

Performance Test Modeling with “ANALYTICS”

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Abstract

Websites and web/mobile applications have become the imperative sales enablers for most organizations. The “optimized user experience” of a website becomes critical for organizations to outperform their competitors. This demands performance testing to be proactive and shift dynamics from measuring responsiveness to improving user experience.

User Experience (UX) index of a software product can be measured by the ease of use, providing navigational comfort and quick responsiveness to end user – In a nutshell – better performance of an application results in better user experience – but unfortunately even after a huge spend critical performance issues are detected / observed in production. Some of the critical factors for these include

- Performance testing objective remains to be meeting response time SLA's
- Ambiguity in load test modeling
- Not emulating actual user behavior during load tests
- Lack of simulation of devices used by end users

Web Analytics tools like Google Analytics, Yahoo analytics etc have come a long way and simplified the process of analyzing, collecting and reporting user behavior which serves as a input in creating a comprehensive performance test strategy and test bed which included loads of compulsive features.

Biography

Jeevakarthik Kandhasamy – certified, test engineering Leader & Architect with experience in Functional & Non-Functional Testing. With over 12 years of experience in Performance testing, consulting, strategic partnering & program management, executing transformation, change management programs in testing space – Jeeva has served financial services majors in India, China, Europe and North America. His interests include championing organizational wide activities like IP lead test assets creations, Frameworks, assessments, Innovation drives & testing road shows.

He currently based in Chicago and leads a testing engagement for a leading global insurance customer

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1 Introduction

A Recent Cisco survey reports that 78% of the North American shoppers use internet, social media or mobile devices for research and purchase of products and services – Along with the brand value, quality and other marketing campaigns most firms rely on their web applications to yield revenue – DISGRUNTLED user experience may turn out to be a perfect recipe for IT organizations failure. Some of the risks associated include

- Increased spend on IT
- Failure to meet sales goals and business objective
- Decreasing revenue
- Denting organizations brand value

The think tanks in most online shops have realized the importance of improved UX Index and have stressed the need and importance of non-functional testing and specifically performance testing. This involves a lot of money for

- Setting up infrastructure for performance testing
- Tools and licenses
- Resource cost

In spite of the organizations spending tremendous money for performance testing – most of the Performance issues are detected in production – The key reasons of failure are

- Performance testing objective remains to be meeting response time SLA's
- Ambiguity in load test modeling
- Not emulating actual user behavior during load tests
- Lack of simulation of devices used by end users

All these clearly indicate that lack of analytical data on the actual user behavior in production. The approach of determining user and system behavior with server logs becomes tedious and uncertain.

Performance testing strategized without understanding the actual user behavior results in finding out issues in production.

2 Solutioning with Analytics

Web Analytics tools like Google Analytics and Yahoo! Web Analytics have come a long way and simplified the process of analyzing, collecting and reporting user behavior which serves as an input in creating a comprehensive performance test strategy and test bed (load test model). Some of the compulsive features include:

- Providing a holistic view of business
- Decision making
- Custom and integrated reporting
- User conversion rate
- Bounce rate and reasons for users exiting the website
- For applications yet to be developed experimental sites are available with analytical data based on trends from competitors and industry standards.

- ➔ Understand visitor behaviors like
 - How visitors use your website
 - How they arrived on your website
 - Geographical locations of users
 - Devices used by users accessing the website

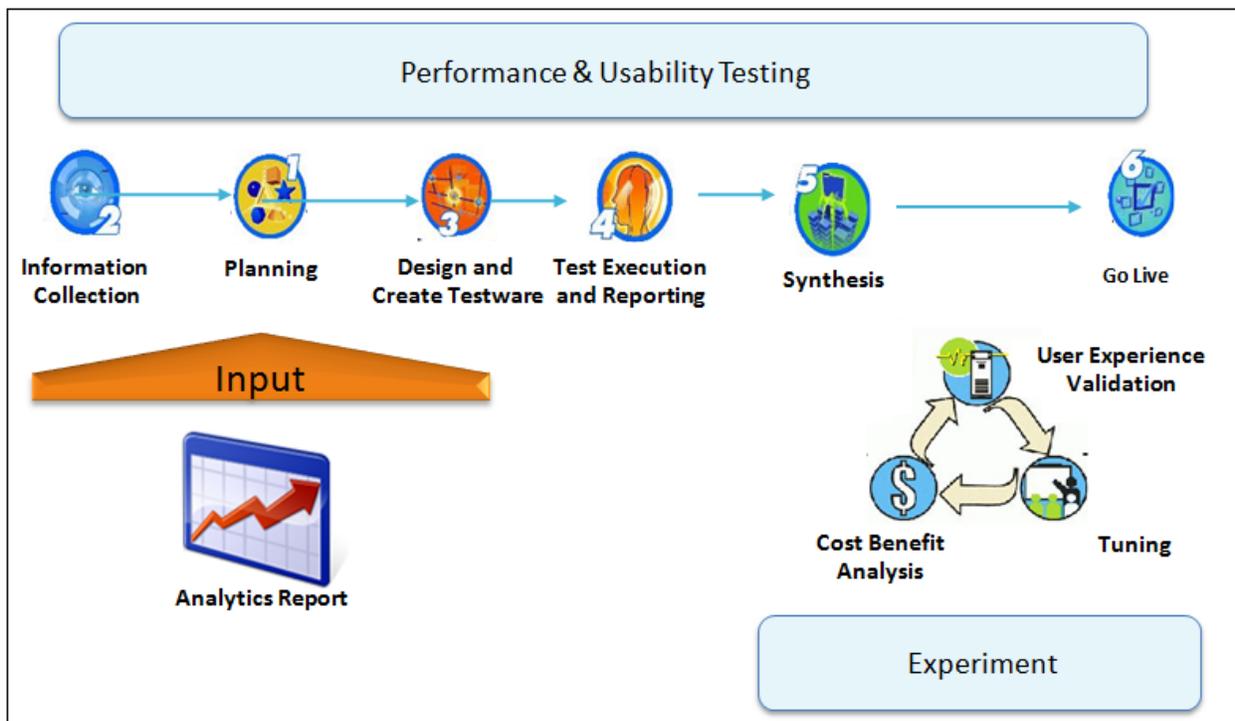
Web Analytics simplifies the process by providing the non functional tester inputs on:

- Who the end users are,
- What they do
- Entry and exit points of the application.
- What they like and don't like in the application.

It's fair to say that web analytics tools can help determine the performance testing objective, help creating the performance testing strategy, load test modeling and executing load tests simulating actual user behavior.

3 Modeling a Performance Test using Google Analytics

The section below explains how a performance test could be designed and executed using Google Analytics. I have provided snippets and screen shots from Google Analytics. The flow diagram below indicates the end to end performance test process.

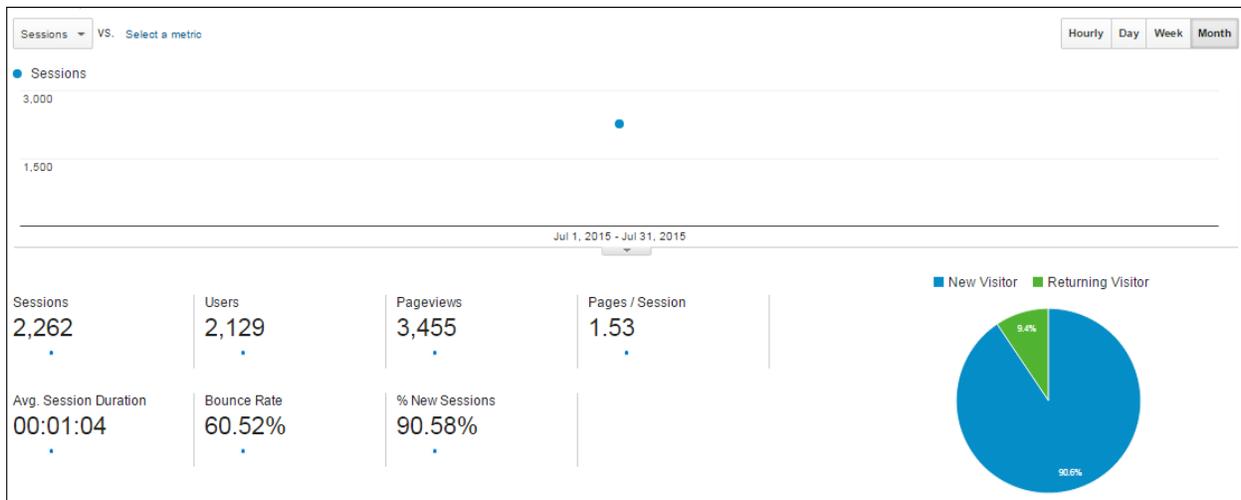


Performance test planning will include designing, executing and reporting a performance test. Some of the key factors for designing of a performance test will depend on:

- ➔ Type of the performance test to determine the virtual user load and the duration of the test – e.g. load, stress, endurance, spike etc.
- ➔ User flow or traversal flow
- ➔ Platform – Client and server systems
- ➔ Geographical distribution of the users

Determining the type of test

For a portal that is already existing in production – user, session, content metrics are available on hourly, daily, weekly, monthly and yearly basis. This behavior analysis should help a performance engineer to correlate and identify the test load, duration and objective of the test. In the section below we will walk through a few scenarios for modeling a performance test, and the advantages of using Analytics tool.



User profile

One of the main flaws in performance test design is not mimicking the user profile – but with analytics various factors is factored in – type of user, demographic, geographical location and the most important factor being - % of new users vs % of returning users which will depict the actual user behavior.

Traversal flow

While identifying the performance test flows it's usually based on the Key Performance Indicators and ensuring they are covered as part of the flows. User flow analytics provides users with the following information:

- ➔ User landing page – that includes total number of sessions – active and inactive along with the drop-offs
- ➔ First Interactions, second and subsequent interactions

This will help us to identify the user flow, interacting internal and external systems and services.

Behavior	Page	Pageviews	Unique Pageviews	Avg. Time on Page	Entrances	Bounce Rate	% Exit	Page Value
Overview		3,455	2,874	00:01:59	2,241	60.52%	64.86%	\$0.00
Behavior Flow		<small>100.00% (3,455)</small>	<small>100.00% (2,874)</small>	<small>Avg for View: 00:01:59 (0.00%)</small>	<small>100.00% (2,241)</small>	<small>Avg for View: 60.52% (0.00%)</small>	<small>Avg for View: 64.86% (0.00%)</small>	<small>0.00% (\$0.00)</small>
Site Content								
All Pages	1. Sample Page - URL / Page Name	1,106 (32.01%)	895 (31.14%)	00:02:40	789 (35.21%)	44.63%	67.72%	\$0.00 (0.00%)
Content Drilldown	2. Sample Page - URL / Page Name	769 (22.26%)	769 (26.76%)	00:04:25	693 (30.92%)	86.90%	90.12%	\$0.00 (0.00%)
Landing Pages	3. Sample Page - URL / Page Name	589 (17.05%)	442 (15.38%)	00:02:05	293 (13.07%)	59.39%	59.59%	\$0.00 (0.00%)
Exit Pages	4. Sample Page - URL / Page Name	309 (8.94%)	265 (9.22%)	00:01:11	246 (10.98%)	47.56%	53.07%	\$0.00 (0.00%)
Site Speed	5. Sample Page - URL / Page Name	230 (6.66%)	184 (6.40%)	00:00:58	17 (0.76%)	83.33%	34.78%	\$0.00 (0.00%)
Site Search	6. Sample Page - URL / Page Name	228 (6.60%)	163 (5.67%)	00:01:15	101 (4.51%)	49.02%	44.30%	\$0.00 (0.00%)
Events	7. Sample Page - URL / Page Name	223 (6.45%)	155 (5.38%)	00:01:11	101 (4.51%)	41.58%	45.74%	\$0.00 (0.00%)
AdSense	8. Sample Page - URL / Page Name	1 (0.03%)	1 (0.03%)	00:00:00	1 (0.04%)	100.00%	100.00%	\$0.00 (0.00%)
Experiments								
In-Page Analytics								

Technology, platform and devices

Application performance in most situations are based on server performance, but with modern technologies – performance of a particular application will depend on the system that is used by the end user. Some of the factors influencing this would include: Browser, Operating Systems, Screen resolution, Flash version and Script control of the user:

Audience		Acquisition			Behavior			Conversions		
Browser	Sessions	% New Sessions	New Users	Bounce Rate	Pages / Session	Avg. Session Duration	File Download (Goal 1 Conversion Rate)	File Download (Goal 1 Completions)	File Download (Goal 1 Value)	
	2,262	90.58%	2,049	60.52%	1.53	00:01:04	11.01%	249	\$0.00	
	<small>100.00% (2,262)</small>	<small>Avg for View: 90.58% (0.00%)</small>	<small>100.00% (2,049)</small>	<small>Avg for View: 60.52% (0.00%)</small>	<small>Avg for View: 1.53 (0.00%)</small>	<small>Avg for View: 00:01:04 (0.00%)</small>	<small>Avg for View: 11.01% (0.00%)</small>	<small>% of Total: 100.00% (249)</small>	<small>% of Total: 0.00% (\$0.00)</small>	
1. Chrome	1,183 (52.30%)	95.94%	1,135 (50.30%)	71.68%	1.41	00:00:51	6.26%	74 (29.72%)	\$0.00 (0.00%)	
2. Internet Explorer	682 (30.15%)	83.87%	572 (27.92%)	45.16%	1.84	00:01:35	21.11%	144 (57.83%)	\$0.00 (0.00%)	
3. Safari	237 (10.48%)	84.39%	200 (9.70%)	58.65%	1.35	00:00:46	7.59%	18 (7.23%)	\$0.00 (0.00%)	
4. Firefox	111 (4.91%)	90.99%	101 (4.93%)	45.05%	1.50	00:01:13	10.81%	12 (4.82%)	\$0.00 (0.00%)	
5. (not set)	24 (1.06%)	100.00%	24 (1.17%)	29.17%	0.29	00:00:00	0.00%	0 (0.00%)	\$0.00 (0.00%)	
6. Android Browser	17 (0.75%)	52.94%	9 (0.44%)	70.59%	1.35	00:00:50	0.00%	0 (0.00%)	\$0.00 (0.00%)	
7. Opera	3 (0.13%)	100.00%	3 (0.15%)	33.33%	3.33	00:01:03	33.33%	1 (0.40%)	\$0.00 (0.00%)	
8. Amazon Silk	2 (0.09%)	100.00%	2 (0.10%)	50.00%	1.00	00:00:10	0.00%	0 (0.00%)	\$0.00 (0.00%)	
9. Opera Mini	2 (0.09%)	100.00%	2 (0.10%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	\$0.00 (0.00%)	
10. IE with Chrome Frame	1 (0.04%)	100.00%	1 (0.05%)	100.00%	1.00	00:00:00	0.00%	0 (0.00%)	\$0.00 (0.00%)	

With the increase in use of mobile devices – most applications today are mobile compatible. Analytics tool provides information on the devices (Browser, OS), network speed, carriers etc.

Geographical distribution

With the business model today being global, performance testing should also follow and be distributed. This could be achieved by understanding the user geographies and simulating it using latency and network simulations during a performance test.

Along with these benefits, analytics dashboards can be used for monitoring production environment real time.

4 Case Study

This section contains a case study describing the need and benefits of using web analytics tools for performance testing for leading auto insurance provider in North America insuring 18 million vehicles across USA.

4.1 Situation

Clients Auto insurance application was the application under test. This was Java / J2EE based system. Based on the Non-functional requirements the objective of performance testing was to ensure the response times of critical Key Performance Indicators (KPI) were less than 7 seconds. The downsized test bed was to ramp up 700 concurrent users and create 2500 auto policies with different driver / vehicle combination in the performance test environment.

4.2 Issues Observed

The client was spending close to 1.5 million dollars annually for performance testing that includes the cost of resources, infrastructure, tools etc. The following issues were reported by business and production team

- Response times for page navigation took more than 11 seconds
- Multiple search failures reported between noon – 3 PM EST
- 2 production outages
- Declining online sales conversion

4.3 Assessment observations

A detailed assessment was executed to understand the reasons for failure by using Google Analytics in both production and Performance test environment.

Some of the key observations related to load test modeling failures are listed below

- The test simulated 700 users creating 2500 policy in test environment – but the actual situation was 2000 + users accessing the system and only 700 users navigate and proceed till purchase – **USER AND VOLUME SIMULATION** issues.
- Close to 65% of the agents were using browsers IE 7 and below which did not support the caching and other UI based performance accelerators – **CLIENT & BROWSER** related issues.
- The client data centre was located in Georgia while more than 40% of the users were from north east and west coast locations – the load test did not reciprocate the **NETWORK LATENCY** similar to production.
- Search initiated from home page took more time while search from other pages were fine – **SITUATIONAL & USER BEHAVIOUR** issues.
- The peak volume reached increased by more than 30% during promotional offers – failure to execute **SPIKE test** due to promotional / un-expected volume.

4.4 Assessment observations

- Non-functional requirements and load test model, test scenario design was updated based on the actual user behavior from Analytics report – the user pattern was not available from server logs.

- ➔ Additional plug-in Recommendations provided to agents for browsers
- ➔ User pattern was modified to include 120 MS and 245 MS network latency respectively for east and west coast users.
- ➔ Multiple performance issues related to code and configuration were observed during performance tests which resulted in the following performance tuning recommendations
 - DB indexing
 - Client side caching
 - Search optimization
 - Load balancing
 - Network performance

4.5 Results

Following are the positive results by using web analytics for performance testing:

- ➔ Realistic simulation of user behavior from production
- ➔ Detected 82% of performance issues during performance testing phase – reduced risk of identifying performance issued in performance
- ➔ Improved user experience – obtained based on customers and agent survey.

Observed trend of improved sales by 6% – 8% on a half early basis.

5 Conclusion

Using web analytics tools adds value to the performance testing process. Some of key benefits include:

- ➔ Efficient load modeling
- ➔ Improving user experience
- ➔ Improve sales and user conversion
- ➔ Decision making
- ➔ Support and adapt based on evolving changes in production
- ➔ Cost effective solutions – availability of open sourced and licensed tools & reports

In tough economic situations, organizations today are forced to deliver high performing applications to retain existing customer base and attract new customers.

The goal of Performance testing needs to shift from measuring responsiveness to improving the customer experience and web analytics tools can help achieve these objectives and help organizations succeed.

References

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