Architectures and Performance Issues of Web Applications

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Abstract- Now a days, websites and web applications are important part of everyone's lives. Almost everyone in the world is familiar to the web applications. Web applications range from simple to complex or high-level applications that can process and deliver data to the users. Due to the very large number of users, web applications are often susceptible to high network traffic and this causes the applications not to respond for some time. For enterprise level web applications, this failure causes financial and other impacts to the businesses. Every user expects a quick response from the application for the information he or she is searching for. Thus, performance of the web applications is very important factor. I am explaining the architectures and the performance improvement techniques in detail here.

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

I. INTRODUCTION

There are many techniques available in the Information Technology sector for information exchange and processing. Web applications are very important tools in the Information Technology field for sharing and processing data. It is very difficult to find someone who never used at least one web application. Since the number of users are huge, web applications are susceptible to failures. Improving performance of web application is an important factor for maintaining a reliable tool for the users. There are many techniques available based on the way the applications are built.

II. ARCHITECTURES OF WEB APPLICATIONS

     1. Single layered architecture

     2. Double layered architecture

     3. Multi layered architecture

Single layered architecture refers to the one layer of the application that does everything to do the tasks. The user interface and the application business logic are all included within this single layer. The advantage of this architecture is that it requires only minimum resources. On the other hand, the disadvantage is, there can be work overload for the server that hosts the application.

Double layered architecture refers to the two layers of the application that handles the tasks. The two layers are the presentation layer and the data layer. These two layers can also reside in the same server. The advantage of this architecture is that the two layers can be coupled and decoupled so that they can be reused.

Multi layered architecture refers to the multiple layers used by the applications to do the tasks. The multiple layers are the presentation layer, the application layer and the data layer. The presentation layer has to call web service to communicate with the data layer. The advantage of this architecture is that multiple servers can be used to host the whole application and the load can be distributed among them. The disadvantage is there can be a delay in getting a response from the service that provides a channel to access the database operations.

III. PERFORMANCE IMPROVEMENT IN SINGLE LAYERED APPLICATIONS

The following can be used to improve the coding for the single layered applications.

- Utilize content delivery network to keep data closer to users for loading pages whenever possible.
- Utilize page caching and fragment caching for retrieve same content
- Write code in such a way that the scripts are loaded after rendering the page.
- Compress files like CSS and JavaScript to remove whitespaces by minification
- Disable view state in asp.net application. View state is used to store control state values. Storing large values in view state can slow down the page.
- Bundling can be used to combine CSS and JavaScript files to avoid multiple server round trips.

- Dispose unwanted resources
- Validate client-side validation
- Load CSS before loading the page.

IV. PERFORMANCE IMPROVEMENT IN DOUBLE LAYERED APPLICATIONS

The same techniques used in the single layered applications can also be used in the double layered applications. Presentation layer and the data layer can be coupled and decoupled if needed. For e.g. if there are multiple database servers involved, new data layer can be coupled if the performance is high with the new database.

The same server has all the published files needed to host single layered and double layered web applications. So basically, single layered and double layered applications are not that different in terms of performance rating. They both utilize almost the same amount of resources. Only difference is in the way the application is built.

V. PERFORMANCE IMPROVEMENT IN MULTI- LAYERED APPLICATIONS

Multi-layered applications are built in such a way that the solution has more than two layers. The presentation layer is separated from the data layer and the presentation layer does not have direct access to the database operations. There must be an application layer that acts as an interface to communicate with the database. The presentation layer must call the web methods to do any database operation.

e.g. Webreferece.Call_Database_Insert_Operation(data)

   Webreference.Call_Database_Select_Operation ()

The advantage of this architecture is that due to the separation of layers, the files that correspond to different layers can be published in different servers and communicate each other using web services. Identical copies of files in all layers can be published to different servers. This is an advantage when the server has to handle huge number of user requests.
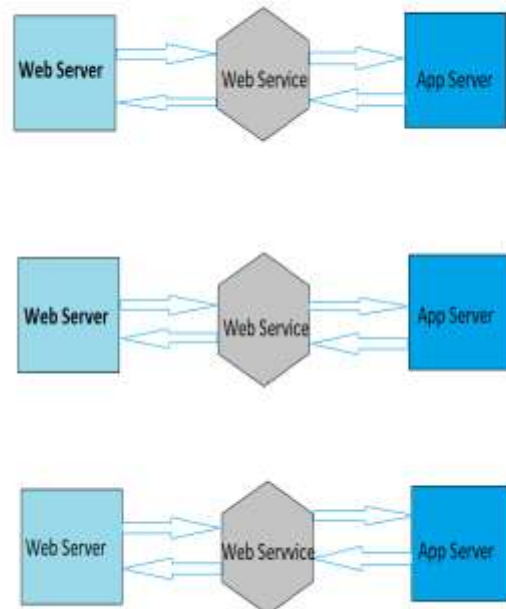

Fig.1: Web servers and app servers are paired together

The above diagram shows multiple web servers and app servers paired together to support the whole solution. The advantage of this architecture is that the user requests can be divided among any pair of web and application servers and

thus the performance can be improved. This architecture offers a way to increase any number of servers based on network traffic. This approach is very advantageous to enterprise level web applications.

This architecture also offers the flexibility to decouple any web and application server and add new pair. In this way, if the performance is an issue with the database currently used, a new data layer can be added that points to new database without much effort. For this purpose, only a configuration change is needed if the pair to be replaced is already setup.

This type of architecture has another major advantage. The data server can be coupled with another web server at the same time when it supports the current web server. In this way, the development time is greatly reduced.

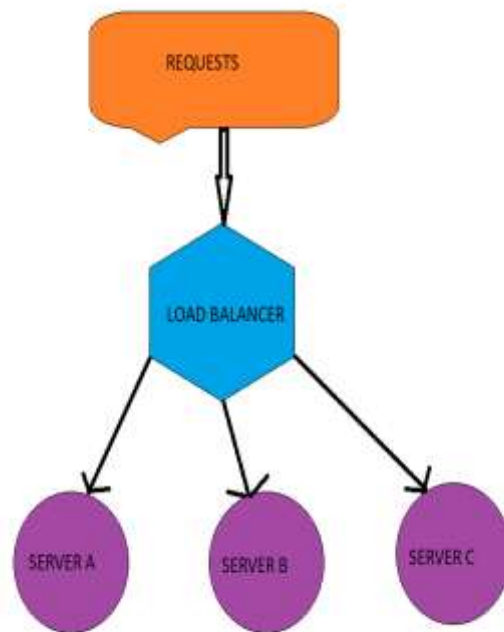## VI. NETWORK UTILITIES TO IMPROVE PERFORMANCE

Fig.2: Load balancer redirects the user requests to servers

There is a network device called load balancer that redirects the user requests to different servers based on network traffic. This technique can be combined with multi layered architecture to improve performance of high-level enterprise applications.

VII. CONCLUSION

High performance is very important for web applications because web applications are important tools in processing information. Faulty applications can cause high loss to the organizations. Based on the requirements, it is up to the software developers to choose the correct technique to improve performance of applications.

VIII. FUTURE SCOPE OF RESEARCH

The next stage of the research is to study the performance comparison of .NET and JAVA web applications. Based on the difference in technologies used, there is a big impact on the performance of the web applications. This study will give more information to improve the current techniques used in developing high performance web applications.

REFERENCES

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