IO Informatics – The Sentient Suite

Our software, The Sentient Suite, allows a user to assemble, view, analyze and search very disparate information in a common environment. The disparate data can be numeric values, images, spreadsheets, web content, public or private databases, or information from applications. This ensures the life scientist gets access to all of the information pertaining to the discovery task at hand, guaranteeing that no stone is left unturned and all evidence is considered when it comes to making crucial drug discovery decisions.

Background -

IO Informatics has produced tools that integrate heterogeneous data to solve knowledge management and project management problems for the Life Sciences industry. Users can integrate, analyze and apply complex data at a fraction of the cost and time normally required. The only other option available today is costly, complicated software and very expensive middleware.

The Sentient Desktop integrates data, applications, databases and instruments into one interoperable environment which is secure and regulatory compliant. Users can access, query and utilize data from sources regardless of format and location, using existing hardware and information technology infrastructure. "Intelligent Objects" act as agents on behalf of data and users, providing efficient data analysis, annotation and creation of relationships. Drug Discovery Managers, Physicians at the point-of-care, or Informatics Experts gain meaningful interaction with the information they need to make informed decisions.

IO Informatics software transforms isolated, incompatible data sets into virtual databases -

For far less time and investment, users can search, link, correlate and manipulate data sets - including scientific data, images, databases, spreadsheets, web content, and other proprietary file formats. For the first time, users gain meaningfully integrated access to all data content, including scientific data and analytical output, not just federated databases, standardized meta-data, file names or header content. Without programming, middleware, or new standards, users can define virtual databases. Data points are linked via very small software entities called Intelligent Multidimensional Objects (IMOs). Data content can remain in their original format and location, with associated IMOs kept locally or remotely, across networks or in centralized storage.

The following products were released May 2004, with new versions released in July 2005:

• Sentient Expert Query - web query which enables cross database query of over 160 pre-selected scientific web databases, and which we can customize for any set of web databases. (Example) To search for GABA (an amino acid) on Google will return 665,000 hits of information, where our Expert query goes directly to the data, in a pre-selected discipline and returns with 8 relevant sets of information.
• Sentient Form Query - easy-to-use form based profiler which enables selective queries and audited reports across disparate data sources. Reports can be saved, linked to source data and mined for value.
• Sentient Desktop - transforms disparate resources into validated "active object" databases and processing grids to support rapid creation of systems-oriented applications without programming. Data management and analysis features are integrated, with instrument control, audit, workflow and collaboration, as well as complex data definition, linking, analysis, query and alerting available to the least computer-savvy end-user.

The Sentient Desktop provides image management and analysis, unified data acquisition, access controls, process management, and collaboration support. Users can view, search, annotate, analyze, update, link and move data quickly and intuitively. The technology does not require mark ups, standards, software wrapping middleware or server clusters.

The Potential –

Using widely available statistics for the drug discovery process, we believe the IO Informatics applications have the potential to save:

- 4-6 months in experimental drug design
- 6 months in data acquisition
- 8-12 months in target validation
- 6-12 months in lead selection and validation
- 4-12 months in pre-clinical trials
- 6-12 months in clinical trials

If $500,000,000 and 7 years is a good number for the cost of a new drug, that would indicate that if we could save, on average, 3.5 years – or even half that – The Sentient Desktop is worth an evaluation!

And, it all runs with Microsoft technology – it runs on a Windows desktop, and can use SQL Server as a source or a repository for objects created by Sentient which transforms disparate resources into validated "active object" databases and processing grids to support rapid creation of systems-oriented applications without programming. Data management and analysis features are integrated, with instrument control, audit, workflow and collaboration, as well as complex data definition, linking, analysis, query and alerting available to the least computer-savvy end-user. IO interactive data objects are accessible through Sharepoint Portals, and can be used to activate Infopath forms and can integrate/aggregate Infopath data; to create a unified database environment that integrates Infopath data with virtually all other data types!

Broad applications:

Life Science informatics – drug discovery, development and trials; disease and treatment profiles/market integration; clinical trials, clinical event tracking and alerting.

Ontology import and curation; structuring of data by end-users (IT expertise not required); end-to-end audit of ALL data and applications usage.

Healthcare informatics – improves healthcare data access, integration and secure distribution, evidence-based medicine and informatics.

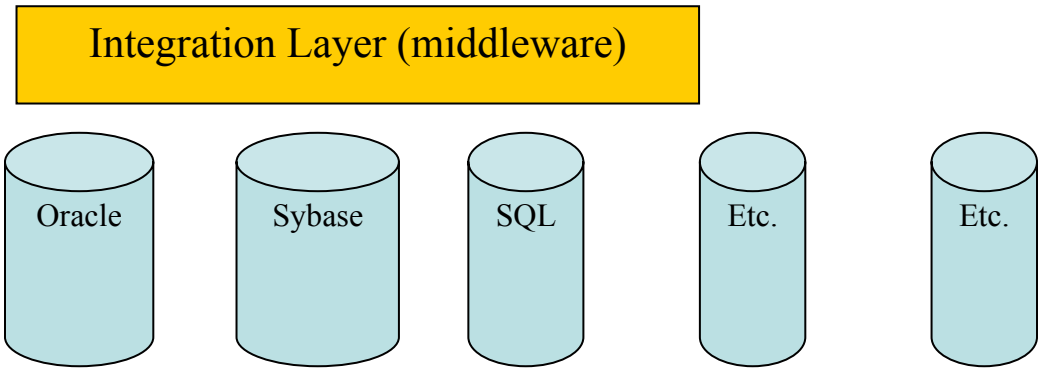
A completely new kind of 'integrated' (a secure, mobile, distributable database) healthcare record.

Differentiating Technology and Intellectual Capital

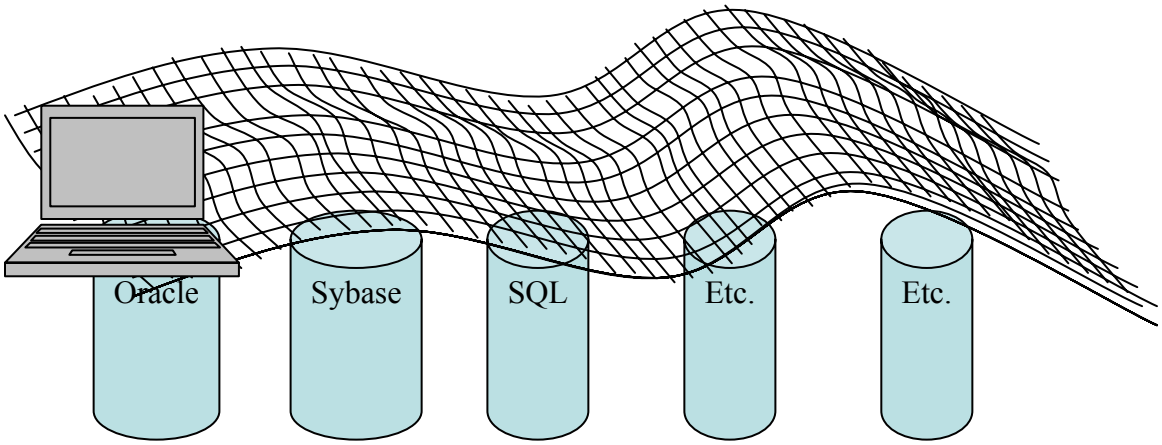
IO Informatics' revolutionary technology represents truly discontinuous innovation, and makes normally inert data 'active' by integrating three **patent-pending** innovations. First, by packaging 'state' and 'relationship' information with data, it transforms data into intelligent objects or knowledge agents, and makes them essentially aware of their content and context. Second, the technology adds value to the user because it has a unifying querying and information-handling environment for normalization of data from different origins. Third, IO Informatics' data agents populate a virtual global data pool of previously dispersed data, creating an integrated database of associated information. The result is an entirely new way of thinking about information. Unlike many other approaches to data integration and the creation of higher order intelligent objects, the IO Informatics approach does NOT rely on a common integration layer (middleware), or a common interpretive language (standards), it simply uses the power of active data association to help users create knowledge, and it does it all from the user's PC.

Problem Addressed

Data access and integration is a major problem for organizations of all sizes. In many instances, disparate data of different formats are spread over incompatible systems. Data is collected but is not accessible easily to the users, or is isolated. Clearly, data can be examined in isolation, but normally cannot be examined according to relationships with other data not held within the same system without physically moving the data or creating costly 'bridges' or integration layers.



Often, attempts are made to integrate data using some sort of 'integration layer' or middleware. Many times data is lost or altered by attempts to use common data formats to integrate systems. Data relationships and context are lost. As a result, it is difficult to leverage the full value from the data collected, particularly data collected in different system or geographic locations. Expensive consulting efforts, massive middleware systems, and intrusive standards are attempts many companies have made to deal with the problem.



IO Informatics creates a 'net' of associated data

The IO Informatics approach is completely different, leaving intact the data in its resident data store and state, and overlaying an associative, non-destructive architecture that is PC based. The impact is dramatic, the cost to implement is significantly reduced, and the benefits to the users are instantly recognizable. This is data integration in a completely new way.

Industry-focused applications modules

IO Informatics has developed a horizontal data integration approach that is applicable to many industries. However, the first market of focus is the Life Sciences market. The company is positioned to market the IO Informatics family of products into other specific industries or vertical markets, which have large data-handling problems. The following is a discussion of our primary market and then an example of how the technology can be applied in another market.

Life Sciences and Drug Discovery

Life Science Informatics –

User-centered Data Integration, Knowledge Building, Process Management

Laboratory Information Management Systems / Scientific Data Management Systems (LIMS / SDMS) - "Beyond LIMS" - IO Informatics has entered the Life Sciences / Drug Discovery market with an advanced product set for scientific data management and data mining that resolves currently "unsolvable" market pains and open new paths to value for its users.

IO Informatics solves known, difficult problems for scientific data acquisition and management through its creation of an object-oriented, active data management system that provides an interactive virtual database for integrating and managing data from multiple systems and potentially stored in multiple locations.

IO Informatics technology moves "Beyond LIMS" by providing simultaneous querying across web, relational and object-oriented data sources; pattern recognition and / or direct user interactivity to enable analysis and querying of previously unstructured scientific data and cybernetic, agentive properties to their software products. IO Informatics has intellectual property and a software architecture that enables query-based data agency and neural network functionality. These innovative methods are applied to scientific data content and relationship analysis, data description and utilization within a user-interactive, object-oriented environment.

Proteomics Application –

2DE (protein image data) Analysis

The concepts underlying the Query and Desktop products have been proven for a specific application that has data needs far more demanding than most industry applications. The software's image analysis strengths combine with its data management and integration environment to create a powerful product for analysis of protein data.

This is an application for analyzing the thousands of proteins contained in two-dimensional gel separation of a biological sample. The application identifies, quantifies and compares proteins from small or large numbers of gels in minutes. It quickly acquires data directly from the gel image or from existing images (or parts of images) in public or private databases. Using the Desktop and Query tools, it finds and ranks correlations with data from any other biological database that is linked to those proteins, in a fraction of the time required by current methods. This is an exceedingly demanding yet critical application for the Life Science and drug discovery market.

"IO Informatics technology allows us to coalesce information gathered during our scientific processes for categorization, normalization (in the database sense), submitting to the proper databases, and returning information back in a way useful for interpretation. The end result is a data set that returns meaningful organized information which takes advantage of all available computer resources rather than searching several hundred databases for the information needed. All of this is completed in a timely, well-organized fashion that allows our scientists to look at data, compose literature, develop new experiments, and write grants better and faster than ever before."

Nathan Pedrick
Research Technician
IuPu Indianapolis (Indiana University -- Purdue University, Indianapolis) -Biotechnology Research and Training Center –Indiana University School of Medicine ---Indianapolis, IN

Benefits to Customers/ Competitive Advantage

- An easy-to-use, simple to install cross-database query method answers critical questions using comprehensive data sets. The query integrates hundreds of databases of user choice in seconds, using a laptop or PC. It delivers selective, audited, controllable output reports for research in seconds that would normally take hours or days to complete. It delivers secure, tracked and audited analysis, process management and use and exchange of critical corporate information across previously incompatible, distributed systems.

- Integration of existing instruments, computing hardware, applications and data resources for improved functionality, with limited software and no additional hardware costs. Value added to existing tools with no new middleware, databases or standards required.

- Faster, more efficient and scalable access to, and analysis of, data in different formats, silos and locations. Revolutionary speed and scalability becomes available, even for data which were previously difficult to access and time-consuming to analyze.

- Uniquely powerful image data analysis, with “universal” pattern recognition, annotation and linking. These functions allow the user to analyze, query, associate data, and to turn unstructured data into searchable decisive knowledge.

- Immediate benefits through low price points for compared value, ease of use, and rapid installation without disrupting existing infrastructure.

These benefits translate to improved information management with lower information technology costs. There is almost immediate return on investment, with efficient, comprehensive querying and reporting at easier adoption and lower total cost of ownership, and automation of corporate processes without redefining users’ existing systems.

Potential within a Single Life Sciences Customer

Potential within the Life Sciences informatics space is excellent. A current customer, Berlex Biosciences (Richmond, CA) demonstrates a pattern of adoption and potential for rapidly expanding sales. Based on the ability of the current product to solve previously intractable image informatics problems for a user group, (in this case, search and comparison of Zeiss microscopy images), Berlex has stated that they see potential for expanding the product across multiple users and groups within the large company. Image informatics alone has the opportunity for use by several hundred users in this enterprise.

IO Informatics products released in May 2004:

Form Query: queries a combination of local and remote relational databases from a single interface, and installs and runs from a laptop or PC without middleware installation or standards requirements.

Expert Query: queries any combination of over 100 web databases, representing a comprehensive data domain, from a single interface. Users may construct their own expert data environments or use the IO Informatics pre-configured Life Science Expert database environment. Installs and runs from a laptop or PC without middleware installation or standards requirements.

Desktop: the "engine" which provides unified data acquisition, access and exchange management, applications integration, process management, and collaboration support. Users can view, search, annotate, analyze, update, link and move data quickly and intuitively. They can access data at the pixel, byte, column/row, and file level. The technology does not require mark ups, standards, software wrapping middleware, or server clusters. The data normalization and comparison feature of the Desktop provides layered information extraction, active linking and querying of data anchor points and annotation.

Included within the Desktop are

Image Analysis Tools*:* the products allow users to easily acquire and analyze images from a variety of image formats and distributed physical storage locations, within a unified analytical framework. The Image Analysis Module preserves raw data integrity at all times, in a regulatory-compliant manner. The tool delivers non-destructive pre-processing, quantification and comparison of entire images and image subset "workspaces" in seconds by evaluating the 'data about the data' that is stored in the meta-data fields and within the framework of the Intelligent Object created by the IO Informatics approach. This feature provides a unified, consistent environment for viewing, analysis; annotation and structuring of visually presented data content.

This feature enables definition, linkage and communication of data subset information contained within multiple related data types, including images and text stored locally or across networks. Using simple point and click, drag and drop and text entry methods, the user can create and save ad hoc definitions of content subsets and to export values reflecting in these selected contents for functional linking and comparison across IMOs and 3rd party reference data within a universal content integration environment.

By addressing intra-data elements, objects and workspaces as defined subsets that can be as small as a single byte, the Image Analysis tool delivers fine-grained, highly efficient direct accessing, and functionally relevant presentation of visual data.

Point-and-Click Query: points at data elements and workspaces within the Sentient Desktop environment to automatically set up and fill queries for the Expert Query requirements.

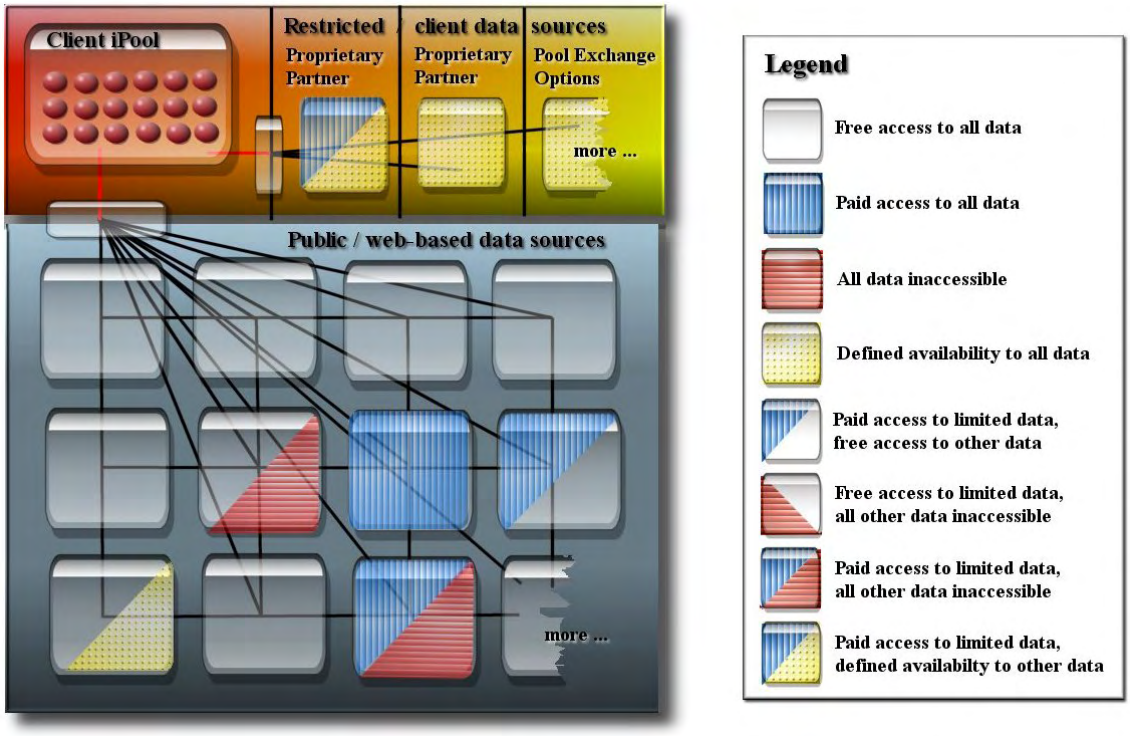


Figure 5: Data Pool Access and the Creation of Relationships