

## Analyzing and Testing Web Application Performance

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**ABSTRACT :** Web application today are become more rich and complex. For building such application developers are using Ajax and Web 2.0 technologies. This powerful technologies offer advanced features for building user-friendly and highly interactive web applications that are providing quality end-user experience. Deploying web application is a challenge both in assuring that the functionality will be maintained and in guaranteeing that the functionality will be delivered with an acceptable performance. Performance problems can bring all kind of undesired consequences. For web applications especially in an e-commerce situation, performance testing is crucial. Performance testing is a type of testing that is performed, from one perspective, to determine how fast some abstract of a system performs under a particular workload.

In this paper we discuss general concepts, practices and tools that lie at the core of performance testing web applications. Performance analysis tools from the open-source can be used to achieve effective web application performance tests. A case study will be given to demonstrate these tools used in a Ajax web application.

In this paper we conclude that performance tools helps software developer to find out bottleneck in performance of the system as well as to choose a good platform for designing web application.

**KEYWORDS :** performance, test, tools, web application

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### I. INTRODUCTION

From last two decades the internet has become a house hold source of information, education, sales, marketing, advertising etc. Today's web applications are also more complex than ever before. Web applications not only offer us new types of applications, but also provide an entirely new way to set up software applications to the users. Web applications use a number of languages, technologies, and programming models to implement highly interactive applications. Web applications are developed today powerful tools and technologies such Ajax and Web 2.0 offering advanced features for building user-friendly and highly interactive applications providing quality end-user experience. As the modern Web applications are complicated, interactive programs with complex GUIs and numerous back-end software components, the analyzing, modeling and testing these applications present a number of new challenges to software developers. As web applications become more and more useful and complex, so the need for performance testing is increasing. For Web applications especially in an e-commerce situation, performance testing is crucial. Users expect high performance from a web application. The performance of a web application depends on many factors including the network, the end systems, the application and most importantly the end user. Web application performance testing is an emerging and important field of software engineering. Performance testing includes monitoring and recording performance levels during regular, low and high stress loads. Performance analysis tools from the open-source such as YSlow and Firebug can be used to achieve effective web application performance tests. This paper begins by present a view of Web 2.0 and Ajax technologies. In section 3 we discuss performance importance, to continue with results in Section 4. We conclude this study in Section 5.

### II. WEB 2.0 AND AJAX APPLICATIONS

Web 2.0 is revolutionizing the way how end-users interact with Web applications, that are becoming richer and richer in design and content and at the same time good user experience has become the most desirable attribute. Instead of using many different pages and server callbacks to deliver content, Web 2.0 technologies such as Ajax enable Web sites to deliver content in real-time to Web clients while the end-user remains on the same web page. Ajax [1] is short for Asynchronous JavaScript and XML, is a web development technique for creating interactive web applications. In Ajax web applications rich functionality and prompt responsiveness to user actions are priorities in their design and implementation. Ajax is a technology that enables better performance and user experience for web applications. In AJAX applications, the state of the user interface is determined dynamically, through event-driven changes in the browser's DOM that are only visible after executing the corresponding JavaScript code. Ajax is really several familiar technologies, which are bundled together in powerful new ways [2], including Document Object Model (DOM), Cascading Style Sheets (CSS),

Dynamic Hypertext Markup Language (DHTML), Extensible Markup Language (XML) and JavaScript. DOM represents the structure of XML and HTML documents, and DOM APIs provide a way for JavaScript to handle the returned document from server and update the displayed page. DHTML and CSS are adopted to create the interactive and dynamic web pages. XML is for data manipulation and conversion. JavaScript is the client-side script for dynamically caching and displaying information that has been received using XML. The XMLHttpRequest object in JavaScript is utilized to perform asynchronous interaction with the backend server via standard HTTP GET/POST requests. Ajax allows for HTTP requests to be dispatched asynchronously with JavaScript code, without reloading the entire HTML page along with all of its referenced resources. Ajax greatly improves frontend performance, because it reduces the total number of HTTP requests.

### III. WEB APPLICATION PERFORMANCE TESTING

The performance [3] of a web application depends on many factors including the network, the end systems, the application and most importantly the end user. If an application identifies end-users by some form of login procedure then a concurrency goal is highly desirable. By definition, this is the largest number of concurrent application users that the application expected to support at any given moment. Performance testing is directly reflecting the behavior of the complete website. Visitors expect the fast response within a short period of time. Web performance testing [4] aim at providing a measure of the actual performances of a web application, and an evaluation of performances that the application could provide, following a change of load; identifying, moreover, possible bottlenecks and providing useful advice about how to fix problems. The aim of web performance testing [5] is to evaluate performances of the web application and all the back-end systems changing the load. Performance testing activity guarantees system performances according to a defined load, identifying where response time is too high. The performance testing [6] involves monitoring and recording the performance levels during regular and low and high stress loads. Performance testing. This type of testing determines or validates the speed, scalability, and/or stability characteristics of the system or application under test. Performance is concerned with achieving response times, throughput, and resource-utilization levels that meet the performance objectives for the project or product.

**Response Time:** time for downloading pages and performing main transactions on the user side and of the back-end systems side.

**Performance application can be divided into three parts:**

**Scalability testing.** Scalability concerns the website’s ability to handle the volumes and types of activities that can occur after launch.

**Load testing.** This subcategory of performance testing is focused on determining or validating performance characteristics of the system or application under test when subjected to workloads and load volumes anticipated during production operations.

**Stress testing.** This subcategory of performance testing is focused on determining or validating performance characteristics of the system or application under test when subjected to conditions beyond those anticipated during production operations.

In this experiment we compared two types of applications:

The first type, traditional application and the second type, Ajax application. The second application is built by integrating components of Ajax techniques.

Both applications offer the same services and have the same interface. We have put scripts in both applications code to test precisely the application response time, results are shown in Table 1.

Users	traditional app	Ajax app
1	1.2342	0.7835
2	1.2353	0.7841
4	1.2361	0.7849
5	1.2368	0.7854
10	2.3587	1.8037
20	3.6492	2.1084
50	5.3852	3.8359
100	8.0674	5.4791

Table 1. Response time in seconds

Graphic test results for Response times in traditional and Ajax application with different number of users are shown in Figure 1.

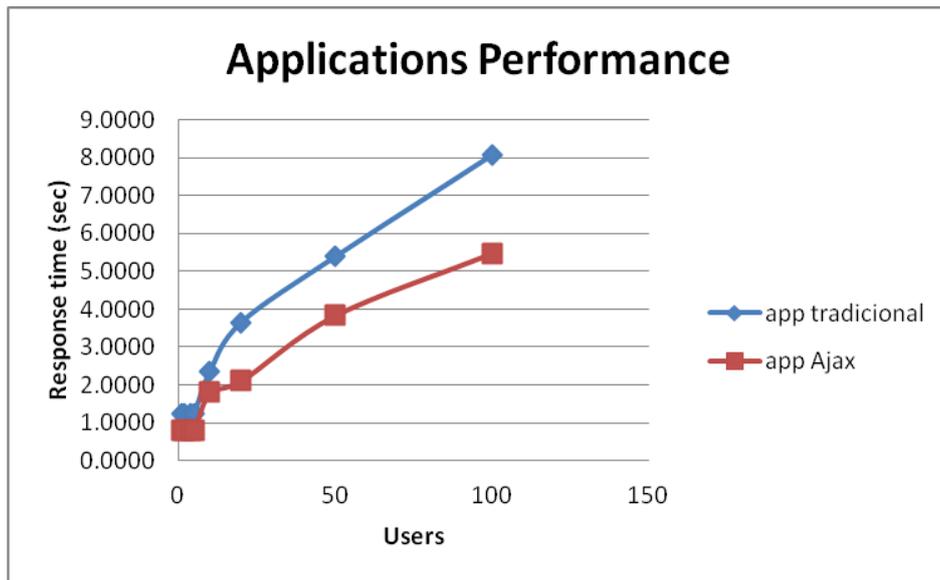


Fig. 1 Response times for tradicional application vs. Ajax application

#### IV. TESTING TOOLS

This section provides a brief introduction to the open source performance testing and analysis tools used in the case study. The web application under test is an Ajax application. Firebug [7] is a web development tool that facilitates the debugging, editing, and monitoring of any website's CSS, HTML, DOM, XHR, and JavaScript. Looking at the statistics in Figure 2, we made 12 GET requests and 1 POST request, with a total response time of 2.56 seconds, and a combined page weight of 983,9 KB.

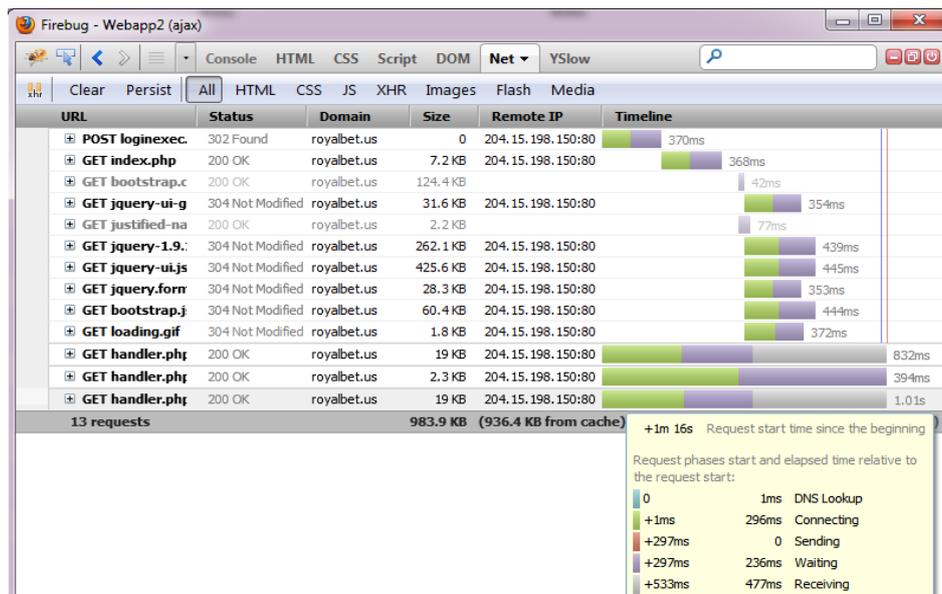


Fig. 2 Firebug network statistics for Ajax application

Firebug enables a number of web application frontend development tasks: network traffic monitoring; HTML inspection and editing; CSS inspection, editing and visualization; JavaScript execution, debugging, logging and profiling; DOM (Document Object Model) inspection. YSlow [8] is a Firefox add-on that integrates seamlessly with Firebug. YSlow analyzes and grades frontend performance and suggests ways to improve performance

based on a set of rules for high performance web pages. Grading is done on a scale of A through F, where A denotes best performance.

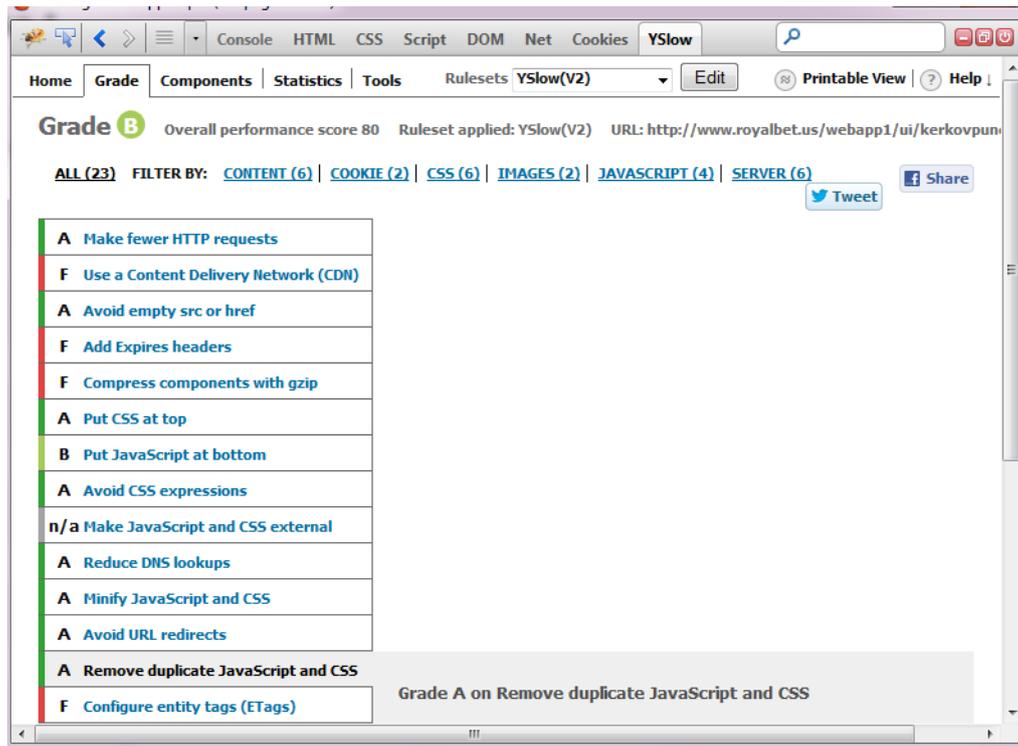


Fig. 3 YSlow grade 'B' for Ajax application

As shown in the Fig. 3, our web pages received a grade B, scoring 80 out of 100 points.

## V. CONCLUSION

Ajax web based applications are more complex compare to the classic web applications. Among many complexities, performance testing is one of the difficult activities which need to be study more carefully. Performance testing and analyzing tools help to evaluate an application under a given load. We introduced two performance testing and analysis tools Firebug and YSlow that can be used to realize effective web application performance tests with minimal overhead. Analysis of test results is useful for system designers to make the best choice of the optimal platform in which to build web applications. Performance tools help software developers to find out bottleneck in system performance, as well as performance models to help them to develop web applications with high performance.

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