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Smart Clients in Business:

Expanding the Edges of the Enterprise Network

White Paper

Abstract

In the past few years there has been a convergence of two distinct trends in business and technology. Organizations are seeking to extend their enterprises and provide knowledge workers with ever-greater mobility and access to information and applications. Powerful new computing and communications devices along with wireless networks are helping provide that mobility. This has sparked the creation of "smart clients," or applications and devices that can take advantage of the power of local processing but have the flexibility of Web-based computing. This paper provides a high-level overview of smart clients, the highlights of the technology underlying them, and how businesses are taking advantage of Microsoft technologies to create and use smart clients to address business opportunities.

Contents

Introduction

The evolution of new and ever more powerful mobile computing and communication devices is allowing organizations to benefit from new business opportunities that are enabled in part through more connected customers, partners, and employees. A major part of today's computing relies on the power of the Web and related technologies, particularly Hypertext Markup Language (HTML), which presents remote data to users without them having to worry about the details of how content was created.

However, HTML-based Web content has its limits. There are usually limitations on a user's ability to respond to or manipulate information received by the "client"—the computer or device that someone uses for accessing data. This is analogous to the mainframe era, when a host computer controlled the content and a user's client terminal controlled the representation (although Web-based technology usually provides a graphically rich user experience).

But today's users want more than just content they can read. Information workers are paid to plan and act, and respond to changes in fast-moving and competitive markets. Hardware innovation, which continues to be aided by Moore's Law (the doubling of chip capacity every 18 months), is putting ever-greater performance on the market at cost-effective prices. Organizations also are seeking to take advantage of the rapid advances in mobile computing to extend the enterprise into the field.

The result is an increasing demand for "occasionally connected," mobile, powerful computing capabilities. This demand is being met through the emergence of "smart clients." Smart clients are computers, devices, or applications that can provide:

- The best aspects of traditional desktop applications, including highly responsive software, sophisticated features for users, and great opportunities for developers to enhance existing applications or create new ones.

- The best aspects of "thin clients," including a small form factor, economical use of computing resources such as processors and memory, ease of deployment, and easy manageability.

- A natural, easily understood user interface (UI) that is high quality and designed for occasional connectivity with other systems.

- Interoperability with many different types of devices.

- The ability to consume Web services.

With smart clients, businesses can take advantage of increased opportunities to extract, consume, analyze, and distribute information that can be used to create new products and expand into new markets, streamline business procedures, and provide better controls over operations.

This paper provides:

- A brief overview of smart client technology.

- A look at how Web services help create smart client solutions.

- A description of tools that help companies start creating and deploying smart clients.

- Examples of how companies in different industries are putting smart clients and Web services to work today.

Through smart clients, organizations can take advantage of a powerful combination: the traditional productivity of business applications and new Web-based technology that can help companies customize and streamline information access to create more connected, responsive, and agile businesses.

Smart Clients: An Overview

The Internet has delivered enormous benefits to business, and organizations around the world benefit each day from streamlined communications, e-commerce, and other features of Web-based computing. But there are drawbacks to a reliance on Web-based computing.

HTML, while capable of providing a visually rich experience, can be frustrating to use in situations and applications where high computing performance is important. Moreover, if users lose a network connection, cannot obtain one in the first place, or need only occasional connectivity to get their work done, the model of Web-based computing is weakened. For example, a sales manager may find Web-based information useful—but what happens when she is disconnected on a six-hour airline flight and cannot access all the files that were available back at the office?

Web-based computing can include other technical limitations. For example, poorly designed user interfaces can make it hard to understand how to use an application, slow performance and downloads can frustrate an employee working under a deadline, and Web-based information may be hard to use with specialized peripherals such as receipt printers or bar code readers. To address these and other user issues, developers working on Web-based applications frequently must deal with scripting and coding that adds complexity to their jobs.

At the same time, organizations are seeking ways to reduce the cost and administrative overhead often associated with "fat clients" such as desktop PCs, which provide plenty of software functionality and computer performance, including processing power and memory, but also typically entail greater management and expense for administration and training.

Now businesses can benefit from the best of both models by using smart clients: the feature-rich functionality of traditional client applications and the flexibility and efficiency of Web-based computing. Smart clients offer the benefits of traditional productivity software with sophisticated, efficient solutions that can quickly deliver valuable and very specific information to users, helping them to be more productive. Smart clients provide more and better options for connecting applications to networks and the Internet—and for working with applications even when disconnected from a network. They are designed to help get better speed and performance from applications, which in the long term can help employees be more productive.

Smart clients exploit the power of today's computing hardware, work online or offline, and access information in a standard way through the use of Web services, helping users and businesses respond to rapidly changing business needs. With smart clients, users don't have to worry about where the data resides and how to get the data—they just have the data when they need it.

Although smart clients can vary tremendously in function and appearance—a trait that underscores their flexibility—they typically contain the following characteristics:

- They "consume," or interact with, Web services that are based on Extensible Markup Language (XML), a widely accepted computer industry standard that enables the exchange of data between disparate computer systems, programming languages, and software applications.

- They take advantage of the local processing power of the client device, providing an extra measure of performance that is often missing in pure Web-based computing, which is highly dependent on the capabilities of a particular network's bandwidth.

- They can be easily deployed, maintained, and updated from a central server, giving organizations the ability to remotely monitor and control the functionality, security, and cost of corporate applications.

- They can be used online or offline, ensuring that user productivity is not compromised even when not connected.

- They can be easily tailored to operate on different types of computing devices, from desktop PCs to Tablet PCs, Personal Digital Assistants (PDAs), and mobile phones with little or no recoding, so companies get the most from their development resources.

Smart clients provide a great combination of benefits: the breadth of information provided by the Web, the computing power of today's devices, and a Web-based model of software creation and distribution that is efficient and cost-effective for the enterprise.

The following chart provides a quick glance at the benefits of smart clients:

Smart Client Applications
Solving Business Pain Points

Business Issue	Fat Client	Thin Client	Smart Client
Need rich, responsive functionality	Straightforward	Limited by web development technologies	Even easier to create than rich or "fat" clients
Need to deploy, update, and maintain easily	Requires extra time and resources	The original reason most recent apps built for the browser	Delivers core functionality required by IT departments
Users should be productive even when offline	Yes, but sync code creation is challenging	No offline capabilities	Key request despite proliferation of unwired tech
Need to reuse existing enterprise data seamlessly	Investment in back end connections is not reusable	Investment in connections not reusable	Web services allow reuse on other IT projects

Smart client applications combine the best of both fat and thin client applications, and benefit various members of an organization:

- Users want rich, responsive functionality from an application. With fat and smart client applications, this is not a problem—but it is for a thin client.

- Users want access to an application, regardless of whether it is connected to the network. That's possible for fat and smart client applications—but impossible for a thin client.

- Both end users and IT professionals want to reuse existing enterprise data seamlessly—for example, reading and writing to a database from the desktop. . For fat and thin clients, you'll need significant funds to accomplish that. But there is no problem with smart clients.

- IT professionals want to easily deploy, update, and maintain an application throughout the enterprise and across multiple sites. That requires money and time for fat clients—but is easy for thin and smart client applications.

The illustration below shows how smart clients successfully integrate the best of both fat client and thin client computing.
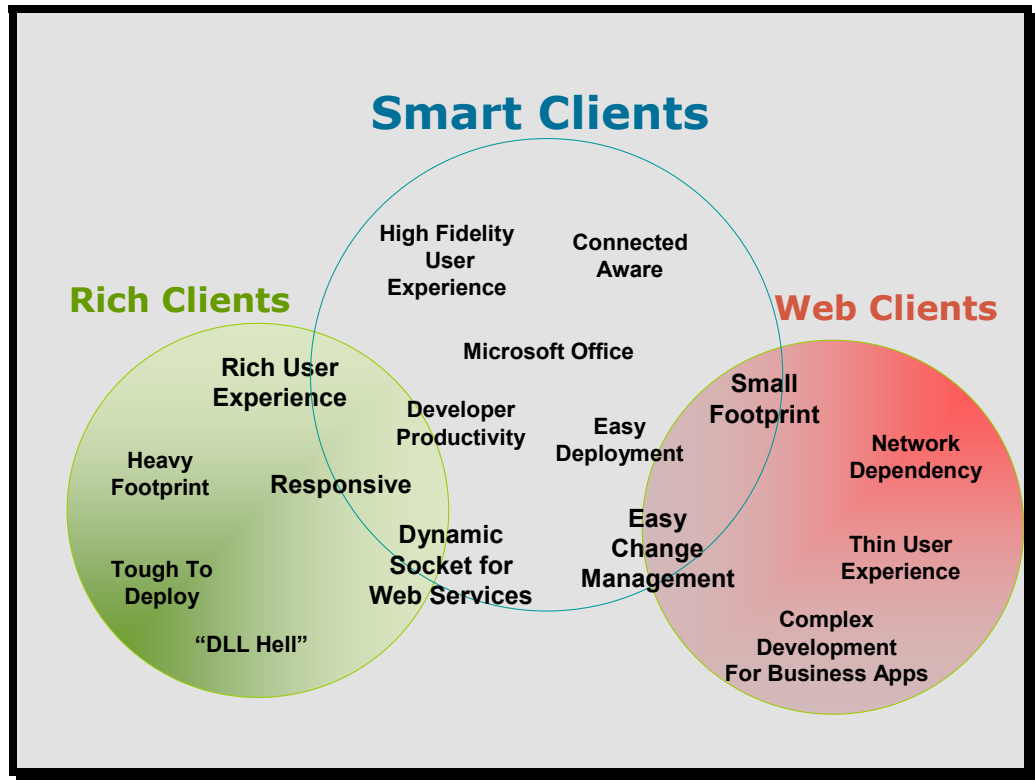
Enabling Smart Clients with Web Services

A primary characteristic of smart clients is the ability to consume and expose Web services, a technology that is rapidly redefining how businesses use computing technology.

Perhaps the best-known Web technology today is Hypertext Markup Language, which helps display and deliver data in a way that is easy for people to understand and access when they use computers that are connected to the Internet or to corporate intranets.

Web services, while related to other Web technologies such as HTML, deliver a newer generation of technology that is designed specifically to enable applications—not just people —to more easily exchange information. Because they are based on XML, Web services can operate among a variety of computer systems and applications—even those based on very different platforms or programming languages. The Web revolutionized how people use applications; XML is revolutionizing how computers talk to other computers by providing a universal data format that lets data be easily adapted or transformed.

As author John Hagel III notes in his book, *Out of the Box: Strategies for Achieving Profits Today and Growth Tomorrow through Web Services*, "The focus of Web services architecture is not to connect people with Web sites. Instead, it focuses on connecting applications and data directly with each other, automating connections that might otherwise have required human intervention. It is designed to ensure that applications and data can be accessed by authorized entities, regardless of location or underlying platform."

Web services also provide a new way to build software, enabling the creation of small, task-specific software services so that the business logic can be used over and over. This helps internal corporate development teams and independent developers design task-specific applications that are faster, easier, and typically more affordable to deploy than traditional software.

Web services are easily accessible over a network. They help businesses overcome a number of critical issues, including linking data between software programs written in different programming languages for different platforms. Web services also can dramatically reduce the complexity of integrating desktop clients with legacy applications and enterprise systems. For example, an appliance manufacturer could use Web services to quickly capture information almost instantaneously on parts pricing and availability from six different suppliers, and then have that information automatically transmitted twice a day to Microsoft® Excel spreadsheets so managers can analyze and predict production costs for the coming month.

Web services are the foundation of smart clients and, as author Hagel notes, "a highly pragmatic technology, one that requires limited investment at the outset and quickly yields business impact …. Web services address compelling business needs regarding flexibility and collaboration better than any existing technology architectures."

As the core technology in smart clients, Web services enable popular applications such as Microsoft Word and Excel to exchange information faster and more seamlessly with server-based applications such as customer relationship management (CRM) systems, and with legacy systems such as older mainframe computers. Web services can minimize the time-consuming and error-prone process of cutting and pasting data between applications, and can overcome the barriers that traditionally have made it difficult or even impossible to integrate the "islands of information" that exist on different kinds of computer systems.

Creating Smart Clients

Today there is a large and rapidly growing number of options for businesses to build and deploy smart clients. This is due in part to a growing consensus within the computer industry about the core technologies of smart clients, such as XML-based Web services, as well as the realization among business decision makers that smart clients can deliver enormous new flexibility and power that, in turn, can help businesses be more competitive.

The financial services sector, for example, is a fiercely competitive industry—and one where companies are using smart clients and Web services to gain an edge. NASDAQ, the world's largest stock market by dollar volume, is employing Web services to deliver financial information to an array of devices that customers can use regardless of their location, thus helping create better customer service and satisfaction. Citigroup, the world's largest financial institution, is using Web services to provide its global investment bankers and institutional investors with real-time personalized information culled from nearly 300 sources, which is then streamed to a variety of smart client devices. This information delivery system is helping the company's bankers and clients make better, faster decisions while streamlining global account team collaboration across time zones and 100 countries.

Microsoft's vision for smart clients is to help connect people, information, systems, and devices through Web services. Microsoft provides the products and tools for enabling the creation, deployment, and use of smart clients that can use the power of Web services to enhance business productivity across a range of hardware, including Windows®-based devices such as desktop PCs, Tablet PCs, portable computers, Pocket PCs, and Smartphones, as well as non-Windows systems.

Organizations can start building and using smart client applications today with a rich array of Microsoft products and tools that eliminate barriers to developing and deploying smart clients. These tools include:

- **Office 2003 Editions.** These provide built-in tools and full support for XML to enable the rapid development of smart client applications. With the Microsoft Office 2003 Editions, businesses can create smart client solutions that become integral components in the organization's information infrastructure, reflecting its own business logic and processing data through the use of Web services. By using XML to separate data from other aspects of a document, presentation, or spreadsheet, information workers can create data that can be reused by other applications. That makes it easer for developers to integrate data into broader smart client solutions for their organization.

- **.NET Framework.** The Microsoft .NET Framework, an integral component of the Windows operating system, provides software developers with powerful tools for creating new smart client applications that can consume Web services, and a foundation for creating applications that can operate on a variety of devices, from PCs and laptops to PDAs and cell phones. Software built on the .NET Framework can be easier to deploy and maintain than conventional software, and includes a new style of application known as Windows Forms, which help expedite the development of clean, easy-to-understand user interfaces. The .NET Framework can minimize conflicts between applications by helping incompatible software components coexist.

- **Compact Framework**. The Microsoft .NET Compact Framework delivers managed code and Web services to smart devices, and enables the execution of secure, downloadable applications on devices such as PDAs, mobile phones, and set-top boxes.

- **Windows client operating systems.** Microsoft provides a full range of client operating systems that can enable smart client development through the use of Web services. Windows XP supports desktop and portable computers, while Windows XP Tablet PC Edition operates the recently introduced Tablet PC devices, which can provide handwriting recognition and other unique capabilities in tandem with smart client applications. Windows XP Embedded is used in virtually every industry for custom

hardware devices designed for very specific tasks; it is an ideal platform for smart client applications. And Windows CE, the core operating system running Pocket PC devices, provides support for Web service–based smart client computing.

- **Visual Studio .NET.** The Microsoft Visual Studio® .NET development system provides comprehensive tools for rapidly building and integrating XML-based Web services and smart client applications. It provides an open architecture that enables developers to use any language that is compatible with the .NET Framework.

- **Windows Server 2003.** A next-generation enterprise server with built-in XML support, the Microsoft Windows Server™ 2003 operating system provides the platform for building and deploying connected smart client solutions. Windows Server 2003 is the foundation of the Windows Server System™ integrated server software.

Smart clients can deliver an impressive combination of power and flexibility for businesses. A large and growing number of corporations recognize that Web services on the desktop can help streamline operations, get solutions to market faster, and reduce demands on IT departments, while providing users with a range of computing options that enable fast access to information.

Smart Clients at Work Today

Following are some examples of companies using smart client technology to benefit their business processes.

Smart Clients Replace Manual Processes in the Field

The ICEE Company manufactures, distributes, and services machines used for making frozen carbonated beverages, and also provides nutritional snack foods to the food service and supermarket industries. To support its customers, ICEE employs more than 450 field service technicians who provide on-site maintenance and support to thousands of mass merchandisers, convenience stores, amusement parks, theaters, and malls across the country.

ICEE's field service work was hampered by inefficient manual processes, so the company decided to improve its communications, dispatching, data collection, and invoicing by deploying a mobile, wireless-enabled field service automation (FSA) system. The solution was built on the Mobile Intelligence Platform, a mobile/wireless application framework from Countermind that is implemented using the Microsoft Visual C#® development tool and the Microsoft .NET Compact Framework.

It has both server and mobile client pieces, which communicate with each other using Web services and can tolerate intermittent connections. In turn, the FSA server takes care of communicating with an existing back-end system. The FSA server receives dispatches, messages, and alerts using a custom Web service gateway. The FSA server then converts them into XML responses and queues them for the appropriate field technician.

The solution is delivering a number of benefits to ICEE, including a quickly deployed and cost-effective mobile/wireless system; a mobile client application that can tolerate intermittent connectivity; the ability to link to various types of connections, including local area network (LAN), wireless LAN (WLAN), and wireless wide area network (WWAN); and a single, integrated development environment for both server and mobile client development.

Amazon Opens New "Doors" by Integrating with Office Programs

Since it opened its virtual doors in 1995, Amazon.com has grown to represent one of the biggest Internet success stories, becoming a Fortune 500 company that offers "Earth's Biggest Selection" of books, apparel and accessories, electronics, sporting goods, gourmet food, computers, kitchenware, music, DVDs, home electronics, and more. Amazon felt that the user experience, loyalty, and sales would be strengthened if customers could access Amazon through commonly used applications such as Microsoft Word and the Microsoft Outlook® messaging and collaboration client.

Using the Microsoft .NET Framework, Amazon.com creates XML-based documents that are fed into a custom application, which handles details of presentation and layout, saving development time and resources. Adopting this smart client development environment is a core component to Amazon's vision of streamlined consumer interaction. Consumers can work in a client-based application that allows information retrieval and purchases from Amazon without having to open a browser, and that is helping create a new kind of user experience that the company believes will help continue its growth.

Windows Forms Facilitate Information Flow

Thomson Financial is one of the largest data and analysis providers in the U.S. financial services industry, built up over the years primarily by acquisitions. Until recently, each acquired business unit operated largely independently from the others—and offered its own software solutions.

Thomson launched an initiative for a next-generation suite of applications branded Thomson ONE and built on the Microsoft .NET Framework. The project was designed to satisfy seemingly conflicting requirements. On one hand, Thomson's customers consist of several distinct types of users who must be accommodated. On the other hand, there are developers who have to maintain the system and the administrators who have to deploy and support it.

Thomson focused on creating smart client applications using the Windows Forms classes included in the .NET Framework. This approach provided both extensibility and customizability while satisfying the needs of Thomson's typical power users. Taking advantage of features that come automatically from using the .NET Framework technologies, it was possible to create the type of operating environment that Thomson's users needed for sophisticated financial analysis work.

The smart client isn't just an advantage to the users of the application. Thomson and its customers can actually save money by distributing work to the clients. Using processing power on client machines not only lightens the load on the servers, but also dramatically reduces the bandwidth typically consumed by constant client access.

Use of Smart Clients Enhances Customer Relationship Management

Salesforce.com is a global leader in delivering on-demand customer relationship management services. Its solutions address integrated sales force automation, customer service and support, marketing automation, document management, and analytics to help companies meet the complex challenges of global customer communication.

Saleforce.com recognized the need to design its software services so that they support the interface best suited for each customer's environment. The use of Web services created with the Microsoft .NET Framework is helping provide a standardized interface to salesforce.com back-end services that can be linked using either browser-based or rich-client interfaces developed by salesforce.com, its customers, or its value-added partners.

To provide users with access to important information and processes while disconnected, salesforce.com also provides a Windows-based PC or mobile device that synchronizes with Web services when it's connected. In addition, the company has developed an add-on to Microsoft Outlook so that customers can perform certain salesforce.com operations within that program.

Conclusion

Smart clients provide more and better options for connecting to information on networks and the Internet, helping users and businesses respond to rapidly changing business needs.

In a paper titled "How to Decide Between a Browser-Based or Rich Client," analysts Uttam Narsu and John Meyer of the research firm Giga Information Group wrote:

> "[HTML] worked well for brochure-ware … [but] it was not able to meet the challenge … in delivering rich, flexible, and easy-to-use desktop applications. With the recent maturation of rich-client technologies like .NET Windows Forms … it is time for companies to stop automatically assuming that an HTML client user interface (UI) is the only cost effective and acceptable UI architecture. With the past problems of rich-client distribution and management essentially now non-issues, companies should be basing their UI technology choices on the architecture that is best suited for meeting the business application needs today and carrying the application successfully into the future."

Smart clients can tap the power of modern computing hardware, work online or offline, and access enterprise information in a standard way using Web services and XML.

Microsoft and its more than 35,000 global partners help organizations and users take advantage of smart client technology by providing a stable operating environment and development tools—including Microsoft Windows Server 2003, Visual Studio .NET, and the .NET Framework. The Microsoft Office 2003 Editions offer an especially compelling opportunity for Microsoft partners and customers to develop smart client solutions using an interface that already is familiar to users. The result is an array of solution options that help businesses compete effectively and more efficiently in the global market.