

# **Enhancing Human and Web Interaction through Mobile Technology**

## **.NET vs. J2EE**

Tim H. Wong, Ganz Chokalingam

California Institute for Telecommunications and Information Technology

La Jolla, CA 92093-0405

thwong@ucdavis.edu, ganz@ucsd.edu

### **Abstract**

The rapid growth of web-based technology has empowered the web more than ever. However, this growth has also increased the size and the complexity of the website, and as a result, introduced new usability problems to Internet users. To cope with these problems, web developers used mobile technology such as Short Message Service (SMS), and Voice Extensible Markup Language (VXML) to enhance interactions between Internet users and web servers. This paper uses the San Diego Wireless Traffic Report, and the SMS Friends web portal to demonstrate how we can use the Microsoft .NET, and the Sun Java 2 Enterprise Edition (J2EE) technology to construct human-and-web interaction systems through mobile technology. And then we will compare the functionality and the efficiency of these two technologies based on our models. This analysis will guide web developers to choosing the best technology for their portal development.

# **1 Introduction**

## **1.1 Development of web-based technology**

The rapid development of Extensible Markup Language (XML) and web programming languages such as ASP.NET, Java, and Cold Fusion has empowered the web more than ever. XML is a highly structured markup language, which serves as a new standard for information exchange on the web. Its strong extensibility and well-formed structure enables the development of voice controlled applications, database information exchange systems, and web services. Currently, many financial institutes uses XML technologies to develop their online banking systems, and Microsoft also uses XML to implement their .NET passport web service. All these XML functionalities reside on the back end of the website, which are transparent to users.

Web programming languages are bridges which connect the back end XML functionalities with the front end user interface. Generally, the website user interface is built using Hypertext Markup Language (HTML), and the job of the web programming language is to collect information from users, and then transfer the data to database systems or to XML applications. An typical example is the web registration form. When users type in their information, and click the submit button, the web programming languages will validate the user inputs, and then store the information in the database system.

## **1.2 Growth of the web portal size and complexity**

As current websites have more and more advanced features , their infrastructure become more complex, and their size also increase proportionally. These complications often introduce usability problems. For example, users may find it hard to navigate through the website.

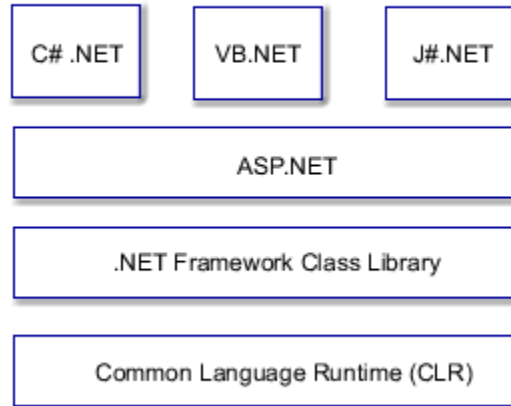
To cope with these problems, developers try to simplify the way that users access web information by using mobile technologies such as Short Message Service (SMS), and voice controlled systems powered by Voice XML. These technologies help to simplify data access in the sense that users can send and receive web information without using any computer or Internet connection, but just a cell phone. Two of the major companies that support these mobile technology developments are Microsoft and Sun Microsystems.

### **1.3 Microsoft .NET**

Microsoft .NET is a new Windows application platform, which primary goal is to provide a common environment for developers to compile and execute their programmers written in different programming languages. The infrastructure of the .NET platform, which is known as the .NET Framework, contains two main components: the Common Language Runtime (CLR) and the .NET Framework Class Library [1]. The CLR is the global environment for compiling and executing .NET applications. During compilation, the CLR translates .NET programming codes into Microsoft Intermediate Language (MSIL), and during execution, the CLR translates these MSIL into appropriate machine languages for the Windows Operating System. [2]

The .NET Framework Class Library provides a set of prepackaged classes for developers to build their Windows and web applications. Using ASP.NET as an example, all the web form controls are built using the .NET Class Library. These classes not only help to save a lot of coding for developers, but also help to improve the consistency of the application [3]. Figure shows an overview of the .NET Architecture.

Figure 1. Microsoft .NET Framework Architecture



#### 1.4 SMS Friends student web portal (an ASP.NET model)

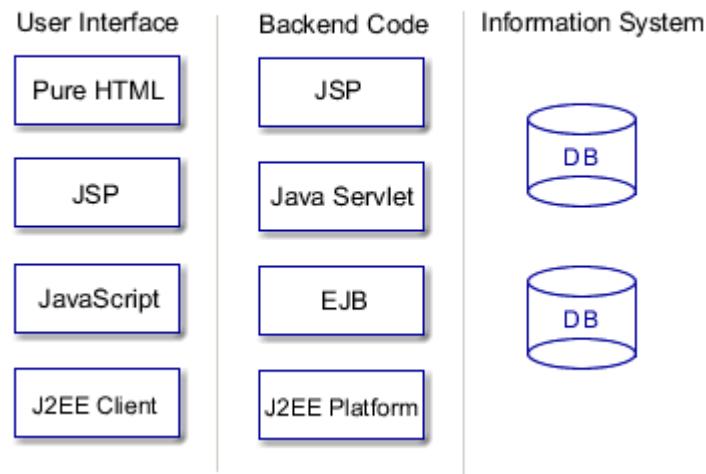
This paper uses the SMS Friends student web portal as a model to analyze the functionality and efficiency of the .NET technology since all its functions are developed using ASP.NET. SMS Friends is currently being developed by the California Institute for Telecommunications and Information Technology (CAL-IT)<sup>2</sup> as a new student web portal for improving the UCSD communication system. This web portal is consisted of two main components: SMS Clubs and SMS Friends Search Engine. The SMS Clubs feature allows users to create their own student clubs and communicate to other group members using SMS Messages. Similarly, this feature also allows professors to send information to all students in the class using SMS Messages. The SMS search engine enables user to search for other SMS Friends members who share the same interest. For example, users can search for members who are majoring in the certain major, or being in the same student club.

#### 1.5 Java 2 Enterprise Edition (J2EE)

J2EE is an industry standard, developed by the Sun Microsystems, for multi-tier application development. It uses the Java programming language as its main

building block. Since Java program runs on the Java Virtual Machine (JVM) instead of the operating systems themselves, it provides a platform free environment for web application development. During compilation, JVM translates the Java program into Java byte codes. And during execution, the JVM translates these Java byte codes to the appropriate machine languages for the operating systems. Therefore, Java programs can run on any operating system that supports JVM. For web applications, J2EE uses Java Server Page (JSP), Enterprise Java Bean (EJB), and Java Database Connection (JDBC) to manage all web controls and database connections. Figure 2 shows an overview of the J2EE Architecture.

Figure 2. J2EE Architecture



## 1.6 San Diego Wireless Traffic Report (J2EE Model)

The San Diego Wireless Traffic Report is our model for analyzing the J2EE platform. Although the development of this web portal only uses a subset of J2EE, its applications are enough for us to analyze the basic functionalities and efficiency of J2EE. The San Diego Wireless Traffic Report, which is developed by the Cal-(IT)<sup>2</sup>, is consisted of two different parts: a web portal powered by JSP, and a voice server powered by Voice XML. The web portal contains functions for users to modify their accounts and personalize their commute. The voice server allows user to get live traffic report using their mobile phones.

## **2 Methods**

### **2.1 Accessing Web Information through Mobile Phone**

Mobile phone companies have been developing new technologies to enable mobile Internet. However, these services often come in high cost, and require high end equipments. It is more ideal and economic if users could access these web information by just making a phone call.

The San Diego Wireless Traffic Report system uses the JSP technology to accomplish this goal. While it uses JSP to manage the web form and database controls, it also uses the voice XML technology to powers the voice server.

### **2.2 Sending information through SMS Message**

Email and Instant Messaging Services such as MSN, AIM and ICQ are the most popular communication tools on the web. However, all these tools have a common limitation, which is that users need access to a computer with an Internet connection. Although wireless connection and handheld PC become more popular and affordable, many people still do not have access to their emails or messaging tools all the time. Therefore, sending and receiving information using mobile phones is more efficient in the sense that it does not require computers with Internet connection.

The SMS Friends student web portal uses the Microsoft .NET technology to accomplish this goal. SMS Friends uses ASP.NET to manages all the web form controls, validations, and SMS Messages. The SMS Clubs and SMS search engine are powered by ADO.NET

## **2.3 Which technology is better? .NET or J2EE?**

To compare .NET with J2EE, we will use the San Diego Wireless Traffic Report and the SMS Friends web portal to compare the functionality, compatibility, and infrastructure of these two technologies.

## **3 Results**

### **3.1 Functionality analysis**

Web form and database management are two of the major components in both the SMS Friends and the San Diego Wireless Traffic Report web portal. In this section, we are going to compare the functionalities of ASP.NET and JSP based on these two components. JSP manages the web form control by JavaScript. Using the San Diego Wireless Traffic Report sign up page as an example, when users submit their information, JSP will trigger the client-side validation script, which validates the information, and then display appropriate error messages for invalid inputs. If all the inputs are valid, JSP will store the information to the database (figure 3). All the database connections are managed by the Java Database connection (JDBC).

In contrast, ASP.NET provides server-side web form controls and validation. Using the SMS Friends sign up page as an example, all the input fields are built using the .NET Framework Class Library. When users submit the form, the values are saved in the VIEWSTATE hidden field on the server-side [2]. Then the ASP.NET validators will validate the information, and display appropriate error messages for invalid inputs (figure 4). When validation is finished, ASP.NET will store all the information to the database using ADO.NET

Figure 3. JSP Web Form Control and Database Connection

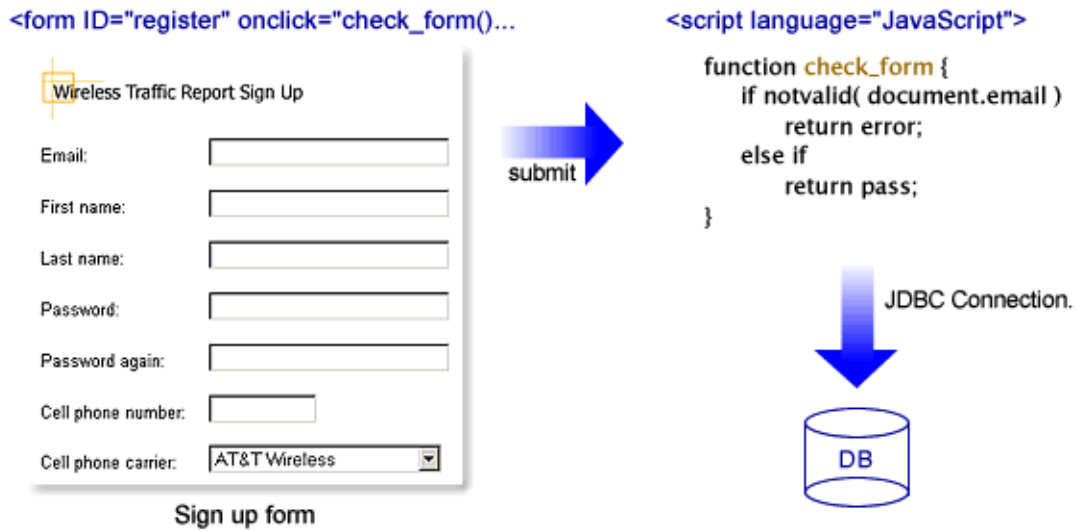
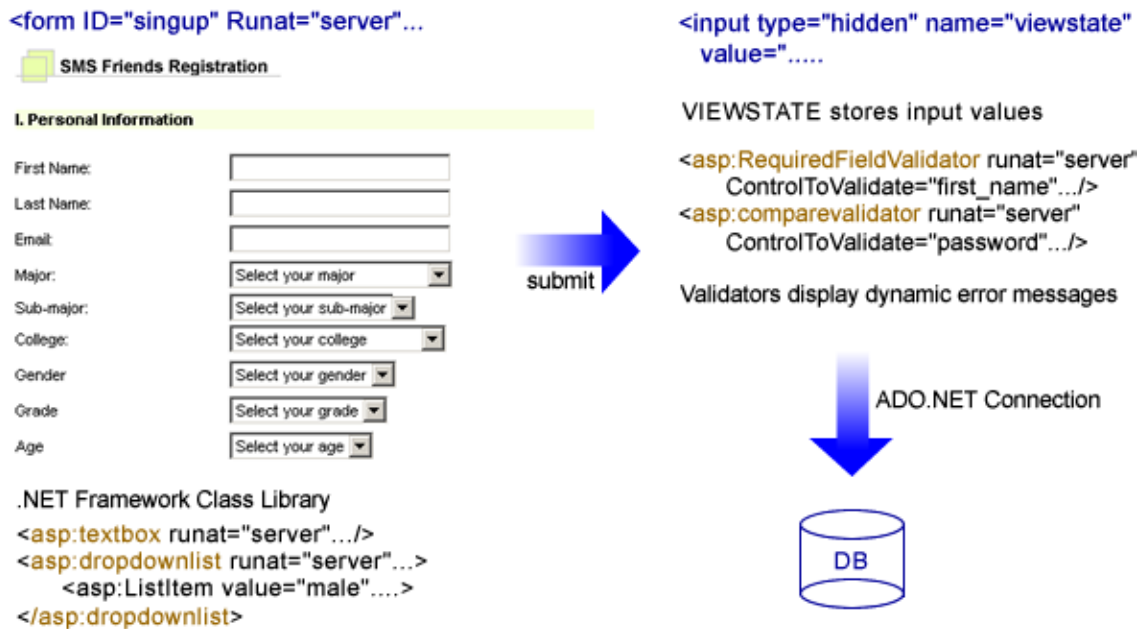


Figure 4. ASP.NET Web Form Control and Database Connection



Although both ASP.NET and JSP have validation controls, the VIEWSTATE feature makes ASP.NET more powerful in the sense that it can maintain the value of the user inputs after the form has been submitted or reloaded.

Moreover since all the controls are on the server side, the validation will work even if the user browser does not support client-side script.

### 3.2 Compatibility and Infrastructure Analysis

Both ASP.NET and JSP have their own system and software requirement. In this section, we will analyze the compatibility of ASP.NET and JSP based on these requirements, and then compare their infrastructure based on the SMS Friends and San Diego Traffic Report. Table 1 summarizes the basic requirements of ASP.NET and JSP.

Table 1. ASP.NET and JSP Requirement

	<b>ASP.NET</b>	<b>JSP</b>
<b>Operating Systems:</b>	<ul style="list-style-type: none"> <li>- Windows NT 4.0</li> <li>- Windows 2000</li> <li>- Windows XP</li> </ul>	<ul style="list-style-type: none"> <li>- Windows</li> <li>- Linux</li> <li>- Other OS that support JVM</li> </ul>
<b>Software Required:</b>	<ul style="list-style-type: none"> <li>- .NET Framework SDK</li> <li>- IIS Web Server</li> </ul>	<ul style="list-style-type: none"> <li>- Java Virtual Machine</li> <li>- Apache Tomcat Web Server</li> </ul>

The San Diego Wireless Traffic Report is running on the Windows 2000 SP5 operating system with Apache Tomcat web server. Since all coding are done win Java, we can migrate the web portal to different systems (including non-Windows system) This shows that the J2EE platform has a better operating system compatibility.

JSP also allows multiple web forms on the same page, which helps programmers to manage and validate user input fields in groups. This infrastructure facilitates the web form controls and validation process.

SMS Friends student web portal is running on the Windows 2000 SP5 operating System with Internet Information Services (IIS). ASP.NET has built in support to

C#, Visual Basic .NET or J# as backend codes, and it can run with ASP applications on the same IIS server. These features show that ASP.NET has a better programming language compatibility. In terms of infrastructure, ASP.NET only allows one server-side form on a single page. This limits the ability of grouping and validating input fields in groups. However, its “code behind file” feature helps developers to separate back end codes from front end codes, which improves the consistency of the coding.

#### **4 Discussion**

With the growth of mobile technologies, more and more web portals are likely to integrate their services with SMS or Voice XML in the future. And eventually, more web services will be developed to support these technologies.

Web services are becoming a new standard for information exchange on the web. The goal of web services is to build up connections between different systems and applications by using a common data transferring standard (XML), and by constructing web applications that can be used by different web portals. The architecture of web services includes three main components: Web Service Description Language (WSDL), Simple Object Access Protocol (SOAP), and Universal Discovery, Description, and Integration (UDDI).

WSDL is the description of web services. It describes what functions are included in the web service, and what parameters are required to run the service. SOAP is the grammar of the web service, it enables web server to understand web service requests, and makes appropriate responses. Finally, UDDI is the directory of web services. It allows users to quickly identify what web services are currently available on the web.

If SMS messaging were implemented as web services, many web portals would be able to integrate their applications with mobile technologies, which would indeed enhance the web communication system as a whole.

## **5 Conclusion**

SMS Message and Voice controlled systems have advantages over email and instant messaging systems in the sense that they do not require access to a computer with an Internet connection. All users need is a mobile phone. Therefore, communications via SMS Message and voice controlled are more efficient in time.

Microsoft .NET and J2EE are two main technologies which feature mobile technology development. According to their applications on the San Diego Wireless Traffic Report and SMS Friends student web portal, Microsoft NET has more advanced features for web form controls, server side data management. Moreover, the ASP.NET has support to multiple .NET programming languages and its concept of “code behind file” facilitate the web development process in the sense that programmers can develop web applications using their favorite programming, and develop their back end codes independent of the front end development.

XML web services are becoming the mainstream for web communications. And the advance of mobile technologies will lead to developments of web services for SMS message and voice controlled systems. When these web services come to live in the future, more and more web portals will be able to integrate their applications with mobile technologies, and this will enhance the web communication system as a whole.

## **6 Acknowledgement**

Many thanks to:

1. Ganz Chokalingam and Nick Hill
2. UC LEADS

## **7 References**

- [1] Thuan Thai, Hoang Q. Lam, *.NET Framework Essential*, O'Reilly (June 2001)
- [2] Mesbah Ahmed, Chris Garrett, Jeremy Faircloth, Chris Playne, *ASP.NET Web Developer's Guide*, Syngress (May 2002)
- [3] Abrian Turtzchi, Jason Werry, Greg Hack, Joseph Albahari, *C#.NET Web Developer's Guide*, Syngress (June 2002)