WIRELESS AND MOBILE MULTI INPUT INFORMATION SYSTEM

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Abstract: The system emphasized in this paper is a multi-channel system that can be accessed trough different channels as WEB, WAP, SMS and IVR for either results submission or overview. The system offers platform independent access to XML web services over predefined SOAP messages. The results gathering system is reliable, secure and scalable. It is appropriate for broad scope of analyses for elections, surveys and research. It is built on the .NET platform over n-tier architecture. An overview is given concerning the response time and the maximum throughput of the system. The congestion factors are discussed in more specific manner. The experience from real work is analytically presented. The paper also deals with the social and political aspects of the system.

Keywords: election, survey, SMS, WAP, web service, n-tier, .NET, XML, security, throughput, congestion

1. Introduction

Everyone can order a pizza via the net, visit a web cam to see dawn come up over distant place and tie together idle net-connected computers to sift through universes of data for complex research projects.

The history of net voting is not an illustrious one. Experts agree that it is too soon to use net voting on a large scale. Before now, voting via the net has been in the news for all the wrong reasons, largely because a referendum or election using electronic voting has gone horribly wrong.

So far, net-voting hasn't been used in a national election but even when it is used on a small scale, the security and technological problems involved in casting hundreds of votes electronically have caught a lot of people out [1] [2].

On the contrary, we are facing a society dependent of Information Systems that play important role in our life. The mobile communication expansion of-

fers new services that are based on the mobile and wireless paradigm. The merge among the wireless & mobile systems with current Information Systems is inevitable. Those mobile and wireless Information Systems offer vast number of access channels [3].

These facts have motivated us to develop a system for fast delivery of information, fast access to information, delivery and access from everywhere. The main goal was development and implementation of 24x7 around the globe system.

2. Wireless & Mobile IS Requirements

The requirements for successful Information System (IS) are: availability, scalability, and security. A solid IS solution is achieved through an architecture that meets these requirements across the network, the service channels, the database, and the operating system (Figure 1) [4][5].

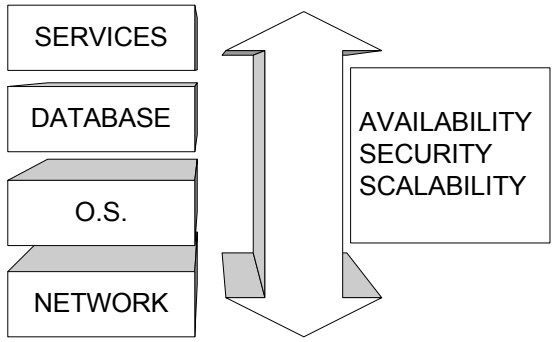

Figure 1: IS Requirements

Availability is the ability to provide continuous access to the services for the clients. To deliver these services successfully, high availability must be maximized across all layers of an infrastructure. The right network design ensures that there is no failure that will impact the high availability of the overall system. It can also be achieved at the operating system, system services and application code layers through a mixture of server redundancy, rescue and failover scenarios.

Scalability is associated with performance enhancements, such as increased CPU speed, increased network bandwidth, etc. Consideration must also be made for supporting a large number of simultaneous user sessions and financial transactions.

Scaling an IS can be achieved by either scaling-up and or scaling-out. Channels should engineer for the virtually limitless capabilities of scaling-out while

maximizing the benefits of scaling-up. This results in smaller initial software and hardware investments, which can be expanded as the business grows.

Security is a major consideration for the infrastructure. As the nature of an IS is dealing with sensitive data, it becomes a likely target for malicious activity originating from the electronic community at large. Strong security consideration should include: Network Security, Data integrity and privacy, Identity security and Security monitoring.

The requirements of the wireless and mobile IS are extension to the above characteristics and include access trough additional wireless and mobile channels as WAP, SMS, IVR and other.

The information is delivered to the IS trough the following channels: WEB, WAP, SMS and Operator. The information from the IS is accessed over wide range of electronic channels as: WEB, WAP, SMS, EMAIL, IVR and Fax (Figure 2) [7].

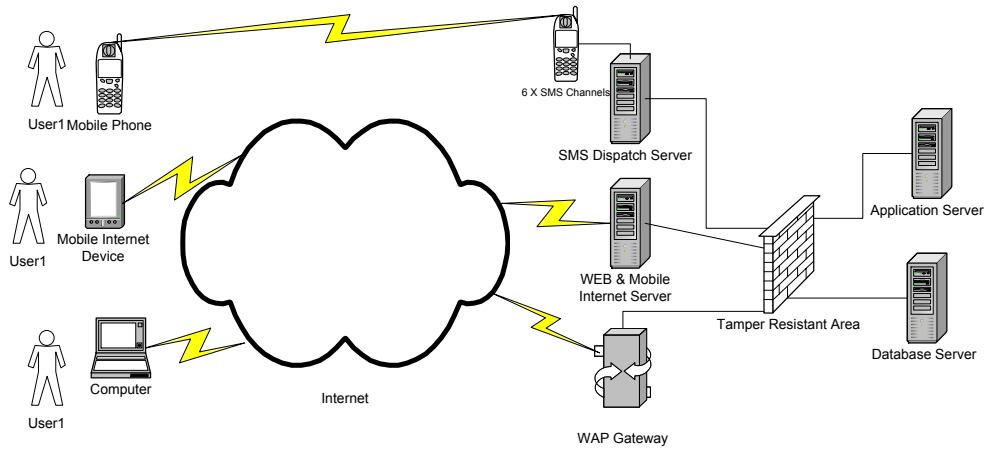

Figure 2: Architecture

3. IS Platform

The operating system used on all the servers within the architecture is Microsoft Windows 2000 Advanced Server. Windows Advanced Server provides scale-up capabilities by utilizing the latest server. Windows 2000 Server and application services allowed us to build more powerful solution on the platform by taking advantage of available features without adding layers of complexity, lengthening development time, or increasing management costs.

Because this environment is highly distributed, asynchronous way of communication trough message queuing is essential to maintain quality of service.

Microsoft Message Queuing technology has been used because its features include, but are not limited to, extremely fast inter-application communication, message delivery guarantees, sophisticated message and queue security mechanisms and queue location independence.

The considered components for open architecture, rapid development and separated content from presentation have been easy to deploy using the Microsoft's platform .NET [6]. The .NET Framework is a high-productivity, standards-based, multi-language application execution environment. The Framework consists of several parts, including the Common Language Runtime; a rich set of class libraries for building XML based services, and ASP .NET.

In the .NET Framework, there are available compilers for 22 programming languages. The choice was on C#. It is the Microsoft solution for bringing powerful rapid development to life.

All the elements of business logic, business rules and data manipulation are placed in the Business Tier. Objects assigned for authorization, authentication, notification, rules, transactions and schedule define the common business logic used by the Presentation Logic Tier and different channels of communication. All the objects are developed as .NET Services in C#. In the given position, these services are implemented as asynchronous applications with message queuing. This tier communicates with the Presentation Logic Tier through predefined XML messages exchanged with the Microsoft Message Queuing (MSMQ).

The user communicates trough variety of channel with different possibilities of content presentation. For the WEB and WAP channel, Internet Information Server 5.0 with .NET server extension is used. The site is developed in ASP.NET with C# code on the server's and Jscript scripting on the client's side. The information content received asynchronous with MSMQ by the Business Tier, is transformed from XML, with appropriate XSLT transformations, to HTML and DHTML. For the sake of the WAP channel, with the use of the MS .NET Mobile Tool Kit, the content is transformed in WML pages.

Dispatcher services are offered for the Email, Fax and SMS channels. They are developed as .NET services in C#. There are different transformations in appropriate format for every channel. The Email channel with the SMTP protocol communicates with Email Server. The Fax channel implements the Active X functionality of the Fax Server that controls a modem pool. With the use of Nokia Connection Manager SDK protocol and network streams, the SMS service manages to push SMS messages to the SMS server of the mobile

provider with the use of normal Nokia mobile devices connected to the servers with serial cables.

With the design of XML Web Service and SOAP Proxy Tier, the power of the .NET architecture comes in to place to achieve communication among different platforms with the support of XML and SOAP.

4. Test Results

The system was comprehensively tested and implemented in real environment. The SMS channel was crucial in the information gathering system and its behavior is presented in this section.

The premier test was in laboratory conditions with 3 input SMS channels and 3 testers (persons that send information over the air using mobile phones and SMS channels). 2973 messages in total were sent and received in 92 minutes. The input channel was not user to its maximum (Figure 3).

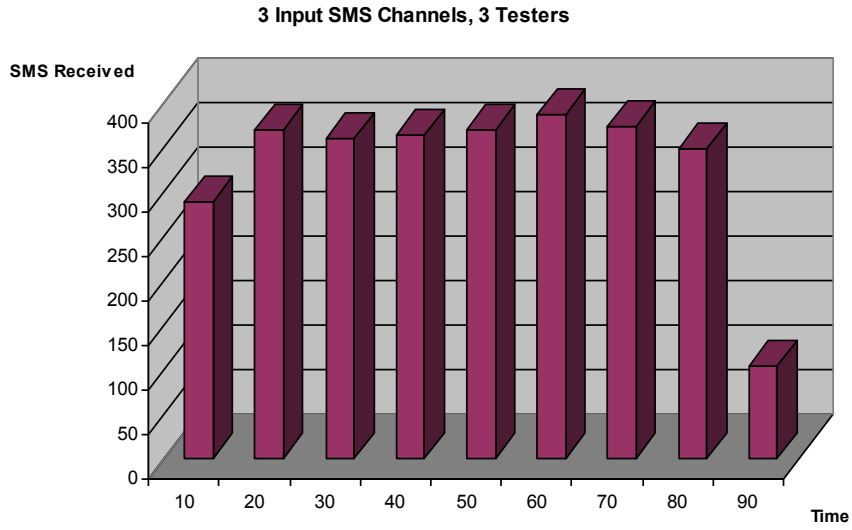

Figure 3: 3 Input SMS Channels – 3 testers

The following test was with 100 testers. The users were not consistent in the channel use as the Figure 4 shows. They did not use the maximum potential of the channel and the total time was 76 minutes.

The third test was in real environment with 2973 testers. Due to massive usage and concurrent approach of more than 20 users to the resources of the SMS channel, the information intake was blocked. The blockage of the queues in the SMS center assigned to the chosen 3 numbers promoted the test as unsuccessful.

To achieve a successful test, the team decided to expand the input SMS channels to 6 (Figure 6). With 6 input channels and 2973 testers all the messages were received in 34 minutes. The expansion was proven to be successful.

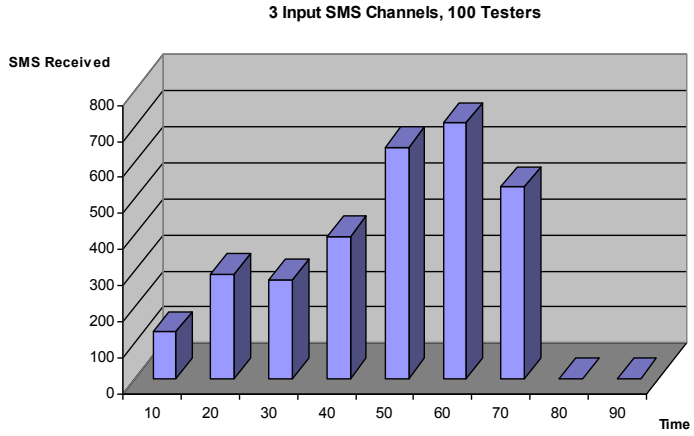

Figure 4: 3 Input SMS Channels – 100 testers

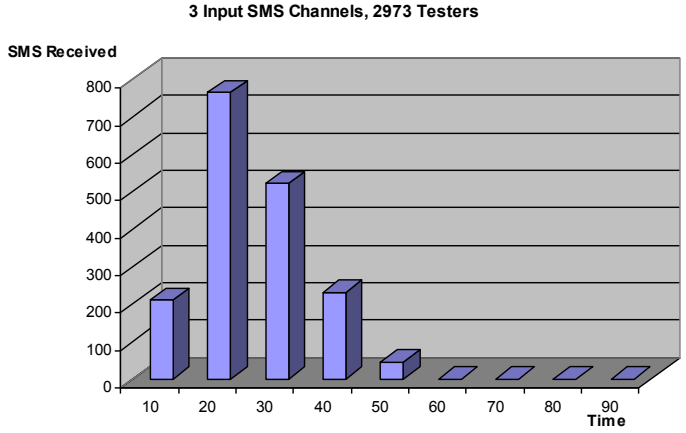

Figure 5: 3 Input SMS Channels – 2973 testers

5. Conclusion

The Information Systems play an important role in today's society. Even though electronic voting is not implemented in massive manner, the usage of advanced technology for results gathering and presentation is a necessity.

The proposed system managed to fulfill the basic requirements for a successful wireless and mobile Information system. The end–to-end solution is de-

signed to be highly available, scalable and secure. The N-Tier architecture and the appropriate platforms contributed in scalability, availability and security of the system.

In the future, all the services concerning fast and secure information gathering and presentation have to be implemented in similar fashion as proposed in this paper.

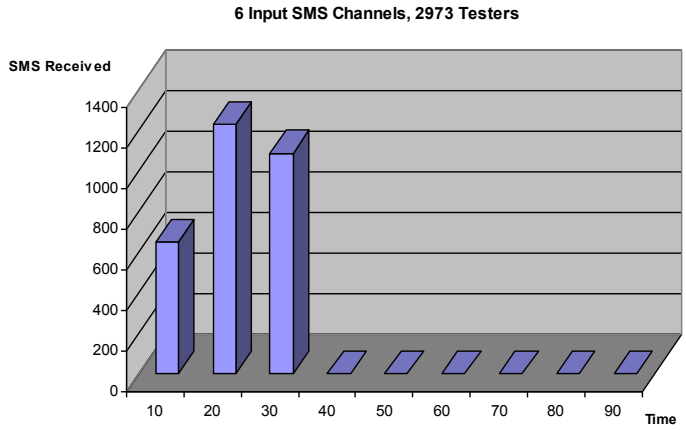

Figure 6: 6 Input SMS Channels – 2973 testers

6. References

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