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Silverlight Implementation

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Information is vital in today's marketplace, not just as a record, but a means to gauge future trends. Nowhere is this more important than the healthcare industry. Today, medical information is no longer centralised to a hospital setting. On the contrary, healthcare has become highly decentralised in terms of patient services as well as service processing. One particular area witnessing significant growth is claims processing.

As one of the leaders in providing claims processing applications, MDI Holdings recognised early that as part of a full Service Healthcare risk management offering, it needed to provide applications which provided both access to real-time information and a feature-rich, interactive and efficient user interface. Towards this, MDI sought a partner with both the technical and business experience to deliver a solution, within budget and in a period of just six months.

MDI finally chose New Age Solution, a small Microsoft Gold Certified Partner specialized in Microsoft Silverlight, with a strong track record of bringing applications for the Web, Custom and Enterprise level to the marketplace.

Based on a collaborative effort, New Age Solution and MDI agreed on four key requirements for the project: scalability, realtime access to data, platform neutrality and an engaging and interactive user interface. To meet these requirements and fully utilize MDI's proprietary claims processing technologies, New Age Solution quickly identified the need to employ emerging technologies such as Grid Computing, WCF, Silverlight and IIS 7.0.

Claims Processing

Claims processing is a service that requires both significant skill and resources to manage fast growing volumes. At a high level, whenever a patient receives treatment for services (in-patient or outpatient), a claim is generated. This claim contains all information required for reimbursement.

At this point, claims processing takes over. It involves evaluating each claim against regulatory rules as well as those established by reimbursement providers for patient services by a particular healthcare facility.

When coupled to the ever-growing corpus of new regulations and reimbursement rules, the advantages of Grid Computing architecture become evident.

As each claim is presented to the system, computational resources are required to assist in its processing. When the volume of claims begins to increase, a Controller component 'calls up' additional computational resources on individual servers in order to process the claim against the business rules engine. On the other hand, as the volume of claims begins to decrease, the Controller begins to release servers from the session.

During a given day, week, month or year, such a cycle will be repeated hundreds of thousands of times.

It is important to note that these servers are not defined by a geographical boundary but by their connectivity to the system.

Project Requirements

As defined by the overall business objective, the Claims Assessment Service (CAS) needed to meet four main goals:

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- Scalability;
- Real-Time access to claims processing data;
- Platform neutrality, and Engaging and Interactive user Interface.

Scalability

The first requirement of the project was for scalability, at the application and hardware level. Towards this, we determined that utilising Microsoft's Windows Server platform 2008 technology could yield scalability via Grid Computing.

This platform serves as the central piece of the Grid Computing platform architecture by providing the means to manage and scale computational resources, on demand, thus providing the proprietary technology with resources to meet claims processing requirements, in an efficient and timely manner.

Real Time Access

The application had to provide real time access to data provided by the Grid Computing component. Again, we looked at another technology from Microsoft, namely Windows Communication Foundation (WCF). For the project requirements, we selected a Publish and Subscribe Model. This allows the user interface, after making the initial connection, to immediately receive data as it is processed through the proprietary claims processing technology.

Platform Neutrality

The application had to run independently of the client operating system. The main reason for this is that in the market, clients can and do run on different operating system environments, and as such it is inadvisable to limit solutions to a particular operating environment.

For this requirement, New Age Solution looked to the web. Rather than just any other web application, we decided on an application built using Silverlight.

Interactive User Interface

Our client believed that in order to be effective, a user interface must be engaging and effective, and we proposed Silverlight. Silverlight is both well established and provides functionality and features which make it a perfect component for such projects.

The Applications: C.A.S and E.A.R.L

C.A.S

Claims Assessment Service, CAS, is designed primarily as a risk management assessment and analysis tool for self-insured companies as well as third party Administrators (TPA). Claims processing involves Administrators having to spend considerable time shifting through and analysing large volumes of billing records for patient services. Often such claims contain coding errors, and lead to a claim being rejected for reimbursement, resulting in extra time and resources to re-process the same claim again. This is where CAS provides a truly unique service and the strength and functionality capable of processing millions of claims in short timeframe. At a high level, CAS is divided into four areas: grid computing, proprietary technology, communication and a graphical user interface.

Grid Computing

Grid computing provided the foundation in terms of providing scalability to meet 'on demand' needs for claims processing. In the marketplace, claims processing volumes are not consistent and as such Grid Computing allowed CAS to meet cyclic peak-and-trough demands by sharing computational resources, instead of investing capital for dedicated hardware which would be available at all times. Furthermore, Grid Computing also provided the hardware support for the proprietary claims processing technology.

Proprietary Technology

The claims processing 'engine' is the heart of the operation. This custom programming logic contains all the necessary information required to evaluate each claim against nearly 50,000 business and regulatory rules for reimbursement. This technology, coupled with the computational resources of Grid Computing, allows the heart of this application to achieve a rate of millions of claims processed in a short timeframe.

Communication

The communication layer of CAS provides the connectivity between the proprietary processing logic to the user interface. The communication

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layer complements the strengths of the custom logic and Grid Computing by being able to push that information to the user in real time as each claim is processed. This communication layer is not one way, but in fact is a continuous two way communication which allows the user to communicate back changes while receiving information.

Graphical User Interface

The graphical user interface completed the final layer of the application. User interfaces (UI) are frequently the facet of an application that determines success or failure in the marketplace. For the CAS, the user interface is a success in terms of its user focused design and simplicity. The UI meets all the requirements of the custom processing logic, Grid Computing computational resource management and the communication layer, combining them into a simple user driven design; this focuses the user on a variety of information compiled in merely a few pages. Information ranging from initiating a claims process job to processing statistics is presented in real-time, without the user having to continually request an update from the backend, via human intervention in the UI.

The signature of this design is the functional manner in which New Age Solution continues what begins in the process logic. Within the custom processing logic is the ability to allocate claims based coding error types. These coding events are propagated up from through the communications layer to the UI and displayed in a single page. Within this page, technology available in Silverlight allows a user to be part of the process, via animations and 3D graphics. It is through the use of technology that the user feels engaged and alerted to information that is only relevant to each task needing to be performed. CAS is an application which takes a major leap forward in minimizing work load, while at the same time maximizing return on productivity for Administrators and Risk Management analysis.

EARL

Empowered Analysis Reporting Log (EARL) is a new application with patent pending. It takes a different approach to the same market as CAS. EARL seeks to position itself as a Business Intelligence Tool for sectors like Risk Management. EARL is designed to put the Administrator in the ‘driver’s seat’ and provide near real-time request claims information specific to a given patient. Since EARL is based on Silverlight, a rich interactive application is not bound to a specific client operating system, and can be viewed through any web browser.

EARL is similar to CAS, in that it shares the same architectural design: Grid Computing, proprietary technology and User Interface. However, there is one exception, namely the communication layer.

EARL, as noted, is a Business Intelligence Tool that requests information for review. The EARL request is made by an authorized person via the UI, whereas CAS is always ‘on demand’ and listening for new claims. Thus, information is not continually pushed to the client via the communication layer. As a result, the user request information, on a patient, is provided when it is needed.

Like CAS, EARL stands apart in the UI layer of the application, in terms of the way Silverlight technology is utilised. From a high level, the UI is laid out in a simple but efficient design. This allows a user to quickly determine both the intent of a page as well as the high level relationship that is depicted.

The user is presented with an anatomical form of the human body from a front and rear perspective. Components such as a list box, data grid and slider controls quickly provide a user with the ability to review severity, type, location, claim details as well as a calendar base timeline. Furthermore, controls such as the timeline and claim severity list, dynamically impact on other controls with dependent information. For example, moving the slider control or narrowing the range automatically update the other controls without having to retrieve data from the source.In reviewing the EARL application, it becomes evident that correctly combing appropriate technology with information leads to powerful Business Intelligence Tools which meet the demands of the marketplace for assessing trends for claims processing and more.

Technology Behind the Applications

WCF

Windows Communication Foundation (WCF) provides functionality that is best suited for enterprise level applications as we move to a more Service Oriented Architecture (SOA). WCF focuses on providing the tools necessary to connect disparate systems of information across geographical boundaries. CAS and EARL, though using the communication platform, go about using these differently.

For CAS, as we have seen, the need is for real-time ‘on demand” communication, and it was thus decided by us to utilize a duplexing message pattern.

Duplex message patterns are similar to peer- to-peer technology, in the sense that both ends, the Server and the Client, are acting as sender and receiver on separate channels. When the user logs into CAS, and has been authenticated, a connection is made directly to the Grid technology; the server instantaneously begins pushing information to the client and will continue to do so as long as information is being processed, within the Grid.

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To improve the communication of information within WCF services, New Age Solution employed a programming technology, called Language Integrated Query (LINQ). By using LINQ, specifically LINQ to Object and LINQ to XML, we were able to improve performance for the demands that CAS made on claims processing.

The communication utilised for EARL took a different approach, based on the requirements of the application. EARL was designed on the Request/Response message pattern. For instance, the Administrator make a request via the UI for information related to a specific patient, by inputting appropriate data and committing an action that would submit the information, in the form of a message, to the service. The service would then provide a Response to the client returning the information, thus terminating the communication between the client and the service.

As a result, by using one service architecture platform, New Age Solution was able to provide two applications, with two different message exchange patterns. In the process, we reduced the overhead and resources that would have been required to maintain differing technologies.

Silverlight

Silverlight is categorised as a Rich Interactive Applications (RIA). Rich Interactive Applications live in a space between client OSdependent applications and the web as seen through a browser. In the past, features present in Silverlight have only been available in client OS-specific applications.

This has now changed, because Silverlight draws on a feature rich subset of components found in Microsoft Windows Presentation Foundation (WPF).

Silverlight has become a well-established technology and is unique in how it shares the best of both worlds: OS client application, applications that run on an internet browser and in a mobile platform such as Windows Phone 7.

To begin, Silverlight runs in any internet browser on any operating system – Linux, MAC OSX or Windows, rather like Adobe's Flash player. Indeed, as with Flash, Silverlight only requires a small downloaded plugin.

Where Silverlight stands apart from its competitors is its ability to present the user with an experience that far surpasses standard HTML language programming with such features as graphics, animation and multithreading as well as integration with the .NET framework.

Rapid Development

These applications were developed in a relatively short time frame. Given the complexity of the data and the visual representation that was required by the UI, this was no small task. Developing with Silverlight has been made easier with the addition of a new component to Microsoft Expression Blend, Sketchflow.

For prototyping, we took advantage of Sketchflow for both applications, CAS and EARL. Sketchflow, part of Microsoft Expressions Blend, provides developers with the tools necessary for a relatively wide range of facilitators: easy mockup of pages with content, images and various other controls; the creation of actual page navigation (using SketchflowMap); visualizing animation using Storyboards; and the simulation of actual data for a more accurate representation.

However, the component's advantages do not stop there. Probably one of its most significant advantages is the ability to take a working example of a Sketchflow application and send it to the client for live viewing. During this review process, the client is able to provide comments, update the Sketchflow package and return it to the development team, thus significantly reducing the time to communicate development status and apply changes to the project.

Without this tool, prototyping and development of both CAS and EARL would have easily doubled development times, resulting in a possible loss of market share.

Multithreading

For CAS, it was important that the application be both scalable and provide functionality to allow users to monitor and respond to multiple coding errors simultaneously. To provide this piece of functionality, we utilized multi-threading. Multithreading is a central part of the .Net Framework and has been, until now, present in only such feature rich applications as those found in OS-specific applications, as WPF and Windows Form.

The advantage of multi-threading is its ability to execute more than one block at the same time. However, to benefit from this technology, there are hardware requirements. Much of the code behind today's enterprise level applications resides on the server. Programming an application,

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with Multi-threading, is dependent on the underlying hardware having multicore processors. Multicores allow the server, based on the application request, to allow ‘threads’ to be spread out so they may be executed simultaneously.

The CAS application, as mentioned, subscribed to multiple coding events, so as to provide the Administrator with a realtime assessment of the claims process, including statistics. Had this been a standard web application or a Flash-based application, such functionality would not be possible.

Graphics and Animations

Visually speaking, graphics and animation are what drive a truly interactive application experience. UI layout and design work can very often determine the successful or failure of an application. On the other hand, if a process is well founded and relayed throughout, as with Sketchflow, a UI design can achieve great success in the marketplace.

Throughout the development process, New Age Solution utilized the right balance of graphics and animations with tools such as Pixel Shader, 3-D Perspective, Writeable Bitmap, Key Frame Animation and many others.

In each instance, the use of such classes allowed the user to focus on a specific area when the application required. A perfect example of this can be found in EARL, whose objective, as mentioned previously, is to provide timeline based information on a particular patient and all relevant claims.

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