

# Optimizing performance of Web Applications

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**Abstract-** In the modern world, web applications are important tools for industries for information sharing and processing. And also, time is an important aspect of day to day life. That means information needs to be exchanged and processed as quickly as possible. There are many factors affecting the execution speed and performance of web applications. There are also many solutions to overcome the performance issues. For small web applications, the performance issues can be solved by relatively simple solutions. But for enterprise level highly complex web applications, the solutions can be complex. I am explaining some of the solutions in detail here.

**Keywords-** web application, layer, database, load balancer, single tier, two tier, three tier, multi-tier

## I. INTRODUCTION

Web applications are actually tools that are used to exchange and process information by using web technologies. While simple websites can be made of just one html file, complex web applications make use of more complex aspx tools, views, database servers and so on. One of the challenges faced by software developers while building an enterprise level web application is how to overcome the performance issues due to high traffic. Whenever there are high number of user requests to the web applications, the response time of the applications becomes larger and larger and at some point of time, the applications may not even respond. This is a common scenario in public websites. Because of this reason, web applications need to be developed in such a way that they can accommodate all user requests. There are many techniques available to enhance the performance of web applications.

## II. TYPES OF WEB APPLICATIONS

There are many types of web applications used by the software industries based on how they are built.

1. Single tier web applications
2. Two tier web applications
3. Three tier web applications

## III. WHAT ARE SINGLE TIER APPLICATIONS

When user interface, back end business logic and database servers reside in the same machine, the applications are called single tier applications. Once the tool is shipped to the user, updates are not possible except if there is an option to download and install updates by connecting remotely.

## IV. HOW TO IMPROVE PERFORMANCE OF SINGLE TIER APPLICATIONS

In order to improve performance of single tier applications, the software developer has to take extra steps to make sure that the code is optimized. There are many techniques available for code optimizations. Some of the techniques are as below:

- Reduce communication to database as much as possible
- Avoid using unwanted html scripts and asp controls on the web form
- Avoid using unwanted loops in the code
- Always make sure to release resources (e.g. database connection) if not used. Sometimes, database indexing and avoiding unwanted joins are good candidates to enhance performance of database operations.

## V. WHAT ARE TWO TIER APPLICATIONS

Two tier applications have two tiers or layers. They are,

1. Client tier
2. Data tier

In two tier applications, there is direct communication between client and database servers. Basically, there are two machines involved in two tier applications. Performance will be reduced if there are more users. So high traffic will reduce the performance of two-tier applications. There should be a connection which is free of any network traffic congestion is required in two tier applications.

## VI. HOW TO IMPROVE PERFORMANCE OF TWO-TIER APPLICATIONS

The same code optimization techniques used in single tier applications can be adopted in two tier applications as well. In addition to that, since the database server is in a different machine, there can be chances that the connection to the database server is interrupted. Avoiding frequent transport to and from the database server should be avoided.

## VII. WHAT ARE THREE TIER APPLICATIONS

Three tier applications have 3 layers for the applications to work. The 3 layers are,

- 1.Client tier
- 2.Business tier
- 3.Data tier

directly. As the above diagram shows, the presentation layer does not communicate with the database directly.

In addition to the layers in two tier applications, three tier applications have one more layer. That is the business layer which is an intermediate layer which facilitates communication between client tier and data tier. In addition to the layers in two tier applications, three tier applications have one more layer. That is the business layer which is an intermediate layer which facilitates communication between client tier and data tier.

#### VIII. HOW TO IMPROVE PERFORMANCE OF THREE TIER APPLICATIONS

Most of the enterprise level web applications are three tier applications. The client tier consists of the user interface whereas the business layer includes web service that communicates with data layer. The code optimization techniques and database performance techniques can be adopted here as well. But more than that, there is another solution to enhance the performance of enterprise level three tier applications. Using multiple web servers and application servers are a way to improve performance of three tier web applications.

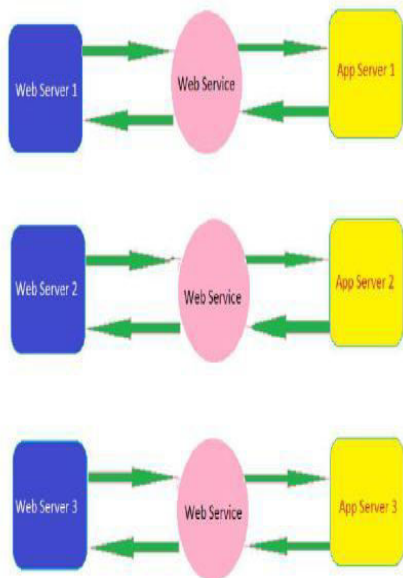


Fig.1: Multiple web servers and app servers

As in the above diagram, multiple web servers and application servers communicate with each other. In other words, the solution is developed in such a way that the presentation layer logic can communicate with database using web service. For each database operation, call the web service that communicates with the database. As the above diagram shows, the presentation layer does not communicate with the database

The solution is divided into different projects. Web project, web logic project, web service project, data project etc. The web project contains asp files, html files etc. and the web logic project contains the logic that communicates with the web project and web service. Data project has the business logic that takes care of the database operations. Create web reference in the web logic project so that it can call web service.

Once the solution is built, publish the web project and web logic project to the web servers. There can be any number of web servers that have IIS servers are running. Each web server should have copies of web project and web logic project files. We also should have same number of application servers that can communicate with database. Each web server is paired with single application server. Publish webservice project and data project files to the application servers. In the webconfiguration file of each web server, the URL of the web service should be included.

### IX. ROLE OF LOAD BALANCER

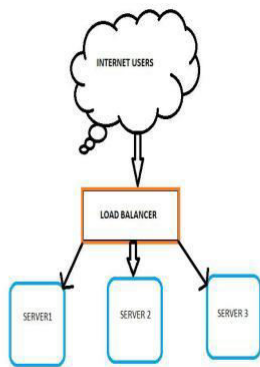


Fig.2: Load Balancer distributes user requests among multiple servers

Server load balancing is a technique by which the site traffic is distributed among multiple servers using a network-based device. When multiple servers are involved in supporting the web application, the load balancer can distribute the user requests based on the traffic to the servers. Load balancer finds appropriate server that has less traffic compared to other servers to direct the user request.

### X. CONCLUSION

Web applications are very popular due to the fact that there are huge number of users. So, these applications should provide and process data quickly regardless of the network traffic. For performance improvement, there are simple solutions and complex solutions available. Page caching is a simple mechanism to improve performance in which the web page is cached for the same user request for certain point of time. Scalability of web applications is an important aspect when

building any web application and, in this way, multi-tier architecture is preferred which allows the applications more scalable. Because of this, using multiple servers to handle high traffic is a very good option to improve performance.

### XI. FUTURE SCOPE OF RESEARCH

The next stage of the research is to study the performance comparison of ASP.net Web form and MVC Web applications. These two architectures in building web applications support different methods to direct the user requests in the web application. Because of this, the performance is affected differently in different web applications.

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