

Software Architectures: A Comparative Study for Web Based Applications

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Abstract

Correct architecture is the backbone of the successful software. To address the complexity of the growing software there are different architectural models that are designed to handle this problem. The most important thing is to differentiate software architecture from software design. As the web based applications are developed under tight schedule and in quickly changing environment, the developers have to face different problematical situations. Therefore understanding of the components of architectures, specially designed for web based applications is crucial to overcome these challenging situations. The purpose of this paper is to emphasize on possible architectural solutions for web based applications. Different types of software architectures that are based on different architectural styles are compared according to the nature of software.

Keyword: *Component based architecture, Layered architecture, Service oriented architecture, Web applications.*

1. Introduction

Software architecture acts as a common model of a system articulated at a high-level of abstraction. This model plays an important role for implementation of system or it acts as a bridge between what is required and what is implemented. It is important for development steps like in analysis, evolution, construction reuse, and understanding. The important thing is that as the software application evolves its architecture evolves and one problem with software architecture is that it has not any explicit representation in general purpose programming languages [1]. Software architecture is used to present software at abstract level. Designing software architecture is important in early stages of development and it helps to reuse software components and their connections [10].

There is also need to differentiate software architecture and design as there is a lot of confusion between these two terms on internet. The difference between design and architecture is qualitative in nature, so their concept must be elaborated to differentiate. First thing, "Architecture is not design" then what is architecture? In simple words architecture is structure of a system [2]. Software architecture describes the element from which a system is built. All elements, their ways of interaction and constraints on those elements are part of architectural description. Architecture has no concern with detail, it is abstract in nature and its focus is on the visible properties of software component. On the other hand design includes the detail to support the architecture. Software design admits the description of procedures, algorithms and data types to satisfy the requirements. The architecture specifications include the description of all parts of a system and can be characterized logically by variables. The specifications of design can also be characterized by the use of logic variable but design specification is limited to some part of the system [3].

1.1 Web based applications: software whose functionality is delivered through web [4]. Ever more web applications are used in related environment for the completion of similar tasks. We can say that these are software products that can be derived from a common infrastructure. For example in online retailing system the common abstraction in a domain can be shopping cart and user registration.[5].

1.2 Components of a web application: are web browser, web server and application server, static or dynamic pages, web objects, Multimedia objects and databases.

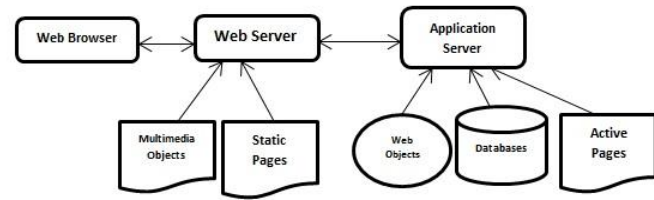


Fig.1 Components of a web application

The architecture of a web application describes the relationship between the components that comprises the web application. Each component of a web application has its own architecture that is of interest for a web application developer. The interaction between the main components are required to show in architectural diagram of a web application and these main components are web objects, database tables and multimedia objects [4].

2. Types of architectures for web Based applications:

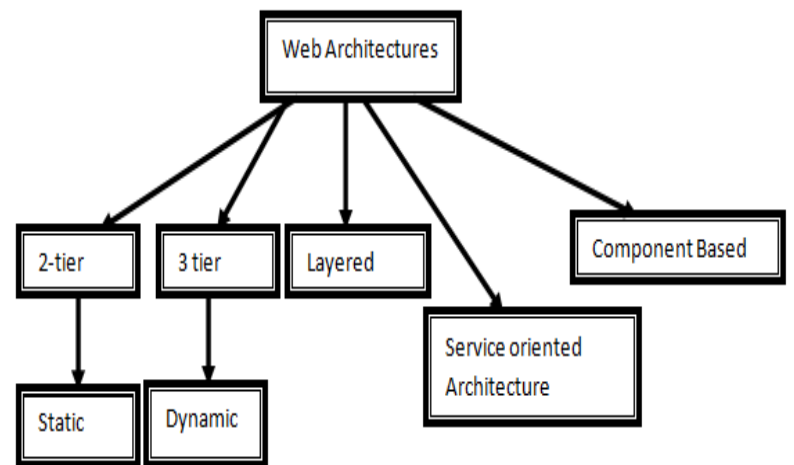


Fig. 2 Software Architectures for different types of web applications

These all types of architectures are used to solve different types of problems. Before taking a look at these types of architectures, explanation of parameters of web applications like layers, components, services, web objects and database etc. is necessary.

Component: a component is an object that encapsulates set of functionalities and meant to interact with other components.

Services: Services are modules that are accessed in a request –reply mode via an interface [6]. A service can also be explain as set of functionality that is explain by one entity and use by another. This service is invoked through software interface without any constraints of functionality implementation.

Layers: Describe the logical separation of components. Allow to encapsulate task in different levels or modules.

Tiers: Physical separation of components.

Web objects: Provide services to the software system through a defined interface.

Databases: It is used to store and share data among various components.

3. Comparison of Software Architectures for Different Types of Web Applications

3.1 Static and dynamic web applications:

Static web applications lie in 2- tier web architecture where user interacts only with web server using a browser. These static web pages include HTML and executable code that run on the browser and do not need to get services through application server. A web application under 3- tier architecture consists of 3 layers; presentation logic, business logic and Infrastructure layer. Presentation layer provides the interface to user. Business logic encapsulates rules related to business logic. An infrastructure layer supports the other layers and the component of this layer is based on the platform on which web application is developed. The web pages that involve application server are dynamic web pages. The application server send requested page to browser by processing and integrating data from various resources such as web objects and databases [4].

3.2 Complex ecommerce web applications:

Web applications like e-commerce are difficult to build because these applications support different user profile. Implementation of new business models and challenging technological issues are combined in web applications. In a particular domain a flexible architecture is needed to understand the application domain, business rules and behaviors etc. More powerful approaches are required to deal with the complexity, evolution and maintenance of web applications. Without architecture the web frameworks and design can lose the reuse opportunity.[7]

J2EE (Java 2 Enterprise Edition) is a platform for distributed multitier applications. We can use J2EE as an example to prove that component based software architecture can improves the implementation of complex applications. The three tiers of J2EE are client, middle and EIS. The use of J2EE is complex so a programmer may assign software responsibilities incorrectly. The use of software architecture can simplify this process because architecture presents the high level abstraction of the system so it improves the communication among the stakeholders. The most important design decision with respect to system development can be presented through architecture and it also promotes the reuse of application [7]

Example 1:

Here is a model view controller architecture in fig 3 that improves the development of J2EE based application. In this architecture model provides the interface for view and also contains the application data elements. A view object is created for each user interface that holds the presentation format information and keeps coordination with the model's state. The Controller translates the processed user input into request for specific application functionality. This separation is because a web application may access through different clients such as web service client and browsers etc.

There are certain limitations of this architecture because it provides set of principles for developing interactive modular applications and not providing a hypermedia structure for web applications. It does not support the navigation aspects properly. Navigation occurs within a context and this information is absent in this architecture [7].

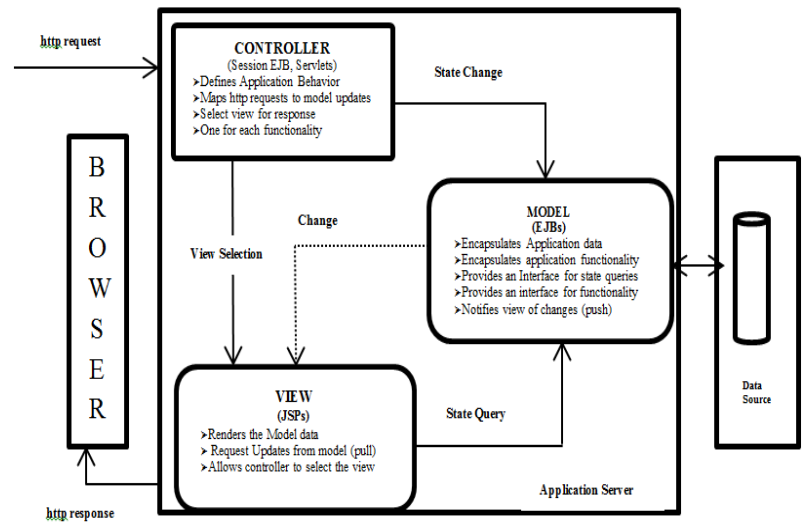


Fig. 3 The MVC (Model view Controller) Architecture

Example 2:

To overcome the problem in MVC architecture a separate navigational layer is introduced in the OOHDM (Object oriented hypermedia design methodology)- java2 architecture. The purpose of this layer is to deal with the context specific information and manage node contents. The objective of this architecture is to encourage good design and implementation activities and to provide support for developing transactional complex web applications. In the fig 3 high level components of OOHDM- java2 and their interaction architecture is presented while handling a request. It is important to note that not all applications use all parts of this architecture; simple applications can use only sub components of this architecture.[7].

Fig 4 shows OOHDM –java2 architecture with the important components while handling a request. Controller converts a user request into an action that is then executed by model. Executor executes a business event and business object model contains data and functionality related to application in encapsulated form. View selector selects a response view after the execution of a business event. Navigational view has the contents to be shown by JSP that is a response interface. JSP provides a response to user components to its request.

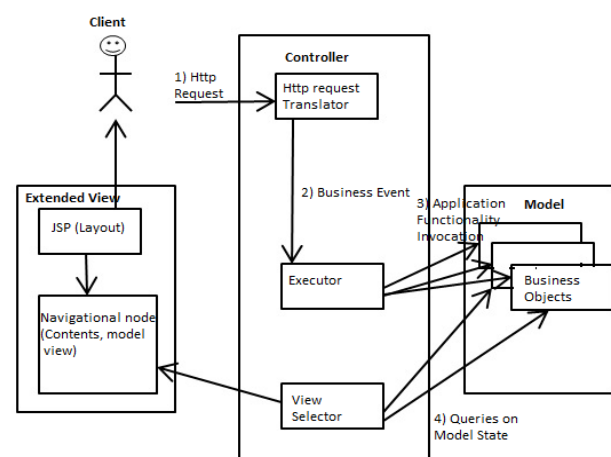


Fig. 4 The main components of OOHDM-java2

3.3 Collaborative web applications:

It is possible to develop a collaborative web application with high synchronous degree. A general architecture is needed to integrate collaborate applications smoothly into web. Layered architecture allows encapsulating task in different levels or modules. It identifies the modules of software, maps the modules to software layers and shows their relationship. Here is an example of general architecture that is based on Layered architectural pattern with MVC architecture that is usually used for client server systems [8].

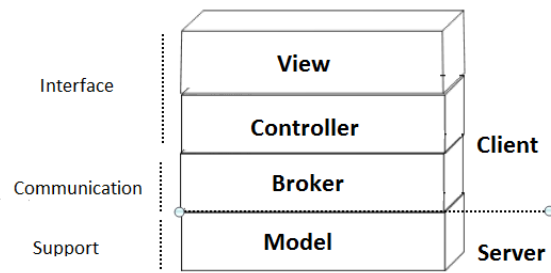


Fig. 5 Components of Layered Architecture

Each component is assigned defined functionality. This architecture shows three levels. View and controller components work for interface level. Each application can communicate with model component through broker component. The interface and communication levels are implemented on client side and inside internet browser. Support level shows the server side and provides the data storage services. This architecture provides the independencies between functionality of application and user interface and also allows using different programming languages to build user interface.

The view component is responsible to organize buttons, text areas and other elements of client's interface and also defines events that user trigger. The controller components manage the events. Model services are used to obtain the information and to visualize that information in application's interface. The responsibilities of broker are to facilitate the communication and manage the send and receive requests. This architecture shows independencies between interface and Model.

3.4 Distributed Web Applications:

The organization that wants to make their processes more efficient so that they can face competition and changes they use Service oriented architecture for their software that enables software as a service concept. For online auction eBay opening up its web service API, this can be taken as an example in this context.

SOA is considering as a topology of interfaces as it is all about the implementation of interface and interface call. It describes the relationship of services and who consumes the services. Services are modules that are accessed in a request-reply mode via an interface. A service can also be explained as set of functionality that is explained by one entity and used by another. This service is invoked through software interface without any constraints of functionality implementation. Simple object access protocol (SOAP) and Standard web services description language (WSDL) when used by software is called web service [6].

In SOA a request is made by a process node and processing request directs the future processing. In SOA the requester knows about the services it requests for. Data retrieval and composite transactions are best fit in SOA where request is made, wait until receives a reply and disconnects on receipt of reply.

Service oriented architecture is structured around the services which performs action on the behalf of clients. It provides invocation at remote sites by clients and supports the construction of interaction explicitly from messages. And thus makes simple to construct one way interaction [8]

4. Conclusion

Depending on the type and nature of a web application to be developed the architecture selection will be different. For example a simple web application may be static or dynamic and software architecture for these applications can be simply 2-tier or 3-tier with the components like web browser, web server and application server. But in case of distributed, environment a web application can be designed through service oriented architecture depending upon the type of problem and need of solution.

Component based architecture provides the reusability of components. This type of architecture mostly used to develop similar families of software. For example web based system share

common infrastructures e.g. shopping cart and user registration in a retailing system. So Complex e-commerce web applications are best supported by component based architecture. Layered architecture provides the independency of components that allows modifications and changes in application. For example layered architecture for a web application allows designing interface in different programming languages.

The architectures discussed above are work in client server environment. Parameters of architectures are different but they are working as 2- tier, 3 tier and multi-tier architectures. For example the type of a component based architecture MVC (Model view controller) discussed above is also work in 3 tier environment because it gets services from application server too.

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