

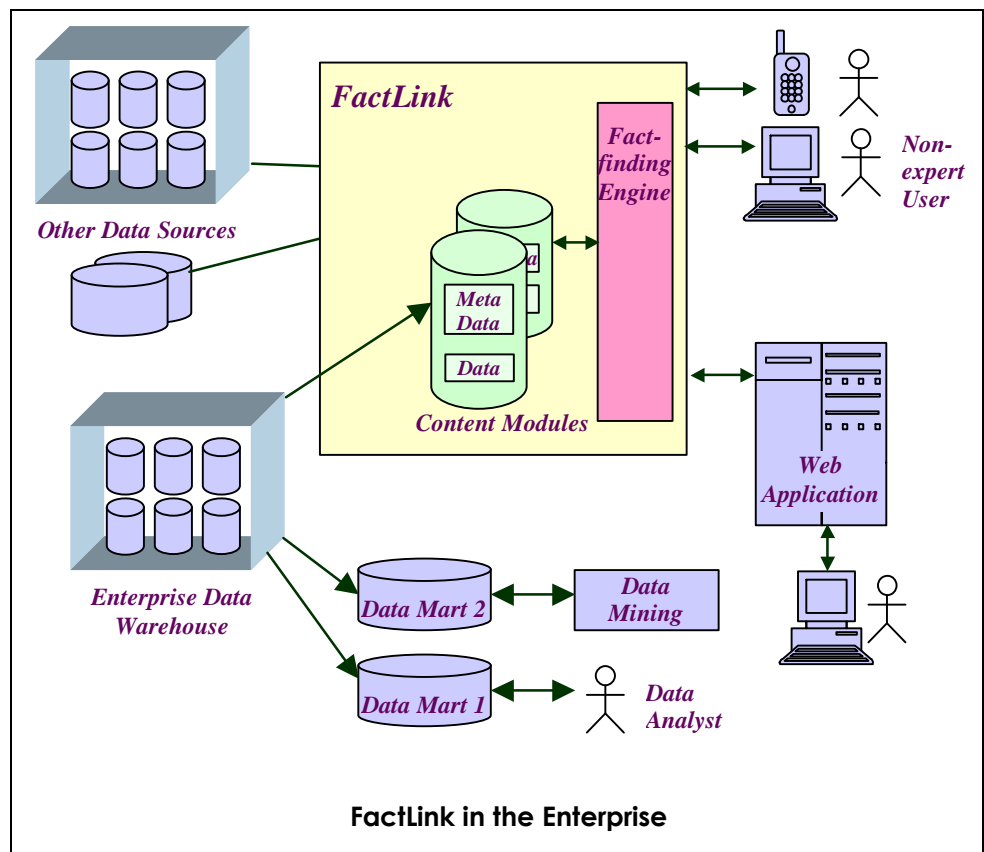


## White Paper: Interactive Data Publishing for the Enterprise with FactLink™

FactLink™ software enables an organization to distribute database content to its customers, employees, and business partners quickly and easily, without custom software development.

With FactLink, an enterprise can make business-critical information—sales and market data, product and inventory information, financial and HR data—immediately accessible to non-technical and non-expert users through web pages, wireless devices, and other in-house or licensed software applications.

FactLink creates an automated index around the combined data assets of an enterprise, enabling end users to search and retrieve



information using intuitive language and familiar key words. FactLink also enriches the value of enterprise databases by providing automated navigational links among related content. As a result, end users can locate and use valuable database content without having to know in which database or format it resides.

FactLink is designed to support rapid application deployment, so that databases throughout the enterprise can be delivered to web, wireless, and other outlets through applications that are designed, developed, tested and deployed in days or weeks rather than months. Once a database has been published, delivery of this information to additional outlets can be accomplished instantly.

FactLink helps to unlock business-critical information by making it directly and broadly accessible to all interested constituencies. FactLink promotes data sharing within an enterprise and among partners and customers, allowing database content to be leveraged within and across organizations.

## The Problem

Almost every organization has a tremendous amount of valuable information stored in databases. In theory, the web should provide an ideal conduit for delivering this information to customers, partners, and employees.

Very few organizations, however, have succeeded in making the contents of these databases broadly and easily accessible to all these interested constituencies. Why? Because it takes a tremendous amount of time and effort to develop an effective, full-featured, web-based database application.

Publishing text or other documents on the Internet is simple: save the document as an HTML page and place it on a web server. Users searching for this information will find the page, and they can use any web browser to access, display, or print the information, and create references or hyperlinks to the page based on its uniform resource locator (URL).

Unfortunately, there's no simple way to place a database onto a web server—web servers were not designed with databases in mind. In fact, until now there have only been three ways to distribute database content via the web:

- Create a custom server-side software application. This approach requires skilled engineering staff and is generally time consuming and costly. In addition, every time you want to change the way the system works it takes additional development and testing—and additional time and cost.
- Use expensive, off-the-shelf software designed for a specific application. This approach often requires you to convert your databases into a very specific format (e.g., a standard product catalog), and it greatly restricts the flexibility you have in how users interact with the database.
- Use skilled data analysts to generate custom reports for each specific information request, and publish the resulting reports on a web page. This approach is very costly and introduces long delays in responding to information requests.

Because it has traditionally been difficult and complex to make databases accessible to larger audiences, the contents of these databases—often the most valuable information assets in the enterprise—remain locked away from the audiences that would benefit most from access to them.

## The Solution

FactLink™ software makes it easy to distribute database content through web pages, wireless devices, or other applications.

FactLink lets end-users search more efficiently for business-critical information throughout the enterprise. They don't need to know where the information resides—in what database, on what server, or in what format—they simply search for the information they want. With FactLink, end-users can search for database contents by entering key words, phrases, or natural language sentences—just as they can when using popular web search engines such as Yahoo or Google.

## Case Studies

The following case studies illustrate the benefits that FactLink provides to enterprise customers.

### Case 1: Financial Services—delivering financial and portfolio data to customers

A major banking institution provides a specialized, subscription-only portal to its high net worth individual customers. They want to enhance the portal with an interactive, ad hoc query system that incorporates information from three sources:

- The bank's customer portfolio management system, which contains detailed portfolio information for each customer

- An external quoting service for equities, bond, and other investment opportunities
- Company news and financial information from a third-party data provider

The system is intended to allow users to ask questions like these:

	User's input	System's response																									
<b>Individual fact</b>	<i>Microsoft net income 1998</i>	In 1998, the net income for Microsoft Corp. was \$7,785 million.																									
<b>Multiple facts</b>	<i>MSFT income '97 '98 '99</i>	<table border="1"> <thead> <tr> <th colspan="4">Annual Form 10-K SEC Filings</th> </tr> <tr> <th colspan="4">Microsoft Corp. US\$ (000,000)</th> </tr> <tr> <th></th> <th>1997</th> <th>1998</th> <th>1999</th> </tr> </thead> <tbody> <tr> <td>Net Income</td> <td>4,490</td> <td>7,785</td> <td>9,421</td> </tr> </tbody> </table>	Annual Form 10-K SEC Filings				Microsoft Corp. US\$ (000,000)					1997	1998	1999	Net Income	4,490	7,785	9,421									
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The IT group has been asked to prototype and test the system in only six weeks. Here are the four steps they follow to get this project done:

- First, they acquire FactLink and install it on a secure server in their corporate data center.
- Second, they configure FactLink so that it knows the format and location of each of the source databases, and the update schedule and security requirements of each one. Linkages to these databases are known as **Data Modules**.
- Third, they create a FactLink **Content Module** for the portfolio management system and the external quote service. The Content Module includes metadata that describes the contents of each database, and indicates the style and format in which information from that database should be presented. The vendor of the third database (company news and financial information) provides a complete FactLink Content Module, so no work is required by the bank.
- Finally, they add a search box to their portal to accept user queries. This search box is called a **FactPort**, and is one of several types of outlets that FactLink uses to deliver database content to end users.

The result is a searchable portal for the bank's non-technical customers, which is every bit as easy to use as a typical search engine. FactLink's automated data management capability ensures that the content that is delivered from each of the three databases sources is kept up to date, and its site management and monitoring tools make it easy for the IT group to maintain system availability. FactLink's business

intelligence services inform IT and management exactly which information the customers are using, enabling them to plan future enhancements to the system.

Months later, the bank decides to add another source of information—a database of independent fund and equities advisors. They also decide to make a subset of information from the portfolio management system accessible to **all** customers through a secure portion of their public web site. Without FactLink, they would have to design, implement, and test a set of major code changes to the existing application, and then create an entirely new application for the public web site.

Instead, they simply create a Data Module and a Content Module for the new database. A one-minute change to the configuration of the FactPort is all that's required to integrate the new database into the portal for high-net-worth customers. An additional five minutes of work creates a second FactPort that delivers a subset of the portfolio database to the bank's public web site. The changes are finished in days, rather than weeks or months.

## Case 2: Market Research - An Interactive, On-line Reporting System

A major market research firm collects and distributes consumer electronics purchase and user satisfaction data through a variety of printed and electronic formats. The company's clients—and its own internal data analysts—have limited web-based access to these data through a custom application that delivers a lengthy pre-formatted report based on one specific brand name, a single product category code, and a single metropolitan area. While the firm has acquired several new database products (quality ratings, new product categories, international sales data), the IT group hasn't yet had the resources available to duplicate the custom application for these new databases.

Using FactLink, the firm takes a new approach to providing on-line database access. The primary goal is to empower their key audiences of internal analysts, end-user customers and consumers, to interact with and query the research data using English keywords and phrases, for example:

*Compare Pioneer & Sony Automotive sales and units in Boston, LA, and Chicago*  
*Top ten sales, profitability New York retail locations*  
*Pittsburgh, Cincinnati highest market share*  
*Leading DVD brand in US, UK, France, Germany*

The product development group tackles this project by acquiring and installing FactLink, creating Data and Content modules for each of their databases, and then creating several kinds of FactPorts:

- A menu-based interface on their subscription site that allows users to choose any number of brands, product categories, and geographic regions, and lets them designate the level of detail and specific categories of information they'd like to see returned.
- An open-format search box on their intranet site enables internal analysts to enter free-form complex information requests that leverage their knowledge of the contents of each of the available databases.
- Product Marketing staff, with a little help from IS/IT, create several standard reports using Excel and Word that embed URLs that invoke FactLink on the fly.

Subscribers now have tremendous flexibility in querying the databases. Analysts no longer need to remember which information is contained in which database—FactLink automatically identifies the correct source for each information request. Users of the new marketing reports can open the file any time they want, and be assured that the report is automatically populated on-the-fly with the most recent available data.

The project improves the bottom line for this market research firm in several different ways:

- Existing high-end subscribers (who use printed, electronic, and interactive reports) value the new reporting features highly because they can get the exact information they need more quickly and efficiently. As a result, they renew at a higher rate, in spite of a subscription price increase.

- New on-line-only offerings expand the subscriber base to a new, much larger market of customers who are able to satisfy their need for information without specialized knowledge or training.
- Internal analysts find that they can use the system to generate two-thirds of all requested custom reports more easily, and with faster turnaround time, that through custom SQL programming.

Finally, the IT department and its team of SQL programmers can focus on data mining and warehousing applications that add value to the firm's raw data sources, while FactLink distributes and manages all the database interactions for non-technical users.

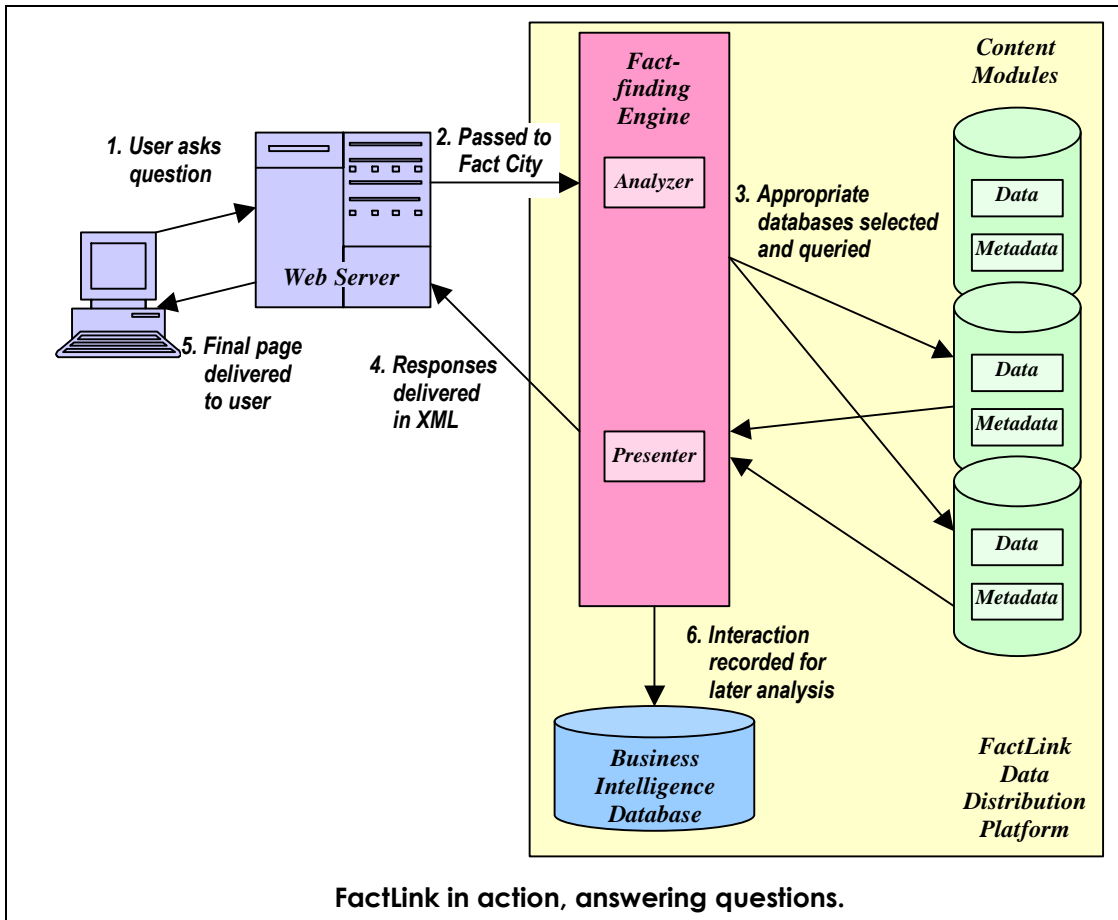
## FactLink Features

FactLink software has a comprehensive set of features that organize, manage, retrieve, and distribute database content. FactLink has three major components:

- *Fact-Finding Engine* The fact-finding engine is scalable, high-performance software for delivering answers to end-user questions. Harnessing the power of Fact City's patent-pending query technology, the fact-finding engine utilizes a straightforward HTTP/XML-based interface to retrieve and deliver answers stored in any number of source databases. This API allows the fact-finding engine to be integrated seamlessly into a customer's web publishing or Intranet infrastructure. A variety of user experiences can be created, ranging from navigational forms-based interfaces to free-form query boxes. The fact-finding engine can scale to tens of millions of queries per day while delivering results in 250 milliseconds or less.
- *Data Management* The data management components of FactLink provide a powerful, modular environment for maintaining, updating, and distributing database content. FactLink organizes database content into **Data Modules**, each of which includes the original data and expanded data generated through FactLink's library of added-value data transformations, and **Content Modules**, which consist of metadata that describes the contents of the database to the fact-finding engine. FactLink accepts databases in their natural format and structure and do not force-fit data into some rigid predefined schema. FactLink provides for fully-automated database updates and transformations that support continuous operation with no downtime. Each content module can have its own schema, value-added transformations, and data update schedule. Any number of content modules can be deployed together for easy access by the fact-finding engine, allowing users to query the modules separately or concurrently in any combination.
- *Business Intelligence* FactLink's integrated business intelligence database delivers detailed insight into how end users interact with database content. Every user interaction is recorded in detail, and these records are processed through FactLink's automated clickstream data warehouse to form a comprehensive database of user behavior. FactLink lets you understand exactly what users are asking, which data assets are generating the most interest, and how the query volume is changing over time. This level of detail is unavailable from ordinary web server logs, which in most cases view all user activity as the same "page view" of a single ASP/JSP page.

## How FactLink Works

The Figure below illustrates how FactLink delivers information in response to a user's request.



An end user interacts with an enterprise web server, which might host a public web site, or a corporate intranet or extranet. The user fills in a form, or enters a question into a question box (1). When the enterprise web server receives an information request, it sends a simple HTTP-formatted request (2) to the fact-finding engine. The fact-finding engine analyzes the query to determine the nature of the information request, and determines the most appropriate SQL query or queries to issue to the available content databases (3). The raw data are extracted from the databases, and processed according to the metadata in the Content Module to create a complete, formatted response. The finished result is communicated back to the web server in XML (4), and composed with static content or information from other sources to deliver the final page to the user (5). A detailed record of the user interaction is recorded in the business intelligence database (6), where it can be used to help understand user behavior and improve the design of the site.

## Inside the Fact-Finding Engine

FactLink uses a unique and innovative method—for which patents are pending—to locate and retrieve relevant database information in response to user queries. The method exploits the fact that database tables are highly structured, and uses the relationships implicit in this structure to interpret the user's request and select the most appropriate responses.

By contrast, there are many software products that attempt instead to improve the quality of content search through natural language processing or semantic analysis and interpretation of search requests. Because these methods fail to exploit the structural relationships inherent in database content, they deliver less accurate and more poorly targeted results.

The figure at the right illustrates how FactLink answers a simple question, *What is the population of Boston, MA?*

The first step is to parse the question, recognizing the individual words and phrases. In this example, both *population* and *Boston, MA* are found in the index of search terms created from each of the available content modules.

Next, the words and phrases are matched to the content modules in which they appear. In this example, the fact-finding engine has found matches for both search terms in a table of demographic information for US cities.

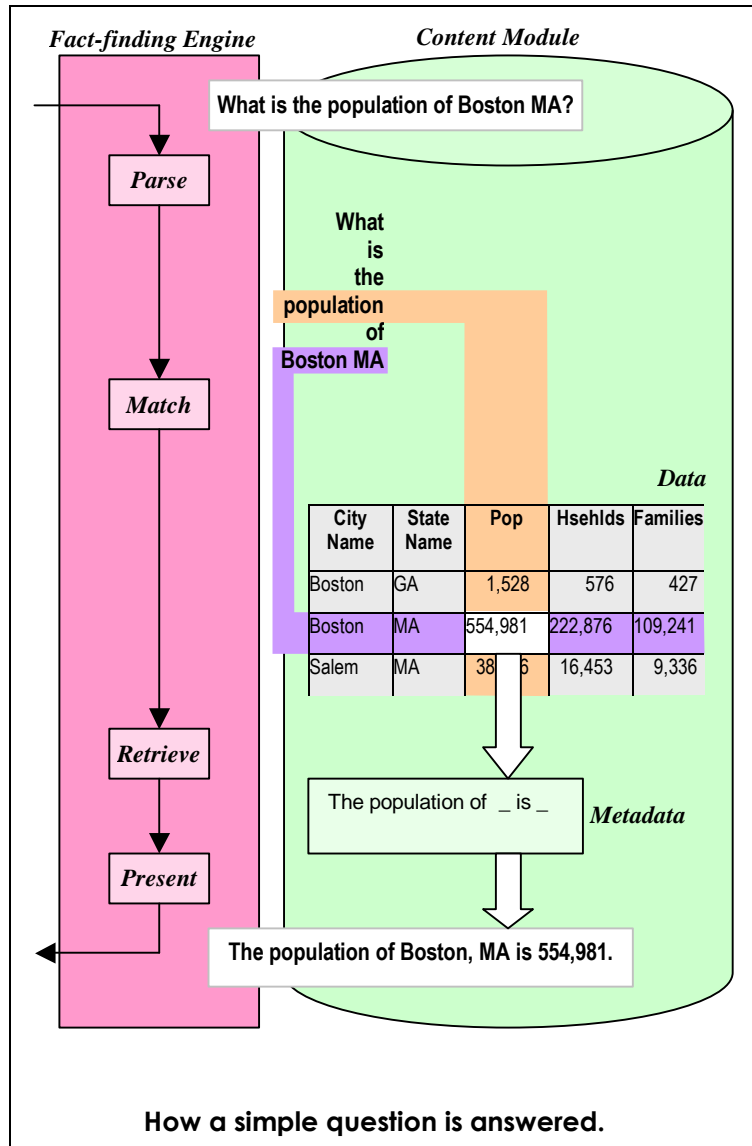
FactLink also knows that *Boston, MA* corresponds to a row of this table, and that the word *population* corresponds with a column. Therefore, relevant data can be found at the intersection of this row and column.

FactLink formulates a SQL query to retrieve the raw data from the table, applies formatting information—in this case, a sentence template that is part of the metadata—and delivers the results to the web server in XML. The web server translates these results to HTML for final presentation.

This example shows a very simple data source, consisting of a single, one-dimensional table. The fact-finding engine is capable of handling much more complex schemas, including those involving multi-table joins, and data of higher dimensionality.

In cases where questions are directed to several content modules at once, a sophisticated ranking and filtering algorithm is used to select the appropriate databases to query, and to omit less relevant answers. When several data sources have potential answers, an optional disambiguation feature engages the user in a dialog to narrow the scope of the query.

The processing steps above are typical of a free-form question. When forms-based interfaces are used, queries bypass much of the parsing and matching phases, and proceed directly to retrieval and presentation. Follow-up hyperlinks, too, follow that path.



## FactLink Features

FactLink is a complete end-to-end solution. When you use FactLink for your online database publishing application, you leverage a sophisticated, mature product that includes a wealth of functional modules to let you tailor the system to the needs of your organization. The following sections describe key features of FactLink.

### Enterprise Features

- *Scalable* Use a cluster of servers to achieve unlimited throughput. FactLink has built-in support for database replication and managing a large site of redundant front-ends and database servers. The FactLink solution has been proven in the field to support loads of 10 million queries per day and more.
- *High Availability* When operating a redundant cluster, perform data and content updates with zero downtime. FactLink's data management services coordinate progressive updating of a cluster, insuring continuous availability to users.
- *J2EE Compliance* FactLink is a fully J2EE-compliant solution, able to run in any Java servlet container supporting Version 2.1 of the servlet specification.
- *Cross-platform* FactLink is available for Windows NT, Solaris, Linux, and other popular operating systems. Relational databases include Oracle, DB2 UDB, and MS SQL Server.
- *Extensible* FactLink's modular structure provides several software APIs for custom extensions.
- *Data Updates* Provide a fully-automated procedure for updating the deployed data. Updates can be performed on any schedule, as frequently as daily. The update process is self-diagnosing and alerts operations staff in the event of failure.
- *Incremental Updates* Perform fully-automated updates using incremental ("delta") data. Use incremental updates in any combination with complete updates, according to the desired update schedule.

### Bringing Data to Users

- *Free-Form Query* Allows users to enter a free-form question and obtain search results. A question can be a complete sentence, such as "What was General Motors' net income in 1997", or just relevant keywords, such as "net income, general motors, 1997".
- *Integrated Results* Delivers search results from multiple content modules in an integrated form.
- *Forms* Create a forms-based interface to database content, allowing users to find information by selecting from menus or filling in the blanks in provided question templates. FactLink's intelligent search term matching retrieves information even if users fill in the blanks with terms that are not exactly the same as what's in the database.
- *Tables* Present information in the form of tables. FactLink tables can be as simple as a single column or row, or very elegant displays of complex three-, four-, and higher dimension data. Headings and subheadings are automatically generated, with optional color banding. The layout can be specified in advance, or dynamically chosen at run-time based on the data being displayed.
- *Sentences* Present direct answers to questions in the form of sentences. For example, if the question is "General Motors net income in 1997," the answer could be "Net Income for General Motors Corporation in 1997 was \$6,698M."
- *Rosters* Present answers in the form of titled lists. This is especially effective for information like the officers of a corporation, the branch offices in a particular state, and so on.
- *Adaptive Presentation* Dynamically choose the best presentation based on the amount of data in the answer. For example, "General Motors net income in 1997" might return a single sentence, but "General Motors, Ford, Chrysler net income in 1997" might result in a table presentation.

- **Relevance Filter** Control the number of alternative answers that are presented based on relevance to the original question, or on how precise the answer is.
- **Proper Names** Intelligently interpret proper names.
- **Dates** Retrieve information organized by date by recognizing a variety of user input formats (e.g., *yesterday, August 1996, 12/2000, March '01, last week, this year*)
- **Alternatives** Recognize alternative search terms that might be affiliated with the same database content. For example, a company could be searched either by its full name or by its stock ticker symbol.
- **Additional Search Terms** Create new synonyms or search terms that match to existing database content. Search terms can be added for nicknames or colloquialisms; for example, *JFK* for *John F. Kennedy*.
- **Punctuation** Intelligently search database fields containing punctuation. For example, if the database contains *Knape & Vogt Manufacturing*, the system could respond to both *Knape & Vogt Manufacturing* and *Knape and Vogt Manufacturing*.

## Data Exploration Capabilities

- **Default Queries**  
Present basic information about a topic when the user is not specific about what he's looking for.

*In the example illustrated to the right, the query "General Motors" does not indicate what information the user is seeking about General Motors. The default query feature enables the system to respond with a basic set of facts about GM, such as a*

*brief corporate summary. Combined with the follow-ups feature, the user can then explore the data and find the information he is looking for.*

Company Snapshot			
GENERAL MOTORS CORP (GM:NYSE), US DOLLARS			
	1996	1997	2000
Sales	155,495,000,000	175,558,000,000	184,532,000,000
Income	2,956,000,000	8,002,000,000	4,452,000,000
EPS	27.84	6.82	8.18
	<a href="#">Assets, Income, Cash from Operations, Ratios</a>	<a href="#">Assets, Income, Cash from Operations, Ratios</a>	<a href="#">Assets, Income, Cash from Operations, Ratios</a>

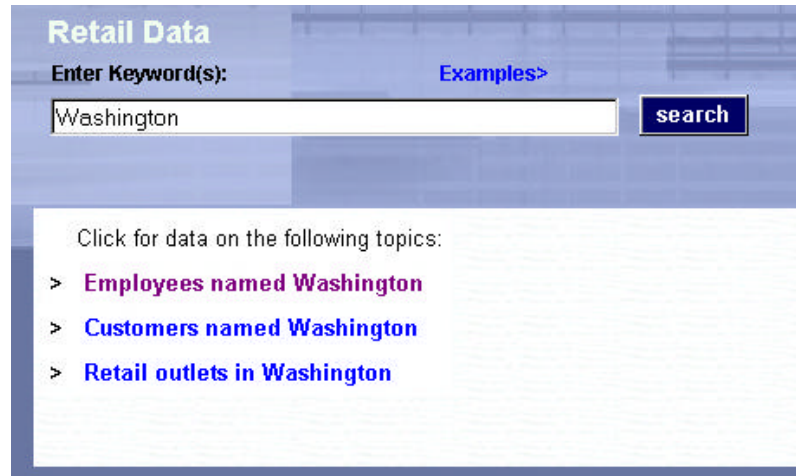
GENERAL MOTORS CORP DESIGNS, MANUFACTURES, ASSEMBLES AND SELLS AUTOMOBILES AND TRUCKS INCLUDING AUTOMOTIVE SYSTEMS AND COMPONENTS, SUCH AS CHASSIS, INTERIOR, LIGHTING, ELECTRONICS, POWER AND SIGNAL DISTRIBUTION, ENERGY AND ENGINE MANAGEMENT, STEERING AND THERMAL SYSTEMS; PROVIDES BROAD RANGE OF FINANCIAL SERVICES, INCLUDING CONSUMER VEHICLE FINANCING, FULL-SERVICE LEASING AND FLEET LEASING, DEALER FINANCING, CAR AND TRUCK EXTENDED SERVICE CONTRACTS, RESIDENTIAL AND COMMERCIAL MORTGAGE SERVICES, AND VEHICLE AND HOMEOWNERS INSURANCE; AND DESIGNS, MANUFACTURES AND MARKETS LOCOMOTIVE AND HEAVY-DUTY TRANSMISSIONS.

[Resume Snapshot](#)

- **Follow-Ups** Adorn each answer with hyperlinks that lead to related information. For example, the answer "Net Income for General Motors Corporation in 1997 was \$6,698M" could be accompanied by links to the complete income statement for General Motors, to results for other years, and so on.
- **Data Gaps** Respond intelligently even when data contains gaps. Automatically display the most relevant or current existing data.
- **Aggregation** Roll up fine-grained data into coarse-grained data, giving users the ability to view the data at the level that interests them most.
- **Extrema** Derive the answers to questions like "who had the most ...", "what has the least ...", "what are the top ...". These derivations are highly configurable, and can make distinctions like recognizing that "best" means the same as "most" when talking about ROI or a basketball score, but "best" means the same as "least" when talking about payback period or a golf score.

- *Disambiguation* Help users refine ambiguous searches by presenting them with choices drawn from different datasets.

*In the example to the right, the user has typed Washington on a corporate portal having several kinds of information that match the word "Washington." The disambiguation module responds by asking the user what kind of information he wants.*



- *Added Content* Supplement the raw data with related human-authored content. Especially, augment data that is only present in encoded form with human readable and searchable translations.
- *Computed Data* Derive useful information by performing calculations on the raw data. For example, if the raw data includes share price and shares outstanding, calculate the market cap.

## Application Integration

- *XML Output* Deliver output from a query in flexible XML form. This is ideal when FactLink is serving as a data back-end to another application. The XML format is designed for easy translation into HTML, while providing additional meta-information to help an application integrate the data in the best possible way.

```
<?xml version="1.0" ?>
<FactSets RP="100" RL="63" RR="63">
  <QuestionText>population boston ma</QuestionText>
  <FactSet RANK="1.0" TOPIC="cac_dispatcher">
    <SentencesFact>
      <Sentence>
        In Boston, MA, the estimated total
        population for 2000 is 554,981.
      </Sentence>
      <FollowUpSet DESCRIPTION="More">
        <FollowUp HREF="...">Population</FollowUp>
      </FollowUpSet>
    </SentencesFact>
  </FactSet>
</FactSets>
```

- *HTML Output* Deliver complete HTML pages directly to the end user. FactLink offers a simple “boilerplate” mechanism that allows database content to be inserted into any predefined page design, and a highly configurable style sheet that gives the designer a wealth of choices in presenting answers whether they are in the form of sentences, tables, rosters, or whatever. Or, supply your own style sheet using the standard XSL style sheet language. Combined with the multiport distribution feature, one server can simultaneously serve data in several different HTML forms, or in combination with XML.
- *Taxonomy* Classify content modules according to their information content. Taxonomic classifications are delivered in XML along with answers, to help drive the assembly of other page content such as related site links. Different query boxes can be directed to particular taxonomic groups of information, allowing for the design of complex sites that have search capability at several different levels.

- *Multiport Distribution* Use one server deployment to serve several different sites, each with a different look and feel and different combinations of content. Each site has a different URL to access the data in its own way.

## Business Intelligence

- *Transactions* Analyze the total number of queries and the number of responses. Break the numbers down by date, time of day, by type of interaction and type of response. Analyze by taxonomic categories to discover which content areas are generating the most interest. Analyze by distribution point to see what user interfaces are most effective.
- *Query Stream* Identify the most popular queries. Learn what questions are *not* answered by the existing data. Use this information to refine the content you distribute.
- *Sessions* Analyze the length of time individual users spend on the site. Analyze the rate at which they return. Determine how their behavior changes the more they use the system.
- *Trails* Perform in-depth analysis of complete user interactions, click by click. See how users interact with all the navigational elements you provide. Identify areas where the user experience could be improved.

## FactLink: Interactive Data Publishing for the Enterprise

FactLink™ software enables an organization to distribute database content to its customers, employees, and business partners quickly and easily, without custom software development. FactLink allows an enterprise to:

- Provide end-user access to data through a familiar, convenient search interface, leveraging a sophisticated, patent-pending technology for delivering database content
- Design, create, test, and deploy interactive web-database applications in days or weeks, rather than months, without requiring trained software engineering or database programming staff.
- Develop sophisticated input forms and data presentation interfaces using standard, predefined templates and presentation methods, producing a professional, polished system without complex web page design or coding.
- Effortlessly deliver different combinations of enterprise data assets to different outlets, including other web-based enterprise applications.
- Tap directly into existing enterprise databases, without requiring any export, import, or duplication of data, and making full use of existing security systems and interfaces.
- Utilize an enterprise-class framework that scales smoothly from low-volume, single database applications to high volume applications involving the simultaneous distribution of hundreds of databases

By bringing data assets together, and facilitating the development of intuitive user interfaces for non-technical users, FactLink adds value to existing raw data assets and puts them in the hands of decision-makers throughout the enterprise.

Talk to Fact City today to find out how FactLink can unlock the value in your company's data assets.



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