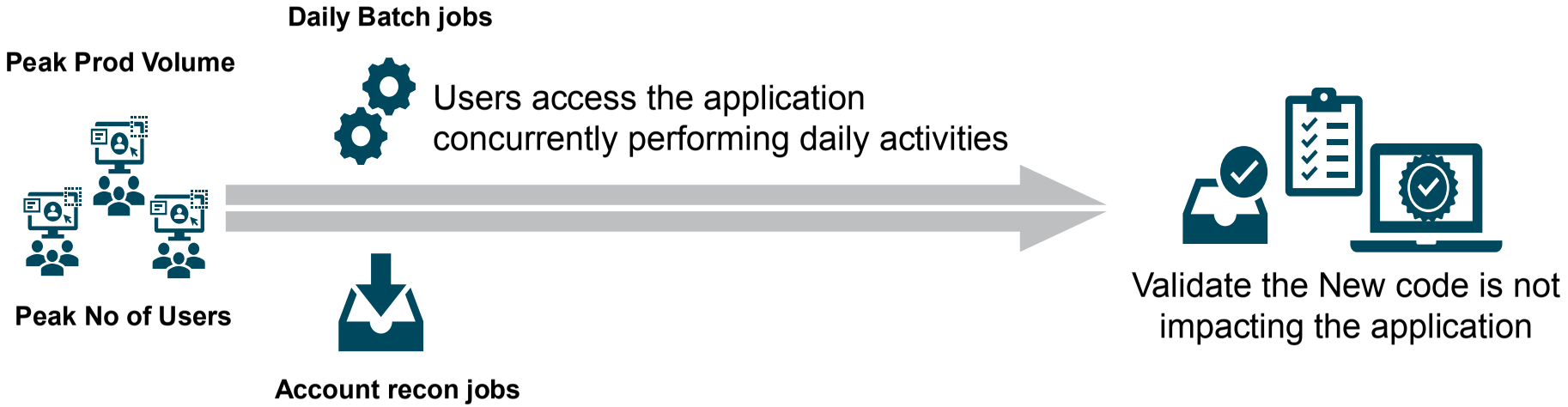
• Collect Business Specifications
• Tool Selection
  ○ Neoload (Citrix applns)
  ○ Jmeter (Others)
	• Understand functionality
	• Finalize Benchmarks
		• Develop Performance scripts
		• Workload modelling
			• Test Run & Analysis
			• Refine & Redefine Performance goals

PERFORMANCE BENCHMARK

BUSINESS SIGNOFF



Day in the Life of Production Performance Testing



What to Validate

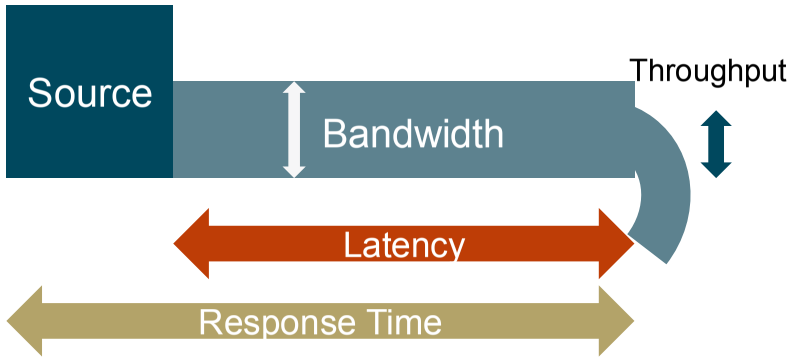
- Check how the application **responds / reacts to the peak load.**
- Evaluate the **user experience for any impacts.**
- Evaluate how the **target system performs while batch run.**
- Helps identify >70% of the individual performance issues.

Pre-requisites

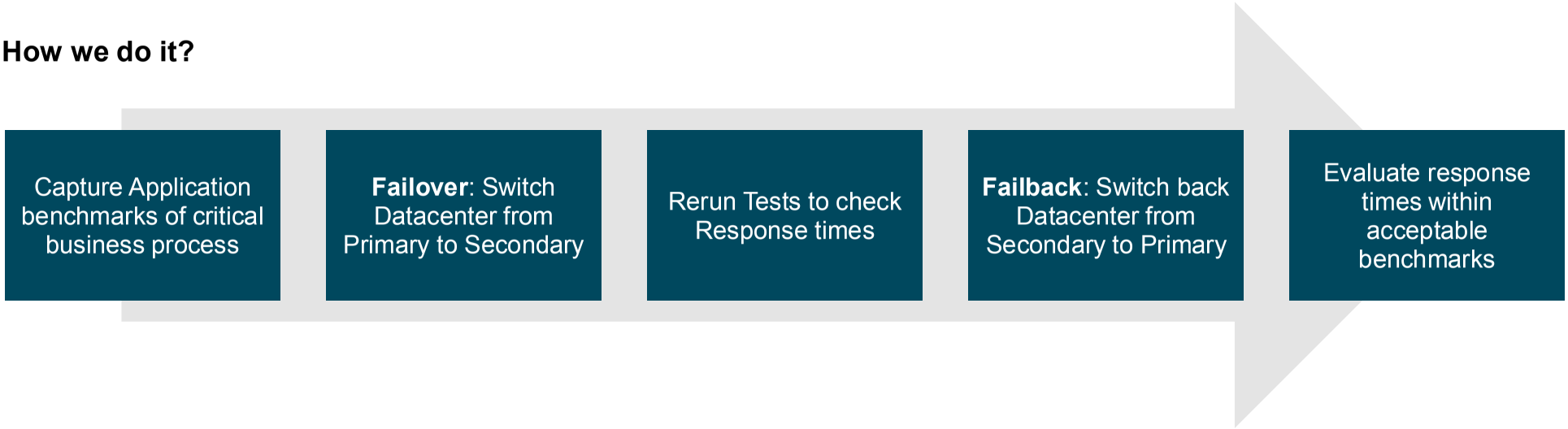
- Production like hardware.
- Setup upstream downstream connectivity.
- Business users with appropriate access.
- Batch jobs setup like production.

Latency Testing

Why perform a Latency test?
A latency test measures the amount of time needed to move data from one point to another.



How we do it?



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