



IBM Directory Integrator: Overview

A Technical Whitepaper



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Note

Before using this information and the product it supports, read the general information under "Notices" on page 19.

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This edition applies to version 4, release 7.1, of The IBM® Directory Integrator and to all subsequent releases and modifications until otherwise indicated in new editions.

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Chapter 1. Introduction

Increasingly, enterprises are seeking to improve operational efficiencies and expand their businesses by opening their internal systems to a broader community of their systems, employees, customers, and suppliers. A consistent and reliable identity infrastructure enables enterprises to expose their internal processes to their supply chain, their customers, and to the growing mass of automated machine-to-machine transactions. Directories are key enablers for security and application infrastructure in an enterprise, and increasingly, enterprises are looking at their directory selection as a strategic standalone infrastructure decision.

Today, the typical large enterprise has more than 100 disparate application directories spread across their organization. As a result, enterprises are faced with the challenge of managing these different application directories, managing user access to these application directories, and managing the security risks associated with these disparate systems. Metadirectories connect directory data from disparate sources across an organization and apply logic to provide enterprise-level views of directory data. They are important tools commonly used to tie together directories of user information to enable resource authentication and provisioning, for example, Tivoli[®] Access Manager and Identity Manager. The power of metadirectory is that enterprises can quickly and effectively integrate their application-specific directories into an Enterprise Directory while allowing individual departments to continue managing their local directories with their tools of choice. Gartner Group research indicates that over 70% of enterprises with over 1,000 desktops will implement metadirectory technology by year-end 2005.¹

To address this growing need, IBM acquired Metamerge, a metadirectory technology provider, and has released IBM Directory Integrator software based on Metamerge technology. IBM Directory Integrator is integration middleware that provides the authoritative, enterprise-spanning identity infrastructure critical for security and for provisioning applications, such as portals. IBM Directory Integrator provides metadirectory services, as well as integrating a much broader set of information into the identity and resource infrastructure. It does all this without imposing an inflexible centralized database, but enables distributed data management. The IBM Directory Integrator open environment is flexible and extensible, and it is ready to embrace the emerging requirements of Web Services. There is virtually no limitation on the type of data or system with which the IBM Directory Integrator is able to work.

IBM Directory Integrator has a number of built-in connectors to directories, databases, formats and protocols, an open-architecture Java[™] development environment to extend these connectors or create new ones, and tools to configure connectors and apply logic to data as data is processed. IBM Directory Integrator can help you by:

- Synchronizing and exchanging information between applications or directory sources
- Managing data across a variety of data repositories
- Establishing a consistent directory infrastructure that can be used by a wide variety of applications ranging from security and provisioning to Web Services

1. Spring Symposium/ITxpo 2001, May 7-10, 2001.

- Enabling integration of additional directory-based information, such as product and pricing data, to applications beyond traditional user identity and passwords

Unlike many first generation metadirectory products, IBM Directory Integrator reduces complex integration problems into small, manageable processes called AssemblyLines. AssemblyLines represent the individual flow of data between connected systems and are easy to develop and quick to deploy. IBM Directory Integrator considerably reduces the time and cost of resolving highly complex integration challenges.

Why IBM?

IBM has a broad business integration strategy with existing CrossWorlds and WebSphere® offerings in process and application integration, and now a directory integration solution which is a critical yet often overlooked component of an integration strategy.

The IBM open architecture approach with IBM Directory Integrator offers customers the freedom to leverage the directory tools and data they have in place today and to select from a wide variety of IBM and non-IBM solutions that can utilize corporate directory data to provide security and Web Services solutions. Some alternative metadirectory solutions might establish a control point within an enterprise environment by using an older directory-of-directories technology that uses significant network and system resources, is difficult to migrate away from and drives preference for middleware from a limited set of solutions. IBM Directory Integrator supports an open and flexible topology, avoiding the inflexible and resource-intensive characteristics of utilizing a central database. The IBM Directory Integrator non-persistent data store technology provides significant scalability and performance advantages over a centralized database while its Java-based tools provide the openness customers increasingly demand.

Chapter 2. Concepts

Simplify the problem

The IBM approach is to simplify a large integration project by breaking it into individual components, and then to solve it one piece at a time. These pieces are the data flows that represent the movement and translation of information between systems, and in IBM Directory Integrator they are implemented as AssemblyLines. Each AssemblyLine provides a single, intelligent data path, where aggregation, transformation and business logic as well as a wide array of hooks and exception handling mechanisms can be applied to the flow of information.

Making the connections

AssemblyLines consist of bi-directional data access components called Connectors. Each Connector is designed for a specific type of data source, for example, database, directory, message queue, transport and so forth. IBM Directory Integrator offers a comprehensive library of Connectors, which can be selected, configured to the desired input or output settings, and clicked into place in an AssemblyLine. Individual components, as well as the entire AssemblyLine, can be tested and debugged at any time. This turns integration development into an iterative, exploratory process which enables simple translation and aggregation solutions to be completed in a matter of minutes.

Business rules & real-time event handling

When an AssemblyLine is finished, additional logic and functionality can be layered on top of the AssemblyLine by writing and including Java code. Or the additional logic and functionality can be added directly to the solution (for example, in AssemblyLines and components) with any or all of the scripting languages supported by the system. These include JavaScript™, VBscript and PerlScript.

Note: PerlScript is supported on Windows® platforms only.

To support real-time integration of connected systems, IBM Directory Integrator offers a wide selection of EventHandlers. EventHandlers are built around the Connector technology in IBM Directory Integrator, so that each one is specially designed for a specific type of data source. Once connection parameters are established, EventHandlers are configured to wait for change events, such as:

- Database triggers
- Directory changes
- The arrival of new mail on a specified account
- Activity on an IP port
- The appearance of files in a directory or at an FTP site
- Relevant messages appearing on a message bus
- HTTP calls arriving over a predetermined port
- Incoming SOAP messages as part of the Web Services framework

EventHandlers can be activated at specified time intervals, for handling batch-style operation of IBM Directory Integrator AssemblyLines.

Once an EventHandler is started, it can be configured to parse and interpret the change event information received from the source. Based on user-defined logic, the EventHandler can execute one or more AssemblyLines to drive the events through the infrastructure.

Transformation & flexibility

For Connectors and EventHandlers that receive unstructured streams of data (such as files or data arriving over an IP port), IBM Directory Integrator provides a selection of customizable and extensible Parsers. Each Parser is designed to handle a specific data format (such as XML, SOAP or CSV), and can be used both for interpreting the structure of an incoming byte stream, or giving structure to an outgoing stream.

All IBM Directory Integrator components can be altered or extended using Java or the supported scripting languages. In addition, new components can be created, tested and deployed directly from the IBM Directory Integrator user interface.

Chapter 3. IBM Directory Integrator

IBM Directory Integrator is a platform-independent and vendor technology-independent development environment for rapidly building, testing and deploying integration solutions.

Written entirely in Java code, IBM Directory Integrator runs on platforms that offer a Java 2 Virtual Machine (version 1.3 or higher), including Windows, UNIX[®] and Linux. Through its support for most common scripting languages and Internet standards, IBM Directory Integrator enables the seamless integration of heterogeneous platforms and technologies, including competing environments like .NET from Microsoft[®], and J2EE from Sun.

Building blocks

IBM Directory Integrator includes the development and testing environment for creating integration solutions, as well as the run-time server for deploying those integration solutions in the customer's infrastructure.

Solutions are created by plugging together IBM Directory Integrator components—extensible integration objects, each one designed to handle a specific API, protocol, transport or format. IBM Directory Integrator components uniquely abstract away the technical details of connecting to and accessing data in practically any type of database, directory, registry, application or device. IBM Directory Integrator components let integration specialists focus the rules and logic for manipulating and transforming data objects, as well as translating them between various system and functional contexts.

IBM Directory Integrator converts repository-specific data formats and schema into a normalized format, simplifying the creation, upkeep and reuse of solution logic. By enabling users to create and maintain libraries of components and scripts, any part of an existing IBM Directory Integrator implementation can be leveraged to create new solutions.

Transformation and integration development and deployment environment

IBM Directory Integrator is a transformation and integration development and deployment environment providing an innovative software solution that is modular, scalable and extensible. IBM Directory Integrator uniquely provides a non-intrusive solution for database and directory integration, which can serve as a valuable resource for advanced security and Web services applications. Much of the interest in IBM Directory Integrator lies in its ability to simplify a wide range of problems and provide very rapid deployment solutions.

Challenges & opportunities

IBM Directory Integrator was designed to address the specific challenges and opportunities presented by the data transformation and integration needs and requirements of businesses today. Non-intrusive integration with any type of data repository is achieved by defining simple rules to manage the flow, ownership and structure of information from one system (or set of systems) into any other system.

With support for all leading databases, formats and protocols, IBM Directory Integrator provides multiple transport mechanisms to move information between data sources and destinations. IBM Directory Integrator is designed to be deployed in highly distributed environments, both inside the firewall as well as with business partners and customers over private networks or securely across the Internet.

Standards support

IBM Directory Integrator supports most standard protocols, transports, APIs and formats, like JDBC, LDAP, JMS, JNDI and XML, and interacts seamlessly with a wide array of repositories and technologies. No matter what identity infrastructure an organization has deployed or plans to deploy, IBM Directory Integrator provides a robust foundation upon which to build and maintain its integrity over time by integrating it with other directories and databases in the enterprise.

Identity infrastructure

An organization's identity infrastructure might consist of directories, databases, registries, even flat files. IBM Directory Integrator is designed to connect to all these systems. IBM Directory Integrator can connect to directory systems from leading vendors such as Computer Associates, Critical Path, IBM, iPlanet/Sun, Microsoft, Novell, OpenLDAP, OpenWave, Oracle, Siemens and Syntegra, as well as other LDAPv3 compliant directories. Furthermore, IBM Directory Integrator supports popular messaging systems such as Lotus® Domino™ and Microsoft Exchange through their native APIs.

Rapid development and deployment

IBM Directory Integrator can deploy rapidly and is suitable for a wide range of customer needs. The IBM Directory Integrator graphical user interface and integration component libraries let users create data transfer and transformation solutions in record time. The system's built-in debugger and script object watch window make testing and debugging simple, fast and intuitive.

IBM Directory Integrator can be configured to function independent of existing information systems and handle data synchronization at specified times. When integrated into applications, IBM Directory Integrator can also use an event-condition-action paradigm and EventHandlers to react in real-time to business process events. The functionality of IBM Directory Integrator can be extended using scripting languages like JavaScript, Visual Basic and PerlScript. IBM Directory Integrator also provides a rich Java integration API and developer support to enable deep customization capabilities.

Chapter 4. Components

The following are the key components of the IBM Directory Integrator architecture:

AssemblyLines

Execute data flows based on the configuration of individual Connectors, EventHandlers, Parsers, and the business logic driving the process.

EventHandlers

Enable the system to respond to relevant events using an event-condition-action paradigm, enabling real-time integration.

Connectors

Connect to devices, systems or applications and perform actions as appropriate.

Parser Interpret and transform the data flow into the appropriate format.

AssemblyLines

The basic organization of work in IBM Directory Integrator is the AssemblyLine. It describes where data comes from, how it is transformed, and where it ends up. The AssemblyLine does the following:

- Builds a compound information object from connected information sources
- Performs modifications on received data or creates new entries altogether
- Adds/updates/deletes the new information object to the assigned destinations

AssemblyLines use Connectors to interface to a large number of databases, APIs and protocols. Data is transferred, formatted, aggregated and synchronized directly between the connected systems. Local storage is not required in this process. However, this does not preclude multiple repositories from being involved in a single transformation process.

EventHandlers

The EventHandler framework adds to the flexibility of IBM Directory Integrator by providing the ability to wait for, and immediately react to, specific events taking place in the information infrastructure. Examples of events can include:

- Changes in a directory
- Arriving e-mail
- Records updated in certain databases
- Incoming HTML pages from a web server or browser
- Arriving Web Services-based SOAP messages

as well as other types of events defined by the user.

Connectors

Connectors are the building blocks of the AssemblyLine. Connectors describe the information sources and destinations. IBM Directory Integrator offers a number of Connectors, supporting numerous protocols and access mechanisms. Extending an existing Connector is simple, quick and easy. You can create a new Connector or extend an existing Connector with any or all of the scripting languages that the

system supports. The ability to mix and match well-established scripting languages is an enormous cost benefit to companies wanting to avoid retraining of staff.

As the AssemblyLine reads data from Connectors, it performs attribute mapping, examining data fields and doing any necessary modifications before the data is moved to its destinations. Custom scripts can perform advanced functions while the AssemblyLine is executing.

Connectors are assigned modes that impose predefined behavior that in most cases enable rapid deployment of IBM Directory Integrator. The behavior of the assigned modes can be overridden by custom scripting.

Advanced delta functionality is available on Connectors that have been configured to iterate over a set of input data. This reduces the workload on both IBM Directory Integrator and the connected data sources. When enabled, only information that has changed since the last iteration (for example, information that has been modified, added or deleted) is passed by the Connector into the AssemblyLine for processing. The delta service also detects records that are missing from sources when compared to previous iterations. This is an elegant approach that can be applied to a number of situations where a data source is unable to provide information about records that have been deleted.

Parsers

To cater to multiple data formats, IBM Directory Integrator uses components called Parsers. Parsers know how to interpret and translate information from a byte stream into a structured information object, where each piece of information is accessible by name. For example, if a Connector reads from a flat file (or other source such as an e-mail or TCP/IP packet), a Parser enables an administrator to define how the data is structured within the file. IBM Directory Integrator provides a wide range of extensible parsers. For example:

- character-separated values
- fixed column
- LDIF
- XML
- SOAP
- DSML

Parsers can be extended using scripting or Java, or created from scratch from templates provided with IBM Directory Integrator.

Hooks

Hooks enable developers to describe certain actions to be executed under specific circumstances, or at desired points in the execution of an AssemblyLine. IBM Directory Integrator automatically calls these user-defined functions as the AssemblyLine runs. Hooks enable fine-tuning of IBM Directory Integrator to handle any task where other products require complex coding.

The majority of the scripting in IBM Directory Integrator takes place in the Hooks. The customer can build custom logic and error handling in hooks.

Scripting languages

A key capability of IBM Directory Integrator is the ability to extend virtually all of its integration components (for example, Connectors, Parsers and EventHandlers), functions and attributes through scripts or Java. IBM Directory Integrator supports a number of plug-in scripting languages and extensive script libraries, which can be used with every AssemblyLine, Connector, Parser and EventHandler. The most commonly used are JavaScript, VBScript and PerlScript.

Note: PerlScript is supported on Windows platforms only.

Plug-and-play

The plug-and-play functionality of these IBM Directory Integrator components enables rapid prototyping and implementation of intelligent data flows, and is perfectly suited to extending and maintaining an installed solution. The unique multipoint-to-multipoint nature of IBM Directory Integrator enables information objects to be built on-the-fly from multiple sources and delivered into multiple contexts. Synchronization or replication requirements are deployed in minutes to hours, and the highly extensible architecture enables an arbitrary depth of adaptation and customization.

Chapter 5. Connections

IBM Directory Integrator encapsulates a wide range of protocols, formats, APIs and scripting languages. These are listed along with the systems to which they provide connectivity:

Databases

Through its support for JDBC and ODBC, IBM Directory Integrator is able to connect to various database systems. For example:

- CA Ingres
- IBM DB2[®] and Informix[™]
- Sybase
- Oracle
- Progress
- Microsoft Access and SQL Server
- MySQL

as well as other repositories.

Directories

IBM Directory Integrator supports LDAPv3 and JNDI, providing access to directories such as:

- CA eTrust
- Critical Path
- Sun (iPlanet, Sun ONE Directory Server)
- IBM (Lotus Domino and IBM Directory Server)
- NEXOR
- Novell (eDirectory/NDS)
- Microsoft (Active Directory and Exchange)
- OpenLDAP
- Siemens
- Syntegra
- DNS
- Sun NIS

The library includes specific connectors for IBM Lotus Domino, LDAP changelog and event notification (for IBM SecureWay[®], iPlanet/Sun and Active Directory) as well as Windows NT Domains (including Active Directory), and parsers for LDIF and DSML.

Transport protocols & access mechanisms

There are connectors and parsers available for the following protocols:

- file system
- command line
- TCP/IP

- SSL
- LDAP
- JMS
- SNMP
- SOAP
- HTTP
- HTTPS
- FTP
- COM
- POP/IMAP

New protocols can be added through scripting, Java or connecting to COM/ActiveX objects (Windows platform only).

Formats

Parsers are available for:

- XML
- LDIF
- DSML
- CSV
- Tab-separated
- Fixed-length formats

New parsers are easily created to cater for organization-specific formats.

Messaging services

IBM Directory Integrator includes specific connectors for messaging middleware technologies such as:

- FioranoMQ
- IBM MQSeries®
- Progress SonicMQ

Through its support for the JMS specification, other messaging services technologies can also be incorporated into an integration solution.

Web Services

IBM Directory Integrator provides functionality for both publishing and consuming Web Services.

Scripting languages

JavaScript, Visual Basic Script and PerlScript are the most commonly used scripting languages among the numerous plug-in script engines available. Any combination of these can be used within an IBM Directory Integrator solution.

Note: PerlScript is supported on Windows platforms only.

Applications

Solution providers can connect to popular ERP systems, such as SAP R/3 and Peoplesoft, through their underlying database systems, or by creating solutions that talk directly to available application interfaces (APIs).

Platforms

IBM Directory Integrator can run on operating systems including:

- Microsoft Windows NT
- Windows 2000
- Linux
- Solaris
- HP-UX
- IBM AIX[®]

Security

SSLv3 encrypts communications on the wire. The Java Cryptography Extension (JCE) opens a wide range of security capabilities, such as encrypting information in communications and storage, X.509 certificate and key management to integrate with PKI efforts in the enterprise.

Chapter 6. Summary

The Business Problem

There are a wide range of different scenarios for describing the types of integration processes for which IBM Directory Integrator is an ideal solution. However, the most common solutions for our customers and partners are in the area of directory and identity integration.

A directory is defined as being a repository of information about people and resources, optimized for searching and retrieval. This database can be:

- A standards-based directory (for example, LDAP/X.500)
- A messaging-system address book (for example, Notes/Domino)
- A relational database (for example, SQL)
- An e-Business registry (for example, UDDI)

However they are defined, directory services, alongside security services, are the cornerstone of a company's identity infrastructure. A wide-range of cross-company applications require an identity infrastructure for authentication and authorization to applications and resources, for example, application servers servicing Web portals, single sign-on systems and network operating systems.

There is also a requirement for accurate data for use in system-specific application development, for example, a white pages telephone directory, a payroll-based survey, network usage reports, and so forth. The key customer pain is provisioning data to the application systems appropriately to deliver key services. There are two conceptual approaches:

Top-down

Centralized administration of all data sources

Bottom-up

Highly-distributed administration on each system and then subsequent redistribution of data

There are technical and political constraints with both mechanisms leading to 80% solutions, for example, customers get most but not all of what they want. As a consequence, many customers are learning that they need the freedom to choose how to design and grow their transformation and integration architecture organically.

The IBM Solution

IBM Directory Integrator reduces the transformation and integration problem into simple, manageable processes. Multiple processes can be run in tandem to provide a broader solution.

IBM Directory Integrator supports distributed environments through a wide range of communication modes. Servers can communicate through point-to-point channels secured by SSL and digital certificates, through encrypted e-mail, through response-request access to HTML or XML documents or JMS-compliant message bus systems, and can communicate with any other system utilizing Web Services.

By simultaneously supporting both any-to-any and many-to-many architectures, IBM Directory Integrator enables individual approaches to integration which achieve highly customizable enterprise solutions.

This distributed model enables organizations to take a radically new approach to system design in the context of both technology and governance. Control can be given to the information business owner, thereby reducing the impact of the organizational conflicts that invariably occur when cooperation between multiple business environments is required. This is both a business-wise and technically elegant solution that dramatically reduces the deployment time of integration projects.

For more information

For more information about IBM Directory Integrator, contact your IBM marketing representative or visit ibm.com/software/directory

Chapter 7. Glossary

CRM	Customer Relationship Management
CSV	Character-Separated Value
DSML	Directory Services Markup Language
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
HTML	Hypertext Markup Language
HTTP	Hypertext Transfer Protocol
IP	Internet Protocol
JCE	Java Cryptography Extension
LDAP	Lightweight Directory Access Protocol
LDIF	LDAP Data Interchange Format
SNMP	Simple Network Management Protocol
SOAP	Simple Object Access Protocol
SSL	Secure Socket Layer
TCP	Transmission Control Protocol
UDDI	Universal Discovery and Description Interface
WSDL	Web Services Description Language
X.500	The ITU-T Series of recommendations for directory
XML	Extended Markup Language

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