IBM Lotus Enterprise Integrator for Domino 7 software.

Real-time access and data management for the intelligent enterprise
Executive summary

Today’s businesses increasingly rely on their information technology infrastructure to create strategic value through enhanced business decision making, reduced information latency and greater supply chain visibility. In this new intelligent enterprise, operational efficiency is not enough. A company’s customers, business partners and employees all demand greater integration and transparency across enterprise data repositories to support collaboration and analysis. Yet even as they make mission-critical infrastructure investments for the sake of their competitive futures, many companies also seek to drive down information technology (IT) costs.

To balance these conflicting forces, IT organizations must find ways to integrate enterprise data sources that can help reduce total cost, compress development timeframes and provide the flexibility and openness required to support constant change. These key benefits define the business value that can be derived from an IBM Lotus® Domino® 7 environment with the addition of IBM Lotus Enterprise Integrator® for Domino software (also known as Lotus Enterprise Integrator software).

Lotus Enterprise Integrator software is a powerful platform for building collaborative applications that access enterprise systems. Lotus Enterprise Integrator software enables rapid connectivity to popular data repositories with point-and-click ease. Depending on business needs, data external to the Lotus Domino server can be transferred to, or synchronized with, a Lotus Domino application, or data can be accessed in real time. Advanced real-time features of Lotus Enterprise Integrator software allow Lotus Domino applications to access and manipulate enterprise data in its native format as though it were located on the Lotus Domino server.
Using Lotus Enterprise Integrator software, companies can bring data from disparate enterprise and Lotus Domino technology-based applications together in a single application. This effectively unifies the business process automation that typically exists within enterprise systems, and makes it accessible from a variety of workstation client options supported by the IBM Lotus Notes® and Lotus Domino software family (for example, Lotus Notes client software, select Web browsers, and select mobile and wireless devices).

No programming is required to establish or maintain access to these external data objects. And business logic and security features defined in the source application are preserved when an application accesses external data through Lotus Enterprise Integrator software.

The business benefits of Lotus Enterprise Integrator software
Lotus Enterprise Integrator software builds on the core integration capabilities of Lotus Domino software and delivers innovative new features that benefit developers, administrators and, ultimately, end users. Here are the potential business benefits for companies that have a Lotus Domino infrastructure:

- **The advanced real-time capabilities enabled by Lotus Enterprise Integrator software allow enterprise data to be a first-class participant in collaborative applications.** Neither the end user of a Lotus Domino application, nor the Lotus Domino developer needs to be concerned about whether data is located on the Lotus Domino server or in another repository.
- **Lotus Enterprise Integrator software can help to extend the value of Lotus Domino services to other enterprise systems and data.** For example, a self-service application can display Oracle software-based data in a Lotus Domino view, access IBM DB2® data from two different servers in the same Lotus Domino view, or perform a full-text search against both Oracle and DB2 repositories at the same time.
With Lotus Enterprise Integrator software, the rapid application development and deployment capabilities of Lotus Domino software are further enhanced by transparent, real-time access to a broad range of enterprise data and applications. For example, developers can create a Lotus Domino software-based user interface as they always have. But instead of building a back-end database on the Lotus Domino server, they would allow Lotus Enterprise Integrator software to connect to external data sources on their behalf.

The ability to utilize Lotus Domino services across heterogeneous enterprise data sources enables organizations to store data in its original format, or in whatever application is most suitable. Thus, the need to move or copy data to support data integration initiatives can be reduced or even eliminated.

Virtual access to data through Lotus Enterprise Integrator software uses Lotus Connector technology, which is designed to preserve application-level business logic, data access rules and security features. Businesses can further leverage current skills and investments in back-end applications, while helping to maintain the integrity of enterprise data.

Simplified data access from a consistent Lotus Notes or Web browser interface can help reduce training requirements and improve the user experience. There is no need to train your employees to use multiple front-end applications specific to each enterprise application they need to access.

To support situations where data transfer may be beneficial, Lotus Enterprise Integrator software allows the transfer or synchronization of data between Lotus Notes databases and external systems like SAP R/3 enterprise resource planning (ERP) software. For example, you might like to make SAP purchase requisitions available in a Lotus Notes database to allow your mobile users to work with this information when disconnected from the network.

Lotus Enterprise Integrator software supports a broad range of server operating systems including Microsoft® Windows® 2000 and Windows 2003, IBM AIX®, IBM i5/OS®, Sun Solaris and Linux® platforms.
For companies with an existing Lotus Domino environment, Lotus Enterprise Integrator software can provide an excellent way to help leverage Lotus Domino investments and Lotus Domino development skills across more applications, especially those that require high-performance access to data in back-end systems.

For businesses newly implementing a Lotus Domino infrastructure, Lotus Enterprise Integrator software offers an easy and exciting way to utilize the unequaled collaborative capabilities of the Lotus Domino architecture in combination with existing data and applications. Organizations of all sizes can help accrue additional value from the skills and technology investments they already have in place.

For software developers, Lotus Enterprise Integrator software enables Lotus Domino applications to operate against external data with essentially no additional development effort. For example, a Lotus Domino technology-based reporting tool can easily be extended to work with a supported relational database management system (RDBMS), simply by leveraging virtual connectivity to the relational data source using the real-time capabilities of Lotus Enterprise Integrator software.

**About this paper**

The remainder of this paper describes the features and capabilities of Lotus Enterprise Integrator 7 software and other Lotus enterprise integration tools in more detail, from a business perspective. Scenarios for using Lotus Enterprise Integrator 7 software to create leading edge business applications are also provided, to help you envision how Lotus Enterprise Integrator software can add value to your strategic applications.
About IBM Lotus Enterprise Integrator software

Lotus Enterprise Integrator software is an enterprise application integration (EAI) tool that provides industrial-strength, bidirectional data movement, exchange, transformation and synchronization across a wide range of applications and data sources. It can perform these interactions on a scheduled or one-time basis, based on a business condition, or simply on demand. Lotus Enterprise Integrator software also provides Lotus Notes and Lotus Domino applications with access to external system data and business logic in real time, helping to ensure access to up-to-date information.

Lotus Enterprise Integrator software uses Lotus Connector technology (described later in this paper) to provide native connectivity at the application programming interface (API) level to many popular enterprise data sources. While optimized to work with Lotus Domino server, Lotus Enterprise Integrator software can also transfer and synchronize data among non-Lotus Domino systems. For example, Lotus Enterprise Integrator software can synchronize data directly between two RDBMS data repositories, without involving Lotus Domino server.

The administrator database provided with Lotus Enterprise Integrator software is an easy-to-use, graphical user interface that enables rapid connectivity to enterprise data without programming (see Figure 1). System integrators use this interface to create connections to external systems, create activities that define the mode of integration and monitor those activities. In keeping with the rapid application development model of Lotus Notes and Lotus Domino software, the Lotus Enterprise Integrator administrator database provides a visual mapping interface to define relationships between systems. It also lets developers take full advantage of the rich programming environment provided by IBM Lotus Domino Designer, Java™, IBM LotusScript® and other Lotus software development tools.
There are two basic tasks associated with implementing an integration solution using the Lotus Enterprise Integrator administrator database. First, connectivity to the data source needs to be defined by creating a connection document. The connection document holds information such as the database name and user credentials needed to authenticate with that database. It also contains information specific to the data source (for example, how to handle transactions in a relational database, or whether or not to enforce formulas on Lotus Notes forms).

Second, the specific function that Lotus Enterprise Integrator software will perform is defined by creating an activity document. For activities that synchronize or transfer data, activity documents hold information about how the data is transferred. For activities that execute a command or program, activity documents store path information and parameters used by that command or program. Real-time activity documents define virtual enterprise data objects that allow the application to treat external data as though it were maintained locally.
One of the challenges in integrating data from disparate systems is how to handle an inherent or implemented nuance of one of the systems involved. For example, documents in a Lotus Notes and Lotus Domino environment offer the option to use multivalue fields. Relational database records do not support this construct, and alternatively treat each of these values as an individual record. Lotus Enterprise Integrator software provides the capability to take multiple records from a data source table and collapse them to a single form field, or perform the reverse operation to expand the data into multiple records. This concept will be further illustrated in the “Virtual fields” section of this paper (beginning on page 20).

Numerous enhancements have been made to the administrator database in Lotus Enterprise Integrator 7 software to make development and administration easier than ever. Before delving into a description of data management and real-time activities, let’s take a look at how new and enhanced capabilities in Version 7 can further benefit your business.

What’s new in Lotus Enterprise Integrator for Domino 7 software
Lotus Enterprise Integrator for Domino software provides the ability to access popular RDBMS and ERP environments in a variety of ways (such as real time, batch, event driven or user initiated), offering a choice of nonprogrammatic and programmatic methods. Version 6 delivered major enhancements, particularly in the area of real-time integration, to those that were provided in earlier versions.

Lotus Enterprise Integrator 7 software continues to evolve by delivering enhanced functionality to its real-time and data management activities. Administrators and developers will welcome the productivity and usability enhancements to the Lotus Enterprise Integrator administrator database (the interface used for application integration as well as administration). IT managers will appreciate the improvements in reliability, availability and serviceability as beneficial to the objectives of their businesses.
Lotus Domino applications often leverage data from external systems to support mission-critical business processes. Maximizing the availability of enterprise integration tools is crucial to the success of these applications. Lotus Enterprise Integrator for Domino 7 software incorporates failover support that leverages the proven cluster replication technology of Lotus Domino software. Data management activities are set up to run on one of a designated set of servers in a cluster. When a server detects that another server in the cluster is down, it searches for that server's eligible activities and runs them. To prevent conflicts, failover servers responsible for running an activity are listed in priority order in the activity definition. The first active failover server on the list runs the activity.

Virtual document activities have been enhanced so that external system events are now synchronized in the Lotus Domino environment. With Version 6, only new records added directly to the external system could be made available to Lotus Domino applications through virtual documents. With Lotus Enterprise Integrator 7 software, update and delete events on the external system can be automatically reflected in Lotus Domino server as well. Thus, regardless of where the changes are made—Lotus Domino server or the external system—the data is synchronized.

Enhancements to the visual mapping capabilities in Lotus Enterprise Integrator 7 software offer even more power and flexibility for the nonprogrammatic integration of enterprise data into Lotus Domino applications. Mapping fields between data sources in activity documents can sometimes be challenging if the tables, views or procedures have many fields. To make this task easier for developers, Lotus Enterprise Integrator 7 software has added the ability to guess which fields should be mapped. When you click the guess button, the software analyzes field names and data types (see Figure 2). The resulting display presents you with suggestions for possible mappings. In this example, the software suggests that PARTNUM may be a logical choice to map to PART, and DESCRIPTION may relate to DESC. And the dialog box allows you to validate or make corrections to the guesses.
Here are some additional ways that the new features of Lotus Enterprise Integrator 7 software build on the proven capabilities of Lotus Enterprise Integrator 6 software:

- With simply a click of a button, you can test connectivity to the external systems while defining the connection document.
- With Lotus Enterprise Integrator 7 software, developers have more options when combining a number of activities together as dependent activities. For example, you can define which of multiple dependent activities is run, based on the success or failure of the calling activity.
- Data management activities can now specify a Lotus Notes ID that is different from the one running the Lotus Enterprise Integrator server, if those activities use at least one Lotus Notes connection document. This option allows you to leverage Lotus Domino security features by defining varying levels of access for different Lotus Domino applications accessed using Lotus Enterprise Integrator for Domino software.
- Connection documents for Open Database Connectivity (ODBC) data sources now support the ability to browse external data.
- Improved analytical tools and reporting allow administrators to more easily resolve issues or maintain their Lotus Enterprise Integrator environment.
Even if you are not ready to upgrade your full Lotus Notes and Lotus Domino infrastructure to Version 7, you can still take advantage of the features of Lotus Enterprise Integrator 7 software. All you need to do is install one Lotus Domino 7 server to run Lotus Enterprise Integrator 7 software, and install one Lotus Notes 7 client to work with the Lotus Enterprise Integrator 7 administrator interface.

**Lotus Enterprise Integrator software: data transfer and synchronization**

Data management, or batch mode, facilitates either one-way or bidirectional data flow to keep data synchronized inconspicuously between two databases on a scheduled or event-driven basis. The data management capabilities of Lotus Enterprise Integrator software are designed to help you synchronize static data with minimal use of system resources, such as network bandwidth and processor utilization, while offering high performance.

Lotus Enterprise Integrator software offers a variety of different data management activities designed to meet the data transfer and synchronization requirements of many companies. These activities can be characterized into three groups: activities that perform a one-way transfer of data, activities that synchronize data and activities that execute commands or programs. The following table provides a list of the various data management activities and their purposes.

<table>
<thead>
<tr>
<th>Category</th>
<th>Activity name</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transfer data</td>
<td>Direct transfer</td>
<td>Copies data from A to B</td>
</tr>
<tr>
<td></td>
<td>Archive</td>
<td>Moves data from A to B, deleting from A</td>
</tr>
<tr>
<td>Synchronize data</td>
<td>Replication</td>
<td>Synchronizes data between A and B</td>
</tr>
<tr>
<td>Execute command or program</td>
<td>Command</td>
<td>Executes an operating system command or structured query language (SQL) statement</td>
</tr>
<tr>
<td></td>
<td>Java</td>
<td>Runs a Java program</td>
</tr>
<tr>
<td></td>
<td>Polling</td>
<td>Runs an activity when condition is met or time stamp is updated</td>
</tr>
</tbody>
</table>
Activities that transfer data

Companies often need to transfer data from one data store to another. These data stores may be located on the same system or spread across disparate systems. The source and the target for this transfer are identified by creating connection documents. Lotus Enterprise Integrator software provides two types of activities to accomplish the transfer of data.

The direct transfer activity copies data from a source to a target. Depending on the specific data store, data can be accessed from a table, view, stored procedure or, in the case of Lotus Notes and Lotus Domino databases, a form or view. Once the source and target have been defined, the next step is to map the fields. This is simply done using a point-and-click interface or using the new guess feature in Lotus Enterprise Integrator 7 software. Then data to be transferred is identified by using a structured query language (SQL) statement for relational databases and a select statement for Lotus Domino technology-based applications.

A number of options allow direct transfer activities to perform special functions when the activities run. For example, an ability to create data definitions (also known as metadata) for the target at run time allows data to be transferred dynamically—even if the target metadata has not been previously created. If the target contains data that has become obsolete, the direct transfer can overwrite the existing data. For example, this option could be useful if you are transferring monthly sales report data, and only the latest month’s data needs to be available in the target.

A variant of the direct transfer activity is the archive activity. The archive activity performs the same operation as the direct transfer activity and then deletes data from the source once the transfer is complete. This activity can be helpful to reduce database size, improve indexing performance and free up hardware resources.
Activities that synchronize data

A typical enterprise integration requirement is to keep data synchronized between two data sources. Lotus Enterprise Integrator software provides a replication activity to perform this synchronization. Two variants of the replication activity are available: primary key replication and time-stamp replication.

Primary key replication provides unidirectional synchronization of data from the source to the target. With unidirectional synchronization, the target data set always reflects the source. This option is useful when changes are made in only one data store, and another data store needs to contain the same data. Primary key replication replicates data based on a unique key, common to both connections, that can be composed of one or more fields in the metadata. The function of the primary key is to determine if matching records exist in both data sources and if an update to a record, the insertion of a new record or the deletion of a record is required.

Figure 3. The replication activity document provides an intuitive interface to define data synchronization.
While one-way synchronization of data is very useful, there are many times when changes are made in both data sources. To facilitate bidirectional synchronization of data, Lotus Enterprise Integrator software provides time-stamp replication. As does primary key replication, time-stamp replication uses a unique key to establish the relationship between data records in the source and target. Since changes may be made to the same record in both the source and target, it uses a time stamp to determine which record should overwrite the other. The record with the most recent time stamp wins.

Activities that execute a command or program
At times, more business logic needs to be applied than can be accomplished with declarative activities like direct transfer or synchronization. Lotus Enterprise Integrator software provides the ability to run an agent written in the LotusScript programming language that leverages the Lotus Connector LotusScript Extension (LSX). More information about the Lotus Connector LSX can be found in the section of this paper titled “Lotus Connector technology and enterprise integration options” (beginning on page 28). For developers who prefer to write their integration solutions in the Java language, Lotus Enterprise Integrator software also includes a Java activity that allows you to call a Java program.

In other cases, you may want to execute an SQL command against an external system to update data on a scheduled basis. Or you may want to run a stored procedure as part of an integration solution in order to execute some business logic after a direct transfer completes. Either of these options can be accomplished with the command activity of Lotus Enterprise Integrator software. The command activity allows operating system commands to be executed as well as database-specific commands. An example of a database-specific command is a formula written using the Lotus Notes formula language.
Activities triggered by events
Lotus Enterprise Integrator software commands can be run on a scheduled, manual or event-driven basis. Data management activity documents provide granular control over scheduling. For example, activities can be set to run at a specific time of day, day of the week or day of the month. Administrators can also specify the repeat interval for an activity. The Lotus Enterprise Integrator scheduler ensures that your activities will run according to the schedule that you specify.

Sometimes you need to execute activities when an event has taken place. Lotus Enterprise Integrator software provides two ways to accomplish this. One way is to use a feature called dependent activities that allows you to chain data management activities together. As mentioned earlier in the “What’s new in Lotus Enterprise Integrator for Domino 7 software” section of this paper (beginning on page 8), Lotus Enterprise Integrator 7 software offers you more granular control when setting up dependent activities. For example, you can define which of two dependent activities is run, based on the success or failure of the calling activity.

Another option is to use the polling activity to run one or more activities when an action or event occurs. For example, you may want to run a replication activity when information about a new customer is added to a customer relationship management (CRM) database. Newly added customer records have a status field that has a value of new. The polling activity would check for records that have a status field with a value of new, and then run a replication activity to synchronize that database with Lotus Domino server. The polling activity can then reset the value of the status field to current, so that record would not meet the criteria the next time the polling activity runs.
Lotus Enterprise Integrator software: real-time access to enterprise data

When you add the real-time activities of Lotus Enterprise Integrator software, Version 6 or higher, to a Lotus Domino environment, you essentially build a three-tier application infrastructure. Users can access distributed enterprise data through Lotus Domino server from a wide range of supported client software options. In this environment, illustrated in Figure 4, the user accesses enterprise data directly in the source application. The data, however, exists virtually in the Lotus Domino front end using Lotus Enterprise Integrator software.

![Figure 4. A three-tier application infrastructure for enterprise integration using Lotus software](image)

Real-time data access methods

The real-time capabilities of Lotus Enterprise Integrator software are delivered as virtual objects. Virtual objects allow data stored in external systems to be as easy to access, manipulate and distribute as Lotus Domino data. Support for virtual objects is so thoroughly and pervasively integrated into Lotus Domino software that Lotus Domino services can act on virtual data as though it were stored on the Lotus Domino server. As described on the following pages, virtual objects allow Lotus Domino applications to manipulate documents, views, attachments, fields and agents regardless of whether the data is stored in Lotus Domino server or in an external enterprise system.
Lotus Domino applications can access enterprise data in real time using the following virtual objects:

- **Virtual documents** let users and applications work with external data at the document level, as if it were stored in a database on the Lotus Domino server. Virtual documents from one or more external data sources are enabled to fully participate in Lotus Domino views, thereby creating virtual views.
- **Virtual fields** let users and applications work with external data at the field level as if it were stored in Lotus Domino server.
- **Virtual attachments** let users and applications store attachments in their original formats, while working with them in a Lotus Notes and Lotus Domino environment as document attachments.
- **Virtual agents** enable applications to directly call stored procedures or other business logic in enterprise data sources in the same fashion as running Lotus Domino agents against data on the Lotus Domino server.

**Virtual documents**

Virtual documents are documents stored in external data sources that appear to reside in Lotus Domino server. There is no component of the external document, or any data referencing it, stored natively in the Lotus Domino database (.NSF). In place of *key documents* stored in Lotus Domino server, Lotus Enterprise Integrator software relies on four columns of information that reside in the external data source. These columns can be appended to the external table itself or can create a separate *key table*. Lotus Enterprise Integrator software provides the specifications for the required columns, along with a utility that automatically creates the key table.

The business logic and security that are integral parts of document-level operations in the enterprise data source are fully preserved.
Figure 5 illustrates how virtual documents appear to users.

![Figure 5. Virtual documents in a Lotus Domino application](image.png)

Because virtual documents resemble and act like native Lotus Domino documents, they can be viewed, sorted, deleted or searched in Lotus Domino views.

A major benefit of virtual views (that is, Lotus Domino views that contain virtual documents) is that Lotus Domino services, like workflow and advanced search, can act on enterprise and Lotus Domino data together in collaborative applications, without the need for special coding to enable the integration. A manufacturing company, for instance, could rapidly merge product information from its newly acquired subsidiary directly into its Web-based catalog—without reformattting, moving or copying the new data, and without programming.
Figure 6 illustrates virtual documents in a Lotus Domino view.

Because virtual documents function as if they were documents native to the Lotus Notes and Lotus Domino environment, any create, update or delete event that takes place at the Lotus Domino server applies to the virtual document data. What happens if these events occur in the external system where the virtual documents are stored? In Lotus Enterprise Integrator software, Version 6.x or higher, the virtual documents activity has the ability to synchronize the create event between external system and Lotus Domino server. This means that as new records are created, they are transformed into virtual documents at an interval specified in the activity. At that point, they become available to the Lotus Domino application.
Lotus Enterprise Integrator 7 software enhances synchronization with external events to include updates and deletes. If a virtual document is updated or deleted directly in the external system, those changes are reflected in the Lotus Domino application. For example, Lotus Domino view indexes are updated to reflect the change. By providing the ability to synchronize create, update and delete events, external system applications can manipulate virtual document data, and Lotus Domino server will reflect those changes.

Virtual fields
If Lotus Domino server is already a part of your infrastructure, you may be familiar with the concept of virtual fields as implemented in IBM Lotus Domino Enterprise Connection Services, provided with Lotus Domino software, Release 5 and higher. Virtual fields work similarly in Lotus Domino and Lotus Enterprise Integrator software. That is, documents containing virtual fields can include data stored both externally and in Lotus Domino server. In an auto body example, the key field might be the estimate number. This key can be stored in Lotus Domino server or, in this case, in a virtual document and used to locate the corresponding external record (see Figure 7).

![Figure 7. Virtual fields in a Lotus Domino application](image_url)
However, the implementation of virtual fields supported by Lotus Enterprise Integrator software, Version 6 and higher, offers several important benefits to developers and systems integrators:

- **As with Lotus Domino Enterprise Connection Services**, the link between the native and external data elements is maintained via one or more key fields stored in both the external data source and in the Lotus Domino data store. However, with Lotus Enterprise Integrator software, as we saw in Figure 7, a key field can reside in a virtual document. Thus, there is no need to create new key documents at the Lotus Domino server level when new records are added to the data source.

- **Virtual fields provide access to SAP R/3 systems using a separate product called IBM Lotus Connector for SAP R/3 with MTA and Workflow software.**

- **To streamline and simplify the creation of virtual fields that reference existing external data sets**, Lotus Domino software incorporates a utility for the creation of keys that correspond to external records. With Lotus Enterprise Integrator software, replication can be used to keep key documents synchronized with changes to the external data made by applications that are not based on Lotus Domino technology.

- **Virtual fields support multivalue data** (see Figure 8). That is, multiple rows of data with the same key can be retrieved and stored in multivalue fields. Applications can then display data in a row-and-column format in Lotus Domino server. The developer can specify the order in which data is retrieved.
Virtual attachments

Virtual attachments make it easy to store file attachments transparently in external systems. A virtual attachment is indistinguishable from a native attachment to the end user and the developer alike.

Any file in a supported external system can be virtually attached to a Lotus Domino software-based document—native or virtual. Users and applications can perform any operation with virtual attachments that Lotus Domino software supports for attachments it stores locally, such as Open or Save. The capability of Lotus Notes and Lotus Domino software, Version 6 and higher, to edit attachments in place is also supported.

Virtual attachments are stored in an external table, referencing the document to which the file was attached. However, the file attachment data is stored externally. For example, in a virtual document, the fields that define a virtual attachment are stored in the data source. Virtual attachments for multiple activities can optionally be stored in the same external table. Specifications of the required columns and a utility to create the table automatically are provided with Lotus Enterprise Integrator software.
Virtual agents

Virtual agents are stored procedures or other business logic native to the data source, which are both represented and callable as Lotus Domino agents. Using virtual agents, a Lotus Domino application can directly call the business logic of supported enterprise systems, as if it were running a Lotus Domino agent.

Using virtual agents, Lotus Domino applications can leverage the real-time activities of Lotus Enterprise Integrator software to work with both enterprise data and the distributed applications that store it. The business logic in enterprise systems can now be applied directly to Lotus Domino server-based documents, which themselves may or may not contain virtual data.

Virtual agents represent a tremendously powerful application integration technology for any size business. Take, as an example, a company that maintains automotive repair estimate data in a DB2 database. Using Lotus Enterprise
Integrator software, a Lotus Domino application can now allow users to work with estimate data as virtual documents. Virtual agents could be used to run existing DB2 stored procedures against the estimate data. For instance, to compute the total for the estimate, the manager could select the estimate and trigger a virtual agent to initiate the appropriate stored procedure in the DB2 database.

Figure 10 illustrates virtual agents.

![Virtual agents in a Lotus Domino application](image)

Figure 10. Virtual agents in a Lotus Domino application

Virtual agents can be run using the same mechanisms as native Lotus Domino agents, such as selection from the Actions menu in Lotus Notes software, or called programmatically using the LotusScript programming language.
Regardless of whether the request to run a virtual agent originates from a Lotus Notes client, a Web browser or within Lotus Domino server, the actual parameter access and external procedure calls always occur on the Lotus Domino server. Virtual agents can be executed on native Lotus Domino data, virtual fields or virtual documents. For added flexibility, Lotus Enterprise Integrator software also supports the invocation of stored procedures (or their equivalent in the data source) on a per-event basis, in addition to creating virtual agents.

**Lotus Enterprise Integrator application scenarios**

Virtually every business has data integration requirements. For example:

- Customers need detailed information on the status of order fulfillment.
- The sales force needs information on current inventory levels.
- Client representatives need customer information when traveling.
- Maintenance needs parts data to complete repair orders.
- Manufacturing needs to coordinate production levels, shift by shift, for just-in-time delivery.
- Warehousing needs production schedule information to minimize storage levels and time.

The architecture of the Lotus Domino server and Lotus Notes client, combined with the capabilities of Lotus Enterprise Integrator software, offers a robust, highly flexible foundation for the rapid development and deployment of collaborative applications. Lotus Domino software and Lotus Enterprise Integrator software represent a proven, single-vendor solution that can dramatically simplify the integration issues businesses face as they roll out—and attempt to tie together—mission-critical applications such as customer relationship management, supply chain management, employee or customer self-service, and business intelligence.
The following scenarios illustrate how enterprises might use Lotus Domino and Lotus Enterprise Integrator software to meet business requirements for data integration.

Customer relationship management
A product goods distributor is using an SAP enterprise system to store customer relationship management data. Salespeople need to have customer information with them as they travel. To help them be productive on their sales calls, they need detailed contact information and records of previous and planned interactions with a specific customer. The replication activity of Lotus Enterprise Integrator software can synchronize the SAP data with an application on a Lotus Domino server. Using the proven mobile and offline capabilities of the Lotus Notes client, sales representatives can update the customer relationship information while disconnected. When they connect at a later time, those changes are subsequently synchronized with the SAP system.

Maintenance service application
A real estate management firm needs to address scheduled and impromptu issues that occur at its properties to maintain high customer satisfaction levels. The firm’s technicians often need to submit parts orders and read technical manuals and schematics to address these issues. In order to expedite a resolution, management provides Web browser-based access to a Lotus Domino application that stores this information. The application is populated with part number information from Microsoft SQL Server and technical details from IBM DB2 Universal Database™ software using Lotus Enterprise Integrator software.
Supply chain execution
For manufacturers and distributors, the ability to provide real-time fulfillment information can directly benefit customers by minimizing delays, stock-outs and other unpleasant surprises. Organizations that can deliver real-time answers to queries about order status, shipment receipt and change orders stand to increase their competitiveness by reducing the cost—and the perceived risk—of doing business with them. Making real-time fulfillment data available internally also helps employees schedule new business more efficiently.

Employee self-service
A human resources department stores employee benefits information in an Oracle database. Using Lotus Domino applications in other departments, employees can access their records in real time, using virtual fields.

Customer self-service
By using Lotus Enterprise Integrator software in combination with customer-facing Lotus Domino applications, companies can give their customers the ability to check fulfillment information on request, using a Web browser, or receive it through regular progress reports. For example, Lotus Enterprise Integrator software can provide a real-time link, through Lotus Domino server, to order status acknowledgment documents maintained in an RDBMS.

Business intelligence
Business intelligence capabilities help companies leverage information assets for smarter decision making and real-time control of key processes. With the rapid development capabilities inherent in forms and views, Lotus Domino software can make an excellent platform for business intelligence applications that structure data across multiple dimensions, such as what if scenarios. Lotus Enterprise Integrator software can provide the real-time access to current data that is often essential for on demand, self-service report generation.
Lotus Connector technology and enterprise integration options

Beyond the basic virtual field capabilities of Lotus Domino Enterprise Connection Services, provided with Lotus Domino server, Lotus Enterprise Integrator software enables the advanced real-time integration described in this paper. While virtual fields alone offer excellent support for rapid prototyping and simple queries, IBM recommends Lotus Enterprise Integrator software as a foundation for the majority of production applications that access data residing outside of the Lotus Domino environment. Lotus Enterprise Integrator software also provides solutions that entail the bulk transfer, synchronization or transformation of data.

The IBM Lotus software strategy for enterprise integration emphasizes rapid development, flexibility and openness, enabling organizations to choose the integration methods that meet their precise requirements and maximize existing skills and resources.

To facilitate straightforward access to corporate data wherever it resides, IBM offers Lotus Connectors—modular software that provides native connectivity to a wide range of enterprise systems, using a common object model. Using Lotus Connectors, developers can rapidly create Lotus Domino technology-based applications that connect to, authenticate with, and exchange data among external RDBMS data sources and ERP systems, as well as text files and other data repositories.

Lotus Connectors can be used in combination with Lotus Enterprise Integrator software, Lotus Domino Enterprise Connection Services or the Lotus Connector LotusScript Extension (LSX) technology to access and manipulate corporate data.

You can start with comparatively simple applications, such as single-record employee self-service. When you are ready, you can utilize more powerful types of data integration to create robust, state-of-the-art solutions such as end-to-end supply chain collaboration.
Figure 11 illustrates the IBM Lotus tools for enterprise integration, and how they relate.

Lotus Connectors
Lotus Connectors manage connection, access and data translation operations between Lotus Domino applications and external applications. Lotus Connectors are available as follows:

- A base set of Lotus Connectors is included with the Lotus Domino server. The base connectors include Lotus Connectors for DB2, Oracle, Sybase, Microsoft SQL Server and Microsoft Access using Object Link Embedding database (OLE DB) and file systems. ODBC is also supported, providing access to many additional systems.
- In addition to supporting all of the above, Lotus Enterprise Integrator software includes a text connector.
- A premium Lotus Connector for SAP R/3 is available separately from IBM.
Standard programming interface
Lotus Connectors provide a comprehensive set of properties and interfaces through a standard API. Developers can therefore utilize a consistent programming interface across all Lotus Connectors, and across popular programming languages and scripting tools. The process of integrating ERP data sources with On Demand Business applications is very similar to working with RDBMS sources. This helps organizations to build upon and leverage developer expertise. ERP connectivity takes place at the application level, so all existing business logic is fully preserved.

Lotus Connector LotusScript Extension
The Lotus Connector LSX is designed to enable custom programming to support finely tuned data-access operations. It is included with Lotus Domino server software and can be used in combination with Lotus Enterprise Integrator software, or separately. The Lotus Connector LSX is a set of LotusScript classes that allows developers to call Lotus Connectors from LotusScript programs. This LSX provides Lotus Domino developers with a programming interface that extends Lotus software scripting capabilities to encompass data that resides outside the Lotus Notes and Lotus Domino (.NSF) database format.

Lotus Connector LSX features
While the Lotus Connector LSX provides a common data model across data sources, its use is not restricted to the Lotus Notes document interface. Calls can send and receive data between the application and the data source. Data interchange can be performed in real time, synchronously or asynchronously. Support for connection pooling can help optimize performance, particularly for Web-based applications.

When to use the Lotus Connector LSX
The Lotus Connector LSX is well-suited for creating finely tuned, highly customized data access operations. It is particularly useful for creating business logic that cannot be easily implemented using the standard Lotus Enterprise Integrator activities. In these instances, developers can use the Lotus Connector LSX in combination with LotusScript code; such code is callable in any situation where LotusScript code is supported. To run Lotus Connector LSX code on a scheduled or event-driven basis, applications can call it from a Lotus Enterprise Integrator scripted activity.
Conclusion

Improving business performance has become the focus of many IT organizations. Increasingly, the intelligent enterprise is looking beyond operational efficiency—to address the growing requirement for on demand access to enterprise data to support collaboration and decision making.

Today’s IT organizations must integrate heterogeneous applications and data sources in ways that meet specific business objectives. Using IBM Lotus Enterprise Integrator for Domino software in combination with IBM Lotus Domino server, companies can rapidly bring together data and business logic from a wide range of applications using a single, highly flexible and easy-to-maintain front end. This can be accomplished while minimizing—or possibly eliminating—the need for programming and for duplication of data.

With Lotus Enterprise Integrator 7 and Lotus Domino 7 software, organizations can help interconnect employees, customers and suppliers, and empower the front line of business to drive competitive advantage. The result is stronger business relationships—with the potential to yield higher revenues, improved customer service, compressed cycle times and lower operating costs.

For more information about IBM Lotus Enterprise Integrator for Domino software, please visit:

ibm.com/software/sw-lotus/lei