An e-Tax Customer Service Technology Pattern for Government

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Management Summary

Tax agencies face both internal and external pressures to provide enhanced customer service capabilities to their constituents. Internally, government officials are attempting to respond to numerous initiatives to enhance the service capabilities of their organization, and to focus their management objectives increasingly towards measures of taxpayer satisfaction in service offerings. In some cases these customer service targets are based on legislative directives. Externally, taxpayers – both individuals and businesses – present pressures for increased service capabilities and ease of interaction in a secure and trusted setting.

The popularity of the Internet has raised the expectation level of taxpayers. They increasingly expect government to be at least as responsive to customer service requirements as private businesses are. For tax agencies, the expectation is for an expanded set of customer service offerings, including services provided over the Internet that we have termed “e-Tax Customer Service.” There is also a desire to enable workers with access to the same set of e-tax customer services to make their jobs easier in serving the public.

Taxpayer as well as employee trust is the essential ingredient to successful implementation of any new services and service delivery methods. Without the element of trust, it is unlikely that taxpayers or employees would be willing to participate in electronic service offerings. This trust is built up by ensuring that:

- Taxpayers or their authorized agents can get accurate reports of their tax information from the agency;
- This information is kept in strict confidence and not exposed to unauthorized disclosure; and,
- Taxpayers will be treated fairly and consistently – regardless of which service channel they utilize.
- Workers can access a comprehensive view of the taxpayer and better serve their needs via e-Tax services.

Today’s tax administration organizations are facing a number of challenges to improve their taxpayer customer service capabilities. The purpose of this paper is to provide an overview of some of the business issues related to this e-Tax Customer Service imperative. The paper then proposes an information technology pattern (system architecture) that is designed by IBM to help tax administration organizations to approach the problem. The information system design proposed in this paper promotes the objectives of enhancing e-Tax Customer Service offerings in a secure and flexible environment. The e-Tax pattern is an example of re-use of existing commercial and government e-business implementations.

The associated technology design recommended below reflects the fact that effective e-Tax Customer Service requires a well-defined strategy for the integration of taxpayer data. This includes a strategy for integration of data owned by the agency as well as information supplied through third parties.

Over a six-month period IBM’s Center of Integration in Dallas will design and code six e-Tax Customer Service offerings described in this paper. Our approach is based on a Messaging Hub concept which coordinates the flow of information among various existing customer systems such as the tax legacy system, government general ledger, call center applications, etc. IBM’s is a publish and subscribe messaging model which has been successfully deployed in the insurance and retail industries and which can work with an intranet, extranet or Internet architecture. At the end of our six-month project the work produced by the Dallas Center of Integration will be used to accelerate e-tax projects in revenue agencies worldwide.
Introduction

The demand for increased electronic customer service offerings for any government body reflects the following goals:

- **Universal access** – In an effort to make sure that citizens and businesses receive fair and equal service, government agencies must provide a variety of service access options. By providing services via the Internet, e-mail, phone (interactive voice-response and Call Center), fax and traditional mail and face-to-face communication, government ensures that individuals and businesses aren’t excluded from services due to limited resources.

- **Consistent dialogue across access points** – Customers should not have to repeat themselves or reenter information when they choose to contact a tax agency using different means.

- **High availability** – The ability to interact with tax agencies on a 24 x 7 x 365 is necessary. This is made possible through Web-based interfaces and automated voice response units. (Of course, accommodations must be made for maintenance of any system.)

- **One-stop service** – Citizens and businesses want to achieve their objectives through one contact point in a timely and efficient manner.

- **Consistent user experience at each contact point** – Although some contact points may be more cost effective or easier to provide, all of them should provide the same level of service, and the same “look and feel”.

- **Improved government efficiency** – Enhanced services and streamlined processes can lead to numerous benefits, including improved tax and regulatory compliance programs and increased employee productivity and job satisfaction, and revenue gains due to better compliance.

- **Two-way communications with citizens and businesses** – Effective service offerings lead to an enhanced understanding of citizen and business wants, needs and behaviors, which in turn leads to a better understanding of what’s working and what’s not.

- **Security** – All service offerings have to be integrated into the legal framework that guides the operations of the government agencies. Citizens/businesses must be informed of their rights to access information, the legal standing of their interactions with the agency (across the different service channels), and the privacy measures used by the agency to secure the taxpayer’s information. There must also be a clear understanding of the security put in place to allow access to accounts by taxpayers’ authorized agents.

There is also the area of the implementation of Business Intelligence (BI) solutions within Tax Administration to help resolve many of the current taxpayer education and compliance challenges facing government tax organizations. Some specific components of an overall BI solution can provide to tax agencies include:

- **Industry specific data models** - that are built and optimized with an understanding of the needs of BI and incorporate lessons learned from multiple agencies.

- **Data warehouse** - to integrate information from various systems into a single source to allow efficient and timely access to both agency and external information on taxpayers.

- **Analytical tools** (Query/Reporting and OLAP) - to allow a detailed structured view of an agency's information and utilizing proven pre-developed templates to reduce lengthy requirements gathering and customization.

- **Data mining algorithms** - designed to determine and flag characteristics within an agency's data warehouse and allow an agency to better identify target segments requiring action.
Campaign management - allows an agency to implement an automated communications strategy that determines target segments for communications, tracks the success of communications, and provides data to help make any successive efforts more successful/effective.

Tax compliance applications - provides the agency with proven tools that help determine "at risk" taxpayers for fraud and noncompliance, and to manage cases that resolve these issues.

Realization of the benefits from electronic customer services ("e-Tax") and BI solutions implies the use of proven information technology framework. Re-use of a proven technology framework in recognition of a common set of requirements is called a "pattern" re-use.

For e-Tax Customer Service, the required Technology Pattern implies the ability to integrate taxpayer information across a number of internal and external sources; encourage the re-use of existing taxpayer information systems where possible; provide consistency of end-user and taxpayer facing systems; and, provide the availability and security required.

The Technology Pattern recommended in this paper is drawn from IBM's experience in implementing e-business solutions in both public and private sector environments.

The use of an industry proven pattern provides the required structure for mapping a technology solution to the requirements for e-Tax services. The pattern should be customized on an individual tax agency basis, dependent on the unique system and functional requirements in each setting.
Trends in the Tax Administration

The selection of a technology pattern for support of e-Tax Customer Service should support the range of business systems and application requirements facing tax administration organizations.

Figure 1 - Scope of Requirements for Tax Administration Systems

Figure 1 provides an overview of the types of application development efforts often found in the tax administration environment. The applications can be characterized as follows:

- **Roll Your Own Silo** – These are point applications often developed around a single tax type or function. They are typically relatively quick to conceive and develop, but are not optimized for providing an integrated view of taxpayer data that could be used as the basis of a customer service offering.

- **Integration** – These are applications that are designed to provide a common process stream and common database across functional and/or tax type boundaries. Although they provide a good basis for creation of a single view of the tax customer, the integrated systems are typically focussed on one business area (e.g. integrated registration or collections), or on just a subset of all the relevant tax types (e.g. leaving out Individual Income Tax because of performance issues).

- **Client Facing** – These are applications that are used directly by the taxpayer. They typically range in complexity from providing access to static information on an agency Web site, to processing of tax form filing and payment transactions.

- **Intermediation** – These are applications that facilitate channel participation by other public and private institutions with which the tax department does business. Examples include banks and other financial institutions, third party return practitioners and originators. The applications are designed to allow third parties to participate in the tax administration process; opening communications channels to selected businesses that provide a value
added service to taxpayers in the tax process. These applications recognize the growing trend of taxpayer service convergence in the private sector and the increasing ability of third parties to supply valuable information to the tax agency while providing convenience to taxpayers.

- **Harmonization** – These are applications that primarily facilitate Government to Government (G2G) cooperation. The applications include taxpayer information exchanges (e.g. Federal – State data exchange) and cross-state tax clearing houses (e.g. for sales and use taxes and for certain fuel and excise taxes). Another example is business registration, which can cross agencies as well as jurisdictions. The applications provide the technology infrastructure for government to government (G2G) data sharing. They help to promote common tax policy/duty imposition across jurisdictions and common data and message standards (EDI and/or XML representations).

e-Tax Customer Service information and transaction events are encountered across the entire range of applications. The selected Technology Pattern should provide an infrastructure that supports information sharing across the complete range of requirements.

### The Use of a Technology Pattern for e-Tax

“Pattern-oriented software architecture” is the selective re-use of systems architecture, products and guidelines that support a class of applications. This paper provides a proposed Technology Pattern in support of the business requirements outlined above.

The use of a pattern in proposing a solution does not imply that there is a one size fits all solution. The attempt is rather to maximize the re-use of industry best practices where appropriate.

The steps to using or defining patterns are:

- Define a set of typical business scenarios that highlight the use of e-Tax Customer Service offerings. These scenarios should reflect tax agency customer service requirements that are common to the majority of tax agencies.
- Recognize where similar business requirements have been faced and successfully addressed before, and then borrow the best ideas from those successful implementations.
- At the same time, examine and accommodate the particular situation and realities of the target tax administration organization.

In searching for a re-usable pattern, it is important to accommodate key systems requirements as well as taxpayer service functional requirements. These system requirements include:

- **Security.** The pattern recognizes the importance of the security infrastructure required for tax administration agencies.
- **Availability.** An e-Tax Customer Service offering faces particular availability constraints. 24-hour availability demands an interactive Web presence and/or automated voice response system and creative approaches to maintenance on the legacy systems being accessed.
- **Heterogeneity.** The proposed pattern takes into account the reality that most agencies want to maximize re-use on existing information systems where appropriate. Many of these point applications work extremely well for the purposes for which they were built.
- **Channel Consistency and Branding.** Since Internet-based customer service is one of a number of contact points with tax customers, it is important to integrate the e-Tax piece into a larger strategy of channel consistency and look and feel consistency for the customer – to avoid promoting different levels of availability and service across different channels.
- **Commonality and Variability in Tax Administration Systems.** Again, the use of a pattern in proposing a solution for e-Tax Customer Service is to take advantage of previously implemented solutions. This approach would take advantage of the commonality that tax administration organizations share in this area. At the same time, the particular variability
relevant to a specific agency needs to be accommodated. Variability may be presented at the application level in terms of the kinds and scope of application systems that need to be integrated for an effective e-Tax offering. For example, some agencies may already have a call center application in place that needs to be integrated into the e-Tax offering. Variability at the business level includes the different tax basis, tax legislation, service offerings and products (including tax forms).

It is important also to point out that selection of technology implies a reference implementation. The logical architecture must be implemented with real products to qualify as a re-usable implementation. A reference implementation with product selection and use is provided below.

**Beneficiaries**

Who benefits from the e-Tax Customer Service Technology Pattern?

**Taxpayers**

The pattern provides increased interactivity with the tax agency, including a gradual expansion of the number and types of transactions that they can invoke. Taxpayers will be able to establish service requests and check on profile and account data in a secure and friendly environment and at their own convenience. It significantly augments taxpayer assistance availability and may be linked with real-time (person to person) support services.

**Tax Agency Employees**

The pattern compliments an overall integration strategy for customer service in tax agencies. It tracks customer interactions and provides opportunities for higher quality customer information, better compliance, and offloading of service requests to a self-service medium. All of this leads to an application environment that makes it easier for the tax agency employees to succeed in their work.

For the tax agency in general, the pattern enhances the potential for success for electronic filing and paying – including implied efficiencies to cash flow and data quality and timeliness.

It also benefits government in not only generating cost savings but also in resulting in revenue gains brought about by improved compliance and collections, better data mining and clearer targeting of audits.

**Practitioners and Providers**

The pattern provides increased channels for supplying their customer’s information through electronic means, for verifying identification and other profile data, and for examining transcript data in a secure environment.

**Other Third Parties**

The pattern provides a secure base for the creation of Intermediation and Harmonization capabilities – in support of the supply and/or exchange of tax customer related information.
The Business Patterns and Requirements for e-Tax Customer Service

This section presents a set of e-Tax Customer Service user scenarios. The approach is to describe a set of possible scenarios around a fictional, small business tax customer. The following scenarios are a representative sample of the kinds of customer service interactions that a small business owner might encounter in an e-Tax customer service environment.

Education and Advisory Services

The small business owner has decided to expand her business and is hiring ten employees. For the first time in the business, the business owner will have to pay wages and also withholding taxes to the government.

With the advice of her friend and accountant, the business owner decides to explore the Web site of the tax agency to learn more about withholding tax requirements. The business owner navigates to the tax agency Web site and explores the “Education and Advisory Services” section of the site. In addition to a set of frequently asked questions, the latest agency bulletins and regulations, the tax site has a set of “tax assistant navigators”, which are like automated question and answer forms that lead her through a particular process.

The business owner selects the “Getting Started with Small Business” navigator. The tax site responds with a dialog that informs her of the security and privacy measures that the site has implemented. The dialog states that her information will be secure from tampering over a secure Internet connection, and that none of the information she supplies will be disclosed to other departments or agencies.

The Small Business navigator owner then leads her through a series of questions that help her to understand what her requirements are and also to calculate her potential filing and payment obligations for withholding taxes.

Based on the responses that the business owner provides in the navigator, the navigator recommends that she registers her business for withholding tax and that she also registers for a PIN to access more comprehensive customer service features over a secure Internet connection. The navigator also recommends that the business owner register a “Power of Attorney” for any tax practitioners that she may have and explains the varying levels of access she can authorize for her tax practitioner. She is also informed that she can perform these functions on-line once she receives her customer service PIN.

The business owner is offered the option of applying for her PIN on-line. She completes the PIN request form. After a couple of weeks, she receives her tax agency customer service PIN in the mail.

The business owner is impressed with the ease of use of the site. She also notes that the site offers her the ability to review her privacy and legal rights in clear and understandable terms. The site is very clear about:

- What information is being gathered about her and her business (e.g., through the navigator tool),
- How the information will be used,
- How the agency will protect her information from disclosure or alteration, and
- How she is able to update or correct her data at the agency.
**Registration**

Although she knows that she could complete the tax agency registration requirements through the mail, the small business owner decides to use the agency’s Web site to complete the process on-line.

The business owner uses her office desktop computer to navigate back to the agency Web site. She finds the e-Tax Customer Service icon that will lead her to the agency’s customer service pages and clicks on the icon. The first page she sees asks her for the user identification and PIN number that she received from the agency through the mail. She types these in and logs onto the e-Tax Customer Service site.

The business owner notices that the e-Tax Customer Service page looks very similar to the other agency site pages, except that the customer service pages are personalized to her and her business. The personalization is based on some of the profile information that she supplied when she first used the tax assistance navigator.

Again, the business owner notices that icons lead her to more information about the agency’s privacy and information security policies.

The business owner navigates to the tax form area of the site. She selects to fill out the “Business Withholding Tax Registration Form”. A “Registration navigator” dialog leads her through the process of completing the registration form. She notices that when the form is presented to her, a lot of the basic information about her and her business is already completed on the form. This is information that she provided in her initial contact with the tax assistance navigator. She reviews the pre-filled information and then completes the remaining parts of the form by answering the questions presented by the navigator.

The final screen on the Registration navigator asks the business owner if she wants to submit the form now or save it for modification later. She chooses to submit. The navigator prompts her to enter her agency assigned PIN to “sign” the form, and the business owner completes the signature and submits the form. The navigator responds back with a screen that provides her with an electronic receipt that indicates that the tax agency has accepted the registration form for processing. The Registration navigator prompts the business owner to print out the receipt and save it for her records, which she does.

Pleased with the ease of use and the process, the business owner then notices that the navigator dialog asks her if she is interested in completing any other transactions, and provides a list of typical transactions that she might be interested in. One of these includes the “Power of Attorney” form, which is described on the screen as a document that allows her to identify her tax practitioner and provide the practitioner with the right to perform tax transactions on behalf of the business owner.

The business owner decides to go ahead and complete the form to allow her accountant to act as her tax practitioner and to transact her business with the tax agency.

The Registration navigator then leads the business owner through the process of completing the Power of Attorney form. At the end of the dialog, the business owner again submits the form and is given a receipt to save for her records.

**Filing**

The business owner informs her accountant that she has completed the withholding registration process and has signed up the tax accountant up as her tax practitioner. The business owner then goes on to concentrate on making her business successful.

The tax practitioner knows that she is responsible for preparing the business owner’s quarterly withholding tax return. When the time to file comes, the tax practitioner uses her computer to log onto the e-Tax Customer Service site, noting that the site has a special section for tax practitioners like her. She navigates to that part of the site and reviews the information and transactions that are available to her. One of the transactions available to her is the ability to
submit a return on-line for one of her customers. When she selects this transaction, the system asks her to first supply her practitioner identification number, which is the key identifier that links the tax practitioner to the taxpayers that have given her power of attorney for their tax business. The tax practitioner supplies the identification and is allowed access to the Return-Filing navigator.

The Return-Filing navigator prompts the tax practitioner to select which return she wants to file, and the taxpayer identification number of the taxpayer she is filing for. The tax practitioner selects the quarterly withholding tax return (Form 941) and supplies the business owner’s taxpayer identification number.

The Return-Filing navigator then leads the tax practitioner through the return-filing process by asking a series of questions and accepting and validating her input.

At the end of the filing process, the Return-Filing navigator prompts the tax practitioner to electronically sign the return for submission which she does and then clicks on the submit button. The navigator responds with a receipt that confirms that the tax agency has accepted the return for processing. The tax practitioner prints out the receipt and adds it to the business owner’s file.

The tax practitioner is also able to submit bulk filings of the 941 for multiple clients.

**Payment**

At the end of the return-filing process, the Return-Filing navigator also informs the tax practitioner of the total amount of withholding tax due from the business. The business owner has registered as an electronic funds transfer (EFT) taxpayer, and the tax practitioner is authorized to initiate the EFT transaction to effect the tax payment.

An easy-to-use Tax Payment navigator leads the tax practitioner through the process of initiating the EFT. The Tax Payment navigator also informs the tax practitioner that the option also exists for the tax practitioner to print out a hard copy of a tax payment voucher form so that she can write a check and mail in the payment at her convenience.

**Customer Service (Taxpayer Self-Service, Assisted Service, and Account Views)**

After her business has been operating successfully for a year, the business owner decides to check her tax information at the tax agency Web site again. She logs onto the e-Tax Customer Service site and is again presented with a personalized welcome screen that provides information and transaction buttons that are of interest to her.

One of the buttons allows the business owner to view a list of her returns and payments made for her business. She clicks on the button and views a display of her return and payment data, organized by year and quarter. On reviewing the information, the business owner notices a data field called “Status” that is presented with her data, but cannot understand what the field means or signifies.

Another button on the screen allows the business owner to contact a customer service representative (CSR) during normal business hours, either through a “chat” instant message program or through a “Internet call”. The business owner clicks on the Internet call button to see if she can get a representative to explain what the “Status” field means on her account.

The site presents a page that explains that the Internet call allows her to converse with a CSR using a microphone and speakers attached to her computer. But the business owner’s computer is old and doesn’t have a microphone attached, so she decides to go back and try the chat feature.

After reviewing an instruction page on the chat feature, and reviewing a page that clearly states the privacy and security features of the service, the business owner confirms her request to connect to a CSR. After a short wait, the business owner sees a window pop-up on her computer and a message from “Your e-Tax Customer Service Rep”. The message reads, “Hi, how can I
help you today?” The business owner types in her question about her account data and sends the message.

The e-Tax Customer Service representative responds that he will be happy to assist the business owner and that he will first navigate to the same account screen that she is looking at so that they are both looking at the same information. The CSR navigates to tax account screen for the business owner and sees the same interface and information that the business owner is seeing. The representative types a message to the business owner, informing her that there is nothing wrong with her account and that the “Status” field is a summary code used by the tax agency to summarize the status of an account. He then refers her to a Web page of frequently asked questions (FAQs) where she can learn more about how to review her account data. The business owner takes note of the Web page address and sends a note back to the e-Tax service representative thanking him for his help and then they terminate the chat window.

**Compliance and Incentive Programs**

One summer, the tax practitioner elopes with her fiancé and forgets to file the business owner’s quarterly withholding return. The tax agency monitors accounts for filing and detects that the business owner has missed a withholding filing deadline.

The agency mails a non-filer notice to the business owner who shows it to tax practitioner after she returns from her honeymoon. After apologizing for the lapse and promising to pay any fines or penalties to the tax agency, the tax practitioner calls the e-Tax Customer Service center toll free number. A series of automated voice prompts lead her to a CSR. The tax practitioner asks for advice on how best to address the non-filer issue for the business owner.

The CSR navigates to the business owner’s taxpayer information screen, and validates that this practitioner is authorized to make inquiries about the account by asking her a series of security questions, including the notice identification number that was printed on the non-filer notice that the business owner received.

The CSR navigates to a screen that holds information about the non-filer compliance case for the business owner. The representative explains when the case was created and what stage the case is currently in, including a review of the non-filer notice and when it was sent out. The representative explains that if the return is filed electronically within 24 hours, the non-filer penalties could be waived. The tax practitioner thanks the representative, then logs onto the e-Tax site and completes the filing.

The tax agency also uses similar account monitoring techniques to segment the tax customer population and to support their own marketing, outreach communications and incentive campaigns. The tax agency uses a data mart and data selection techniques to generate a campaign for encouraging the use of electronic filing and electronic services offered by the agency and sends out hard copy mail and e-mail to selected practitioners.

Shortly after the resolution of the non-filer case for the business owner, the tax practitioner receives a letter from the tax agency, thanking her for using the e-Tax site and asking for her help in encouraging her other customers to make use of the e-Tax service. The tax agency has identified the practitioner as a good candidate for a campaign aimed at increasing the number of practitioners who file forms electronically for their clients. The agency conducts both a snail mail and e-mail marketing campaign and sees an increase in electronic filing by practitioners. This can be attributed to the actions of practitioners who like the one in our case is so pleased with the ease of use of the e-Tax service and with the level of support offered to her and her clients, she decides to run her own marketing campaign for the customers she has that do not already take advantage of electronic filing or the e-Tax Customer Service site.

**Common Themes and Requirements**

The business scenarios described above share a basic set of system requirements:
Applications participating in the e-Tax Customer Service site must be able to share tax customer information;

When a transaction button on the site is clicked, the Web application must be able to perform the transaction directly or be able to invoke a transaction on a related system using some type of messaging interface;

The tax agency must consistently communicate and enforce the agency’s information security policies and taxpayer data must be effectively secure from unauthorized disclosure.

These common themes and system requirements are addressed in the logical and physical application patterns presented below.
A Logical Pattern to Address e-Tax Requirements

The e-Tax business scenarios described above present a simplified view of a typical tax agency’s technology environment. In fact, the simple narrative poses a number of technical challenges. This section proposes a set of logical (conceptual) application configurations that are designed to address these challenges.

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**Figure 2 - e-Tax Customer Service Logical Diagram**

The key to achieving the e-Tax Customer Service vision is to recognize the importance of taxpayer data and application integration. Our e-Tax Customer Service Technology Pattern for tax administration is based on the integration of new electronic services with existing or planned application infrastructure.

This point is important for many reasons:

- There is no single tax application that can completely address all the functional needs of a tax agency. A sound approach to integration of business functions across multiple application systems has to be implemented.
- Many tax agencies already have a large investment in information technology and customer data that they do not want to replace. A technology strategy that allows for integration of existing assets is required.
- The information technology industry is highly dynamic, and innovations drive customer service expectations. Since it is very difficult to predict the future of
technology innovations, the safest approach for tax agencies is to adopt a flexible technology architecture that allows for adaptation in the future.

Figure 2 is our proposed e-Tax Customer Service application architecture. The illustration highlights the importance of positioning the e-Tax Customer Service business requirements in the context of an application integration architecture. Customer relationship management and business integration are the centerpieces of the architecture, which is in keeping with the business focus of enhanced customer service.

The e-Tax Customer Service entry point for tax customers is a part of a larger support system for customer interaction – “Customer Touch Points” – that extend from person-to-person interaction, to call center support, mail and Web interaction. These “channels” of access must be managed in order to provide a common service “brand” for the agency and enhance the consistency of the service dialogue with the customers.

Customer access across the different channels is managed through integration with a core Customer Relationship Management (CRM) Process Integration function.

Transactions supplied through the managed interactions are the foundation for the creation and maintenance for a set of master file data for the tax customers and their authorized agents. A set of “Core Tax Processes” utilizes this data to create and integrate the taxpayer master file.

These customer interactions act as one of the primary sources of data for the agency, the other being data supplied through 3rd parties (private sector and other government bodies) that are managed through an “Information Supply Chain Integration” function.

The “Business Integration” function is used as the glue that ties together the applications used to support the overall integration framework. It allows the packages to communicate efficiently and provide an overall service framework.

Core Tax Processes are used to monitor tax customer accounts for exception conditions and as a primary source for deriving management reporting and revenue accounting information (managed by the “Core Enterprise Operations” function).

In addition, Core Tax Processes maintain the information that forms the basis for tax customer campaign, data mining and general relationship management.

The combination of Core Tax Processes, 3rd party and other agency data and managed interaction through the CRM core, provide a rich set of data for personalization of the interface provided to individual tax customers through the e-Tax Customer Services offering.

The topology presented is predicated on the use of a reference application framework – in this example the IBM Application Framework for e-Business – that recommends a set of technologies and standards appropriate for providing an e-Tax Customer Service enabled set of applications. Some of these technologies are included in the physical implementation described below.
Figure 3 provides a simplified representation of the proposed e-Tax Customer Service technology pattern. In the diagram, a set of customer facing services ("Customer Touch Points") provide a front end to a number of supporting applications and application services. These supporting applications and services are centered on a "Business Integration Messaging Hub" which is responsible for coordinating the flow of information ("messages") among the participating applications.

The logical architecture presented in Figure 3 is not meant to suggest that all the required applications or technologies for integrated e-Tax are represented. The important feature is the use of the Business Integration Messaging Hub and the bi-directional flows of taxpayer information from the participating applications and services. Use of the Business Integration Messaging Hub topology allows for maximum flexibility in the mix and match of application components to satisfy the business requirements for e-Tax Customer Service.

The components of Figure 3 are described as follows:

- **Customer Touch Points** – Represent the applications and services that are the customer facing applications with which most tax customers will interact.

- **Call Center and Customer Service Representative Resource** – Responsible for maintaining a history of customer contacts and essential customer data across all customer touch point channels.

- **Application Server** – Primarily responsible for providing a secure Internet environment for customer interactions with the agency over the Web.

- **Electronic Forms Processing** – Responsible for managing the tax form publishing, entry and validation processes, across different modes of form entry including electronic filing.

- **Tax Operational Systems** – Responsible for maintaining tax customer accounts, including registration, form processing and taxpayer account data. Also includes applications that
manage taxpayer cases arising from specific business conditions such as refunds, collections, appeals and audit.

- **Government General Ledger** – Responsible for reporting aggregate revenue data for the agency, reflecting financial activity over any given accounting period and across all types of taxes and fees.

- **Data Warehouse and Business Intelligence Tools** – Responsible for maintaining critical customer and operational data to support business process improvements and customer support and marketing campaigns.

- **Notification System** – Responsible for managing the taxpayer notification process, including design and format of notices, notice generation and staging, address verification and printing.

- **Other Government Agencies/Third Parties** – Responsible for providing filing information or information which, when combined with tax data, gives a fuller picture of a taxpayer’s profile for purposes such as auditing.

Each of these application components is responsible for supporting a particular set of requirements for e-Tax Customer Service, and each may maintain a part of the total data for the taxpayer.

The diagram illustrates the fact that key taxpayer data maintained in back office systems must be made available to the customer facing and support applications and personnel. It is the Business Integration Messaging Hub that makes this possible. The bi-directional lines leading to and from the various components into the Messaging Hub illustrate both potential data flows and required data transformations. Component-specific “adapters” are responsible for preparing message data, putting the data on and getting it off of the message queues managed by the Messaging Hub, and triggering transaction processing by the receiving component where necessary.

Using the proposed Technology Pattern, each component can be enabled to respond to service requests from the other components in the system. These requests can take the following forms:

- Request to provide taxpayer information;
- Request to create, update or delete a copy of key taxpayer information;
- Requests to perform a particular function and optionally confirm successful completion of the service request.

The proposed Technology Pattern allows us to address the e-Tax business scenarios while retaining the required adaptability and flexibility assumptions.

The primary focus of e-Tax is creating a single view of the tax customer that is accessible to the CSRs who deal with taxpayers on a daily basis. The same information (or subsets of it) can be made available to the taxpayers themselves through the Internet, assuming that the right security mechanisms are in place. The e-Tax Technology Pattern provides the option to either maintain a copy of required taxpayer account information in the Call Center application, or to provide a message interface to the Call Center application so that it can query the other components for a view of the required data.
The implementation of the proposed e-Tax Customer Service Technology Pattern relies on the processing of messages between the components that comprise the total solution. This implies a mechanism for structuring and defining the messages that are passed among the different components. Fortunately the choice of the right design for this message structure is simplified by the existence of the eXtensible Markup Language (XML), which is an emerging standard for these types of message and service enabled architectures.

Figure 4 illustrates the use of a set of XML messages to support the messaging between the e-Tax Customer Service application components. XML provides the ability to define a set of application messages to support the architecture.

To implement the architecture, a set of messages is defined for every processing event of significance to other components. The XML messages are emitted from the source component as required and placed on the Business Integration Messaging Hub where they are routed to the components that subscribe to that particular event. In this way, key components such as the Call Center CSR Resource can be kept in synch with events arising in other component areas. For example, the fact of Internet filing may be of significance to the Call Center application, and thus a message from the Internet filing solution is placed on the Messaging Hub so that the Call Center application can automatically create an entry in the taxpayer’s contact history file.
**Physical Pattern to Address the Requirements**

With a logical architecture defined, the final step is to describe a physical implementation that matches the logical pattern and meets the e-Tax Customer Service requirements.

This section provides a description of the runtime topologies that support the logical architecture defined above, and then provides a description of a reference implementation with product mappings given for each of the functional components of the architecture.

**Design Principles**

To review the key design principles for the e-Tax Customer Service Technology Pattern:

- **Security**: The selected pattern must demonstrate how information security is provided and how taxpayer data is protected from unauthorized disclosure.

- **Substitutability of Package Components**: The selected pattern must allow for a mix and match of existing and commercial-off-the-shelf applications that are appropriate to each tax agency. Flexibility, adaptability and support for heterogeneous operating systems are required.

- **Message Passing**: The selected pattern must demonstrate how the applications are able to effectively communicate with one another through messaging.

- **XML Based Messages**: The selected pattern must demonstrate how the required messaging can be based on a consistent XML format and schema.

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<th>Outside World</th>
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<tr>
<td><strong>Public Key Infrastructure</strong></td>
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<td><strong>Domain Name Server</strong></td>
<td><strong>Load Balancer</strong></td>
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<td><strong>User</strong></td>
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<td><strong>Integration Hub</strong></td>
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<tr>
<td><strong>INTERNET</strong></td>
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<td><strong>Notifications</strong></td>
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<td><strong>Domain Firewall</strong></td>
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<td><strong>General Ledger</strong></td>
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<td><strong>Operational Systems</strong></td>
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<td><strong>Call Center</strong></td>
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<td><strong>Data Warehouse</strong></td>
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**Figure 5 - e-Tax Customer Service Reference Implementation**

Figure 5 provides an illustration of a reference implementation of the e-Tax Customer Service Technology Pattern.
In this topology, the taxpayer views the tax agency functionality through a secure Web site. The Web site is responsible for maintaining static content and for interfacing to the Application Server in the agency's internal network and for preparing dynamic pages for presentation to the taxpayer. For the Web user, the Application Server manages the interaction with the other components in the architecture, through message passing across the Integration Hub.

The applications in the internal network may maintain their own taxpayer related databases and share information through the Messaging Hub.

**Description of Physical Components**

The recommended e-Tax Customer Service Technology Pattern consists of a number of nodes, which are illustrated in the diagrams below. The nodes are distributed across three security contexts. Taxpayer customers access the e-Tax services from the “outside world”. Their point of contact with the agency is through a Web Application Server that sits within a “demilitarized zone” – between the firewalls that protect the agency systems. The actual information systems that maintain taxpayer data sit within the “internal network” of the agency. The internal network supports internal user access and sits behind the Demilitarized Zone (DMZ) firewalls that protect the system from unauthorized access.

Each node in the physical implementation is responsible for a specific set of functions and services. The following is an overview of the recommended nodes.

**WEB APPLICATION SERVER**

The Web Application Server is responsible for publishing static Web content and for providing customer access through the Web to services and functions within the agencies internal network. Although the Web Application Server may have access to certain parts of the taxpayer customer data, its primary responsibility is to publish static content and to act as a secure gateway to the agency’s internal network. The Web Application Server may redirect customer application function to the Application Server that sits behind the agency firewall.

For purposes of scalability, the Web Application Server may be vertically scaled by increasing the number of processors in the server, and horizontally scaled by increasing the number of servers.

**PUBLIC KEY INFRASTRUCTURE (PKI)**

The PKI node supports authentication of taxpayer customers to the agency, using certificate based approach to authentication. PKI allows the secure interaction between two unrelated parties over the Internet, authenticating.

Note that at this time, legal and technical constraints to implementation of PKI services for government are still being resolved. The PKI node is included as an optional security measure that should be considered once these issues are resolved.

**DOMAIN NAME SERVICE (DNS)**

The DNS node assists in determining the physical network address associated with a specific Uniform Resource Locator (URL) address. The DNS service is typically operated through Internet service providers in the outside world, although DNS is also implemented in the agency’s site as well.

**USER NODE**

The user node is typically a browser-enabled personal computer or other device. The browser should support Secure Sockets Layer (SSL) communications for secure data connections to the agency site.
Note that, for simplicity, the e-Tax physical topology diagram does not include a node for users within the internal network of the agency. Each of the application components with the internal network may support a number of different client node types, including dedicated clients (fat clients), terminals and terminal emulators, and Intranet (thin client) access.

**DIRECTORY AND SECURITY SERVICES NODE**
The Directory node maintains information on the attributes of various resources and users within the internal network of the agency. It is used in the e-Tax Customer Service implementation as a means to authenticate both internal and external (tax customer) users, by maintaining the PIN and (eventually) certificates belonging to the users of the system.

**PROTOCOL FIREWALL AND DOMAIN FIREWALL NODES**
Firewalls provide services that can be used to control access from a less trusted network (e.g. the Internet in the “outside world”) to a more trusted network (the “internal network”). The protocol firewall is used to screen Internet traffic so that only specified ports of access are allowed. The domain firewall is used to protect the internal network so that only specified services are accessed.

**LOAD BALANCER NODE**
The load balancer node assists in supporting the horizontal scalability of the solution by dispatching Web requests among several identically configured Web servers.

**APPLICATION SERVER NODE**
This node is responsible for coordinating requests for business functions from the Web server to the other components of the internal network. In some cases, this node may also serve as a Web server for the agency Intranet.

**INTEGRATION HUB**
This node acts as the heart of the messaging interface between the different applications that provide total support for the e-Tax Customer Service framework. As mentioned above, e-Tax Customer Service assumes that both internal and external users have a means to access an integrated view of customer information, and that this requires the implementation of a coordinated messaging infrastructure. The Integration Hub node is responsible for receiving and routing messages between the applications that share information about tax customers.

**APPLICATION COMPONENTS IN THE INTERNAL NETWORK**
These application nodes represent the applications that are typically part of an overall tax administration information-processing environment. The application nodes are described in more detail below.

**Reference Implementation**
The physical pattern illustrated in this paper reflects an actual implementation to be carried out by IBM at its Dallas Center of Integration laboratory. The implementation serves a number of purposes:

- Proof of concept for integration
- Functional and performance test bed and benchmark
- Framework for testing alternative components
- Training facility for customers and IBM engagement teams
In order to accomplish the implementation, a selection of operating systems and supporting hardware was performed. However, the pattern is supported on a number of different operating systems including OS/390, Unix, and Windows NT.

The following sections describe the product selections used for the reference implementation.

**Security Overview**

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<tr>
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<td>Integration Hub</td>
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**Figure 6 - e-Tax Customer Service Security Infrastructure**

Figure 6, illustrates the product selections for the security infrastructure of the reference implementation. Taxpayers, accessing the e-Tax Customer Service facility may be authenticated either with certificate management (PKI, when available) or through a PIN maintained in the directory service of the agency. The Web Application Server resides behind a protocol firewall that allows access only through Web browsers to the Web server.

The applications that support the e-Tax Customer Service scenarios sit behind a domain firewall, which further protects the internal network. The agency directory can be used to authenticate both internal and external users and also to validate user privileges at the message and application level.

The Application Server in the internal network controls access to the data and services of the applications in the internal network.
**Messaging Overview**

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<td>MQ Series 5.1</td>
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<td></td>
<td>WebSphere App Server Adv Ed 3.021</td>
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<td>JDK 1.1.8</td>
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**Figure 7 - e-Tax Messaging Infrastructure**

Figure 7 illustrates the products selected to support the messaging infrastructure for e-Tax Customer Service.

The Application Server coordinates access to internal network applications and data for external users coming in from the Web. In certain implementations, this server can supply transaction monitor services for application support of internal network users.

The Integration Hub implements IBM MQ Series as the underlying messaging mechanism. Applications in the internal network communicate with one another by placing messages and retrieving messages off of MQ series queues. In most cases in the reference implementation, these messages are formatted as XML strings.

XML messages are tied to significant processing events, such as the addition of a new taxpayer record, changes to the taxpayer record, filing and payment and so on. The applications responsible for managing these events are also responsible for publishing the XML messages related to these events onto the Messaging Hub. Other applications in the network that are interested in these events “subscribe” to these messages. Thus a single event leading to a single message being published on the hub can lead to updates in multiple subscriber applications.

The IBM MQ Series Integrator manages this “hub and spoke” messaging protocol which allows multiple applications to be updated on the basis of a single message event.
### Application Overview

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![Diagram](image)

**Figure 8 - e-Tax Application Components**

Figure 8 illustrates the typical internal network applications that support e-Tax Customer Service.

#### NOTIFICATIONS

Outbound notification is a key part of the tax agency’s business. Many tax agencies utilize specialized noticing and mail out applications to support high volume production of notices and letters to tax customers. When the technical and security issues surrounding electronic mail from the tax agency to taxpayers is resolved, this application component can be augmented with e-mail of notifications and communications to taxpayers.

The e-Tax Customer Service reference implementation uses the DOC 1 product from Group 1 software for the purpose of generating outbound notices to taxpayers and practitioners.

Use of a cross-industry e-mail assembly may also be incorporated in the notification scenarios.

#### GENERAL LEDGER

Although not directly related to customer service, the maintenance of a ledger of revenue accounts is a primary responsibility of tax agencies. Tax agencies typically must provide reports of changes to revenue collections to their parent institutions, e.g. to government treasuries.

As taxpayers file returns and make payments to the tax agency, the agency reflects these financial events as updates to the revenue ledgers that they maintain for these reporting functions.

The e-Tax Customer Service reference implementation uses the SAP R/3 financial accounting package for the purposes of maintaining the revenue ledgers/
OPERATIONAL SYSTEMS
These systems are responsible for maintaining the taxpayer master files, which typically cover core tax functions such as registration, taxpayer forms management and processing, maintenance of individual taxpayer accounts, and the monitoring, creation and management of tax cases to manage exception conditions detected in the taxpayers data.

CALL CENTER
This application is responsible for providing support to the CSRs who handle incoming calls from taxpayers. The call center application is a critical part of e-Tax Customer Service and must have accurate and timely taxpayer data accessible to the service representatives who are handling taxpayer requests in real time.

The e-Tax Customer Service reference implementation uses Siebel 2000 eBusiness applications for Call Center support.

This component area is related to the channel support for interactive voice response (IVR) applications, which provide customer support without having to engage a CSR, and also route calls to the appropriate CSRs depending on the type of service being requested.

DATA WAREHOUSE
This application is responsible for storing selected agency and customer data to support short term and long-term decision support initiatives.

In the e-Tax Customer Service pattern, this application could be used to store taxpayer personalization data, to hold information on operational statistics for the other applications, and to provide a basis for the selection of taxpayers and tax practitioners that are potential recipients of new customer service initiatives.

The e-Tax Customer Service reference implementation uses IBM Visual Warehouse version 5.2 for this application area.

ELECTRONIC FORMS PROCESSING
The e-Tax Customer Service business scenarios highlight the importance of providing the capability for taxpayers to fill out and submit tax forms over the Internet. This application area is responsible for providing that functionality.

The e-Tax Customer Service reference implementation uses IBM Electronic Forms Processing for Taxes running under AIX for this application area.
References


IBM Application Framework for e-Business Web Site:
http://www.ibm.com/software/ebusiness