A Visible Solution Paper

A Strategic Approach to Data Warehouse Development

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The business-driven, data-centric Enterprise Engineering methodology pioneered by *Visible* provides an effective, productive, common sense approach to developing strategic data (information) warehouses.

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What is an Information Warehouse?

An "Information Warehouse" is a collection of computer-based information that is critical to successful execution of enterprise initiatives.

The *Visible* definition of an information warehouse expands the concept of data warehouse. An information warehouse is more than an archive for corporate data and more than a new way of accessing corporate data. An information warehouse is a subject-oriented repository designed with enterprise-wide access in mind. It provides tools to satisfy the information needs of enterprise managers at all organizational levels — not just for complex data queries, but as a general facility for getting quick, accurate, and often insightful information. An information warehouse is designed so that users can recognize the information they want and access that information using simple tools.

An information warehouse is a blending of technologies, including relational and multidimensional databases, client/server architecture, graphical user interfaces and more. Operational (legacy) systems create, update and delete production data that "feed" the information warehouse. The principal reason for developing an information warehouse is to integrate operational data from various sources into a single and consistent architecture that supports analysis and decision-making within the enterprise.

For those enterprises that believe information is a valuable resource, an information warehouse is analogous to a physical warehouse. Operational systems create data "parts" that are loaded into the warehouse. Some of those parts are summarized into information "components" and stored in the warehouse. Information warehouse users make requests and are delivered information "products" that are created from the components and parts stored in the warehouse.

Information warehousing is one of the hottest industry trends — for good reason. A well-defined and properly implemented information warehouse can be a valuable competitive tool.

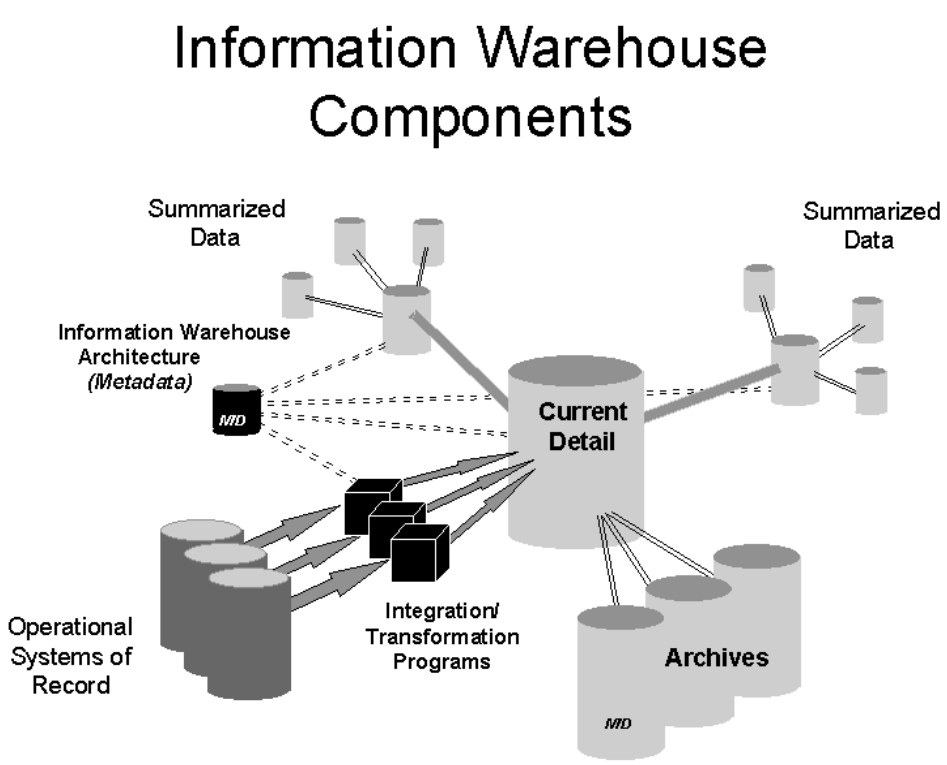
Information Warehouse Benefits

Implementing an information warehouse provides significant benefits -- many tangible, some intangible.

- **More cost-effective decision making**. An information warehouse allows reduction of staff and computer resources required to support queries and reports against operational and production databases. This typically offers significant savings. Having an information warehouse also eliminates the resource drain on production systems when executing long-running, complex queries and reports.
- **Better enterprise intelligence**. Increased quality and flexibility of enterprise analysis arises from the multi-tiered data structures of an information warehouse that support data ranging from detailed transactional level to high-level summary information. Guaranteed data accuracy and reliability result from ensuring that an information warehouse contains only "trusted" data.
- **Enhanced customer service**. An enterprise can maintain better customer relationships by correlating all customer data via a single information warehouse architecture.
- **Business reengineering**. Allowing unlimited analysis of enterprise information often provides insights into enterprise processes that may yield breakthrough ideas for reengineering those processes. Just defining the requirements for an information warehouse results in better enterprise goals and measures. Knowing what information is important to an enterprise will provide direction and priority for reengineering efforts.
- **Information system reengineering**. An information warehouse that is based upon enterprise-wide data requirements provides a cost-effective means of establishing both data standardization and operational system interoperability. Information warehouse development can be an effective first step in reengineering the enterprise’s legacy systems.

Information Warehouse Components

The following primer describes each of the components of an information warehouse (see figure). This description is based upon the work of W. H. Inmon, credited as the father of the data warehouse concept.



Summarized Data

- *Lightly summarized data* are the hallmark of an information warehouse. All enterprise elements (department, region, function, etc.) do not have the same information requirements, so effective information warehouse design provides for customized, lightly summarized data for every enterprise element (see Data Mart, below). An enterprise element may have access to both detailed and summarized data, but there will be much less than the total stored in current detail.

  Highly summarized data are primarily for enterprise executives. Highly summarized data can come from either the lightly summarized data used by enterprise elements or from current detail. Data volume at this level is much less than other levels and represents an eclectic collection supporting a wide variety of needs and interests. In addition to access to highly summarized data, executives also have the capability of accessing increasing levels of detail through a "drill down" process.

Current Detail

- The heart of an information warehouse is its *current detail*, where the bulk of data resides. Current detail comes directly from operational systems and may be stored as raw data or as aggregations of raw data. Current detail, organized by subject area, represents the entire enterprise, rather than a given application.

Current detail is the lowest level of data granularity in the information warehouse. Every data entity in current detail is a snapshot, at a moment in time, representing the instance when the data are accurate. Current detail is typically two to five years old. Current detail refreshment occurs as frequently as necessary to support enterprise requirements.

System of Record

- A *system of record* is the source of the data that feed the information warehouse. Data in an information warehouse differ from operational systems data in that they can only be read, not modified. Thus, it is necessary that an information warehouse be populated with the highest quality data available, i.e., data that are most timely, complete, accurate, and have the best structural conformance to the information warehouse. Often these data are closest to the source of entry into the production environment. In other cases, a system of record may be one containing already summarized data.

Integration and Transformation Programs

- Even the highest quality operational data cannot usually be copied, as is, into an information warehouse. Raw operational data are virtually unintelligible to most end users. Additionally, operational data seldom conform to the logical, subject-oriented structure of an information warehouse. Further, different operational systems represent data differently, use different codes for the same thing, squeeze multiple pieces of information into one field, and more. Operational systems in most enterprises have been developed independent of a common data architecture, which means that most operational data are stored and managed redundantly and may even reside in many different physical sources: old mainframe files, non-relational databases, indexed flat files, even proprietary tape and card-based systems. These operational data must be cleaned up, edited, and reformatted before being loaded into an information warehouse.

  As operational data items pass from their systems of record to an information warehouse, integration and transformation programs convert them from application-specific data into enterprise data. These integration and transformation programs perform functions such as:

- Reformatting, recalculating, or modifying key structures
- Adding time elements
- Identifying default values
- Supplying logic to choose between multiple data sources
- Summarizing, tallying, and merging data from multiple sources

- When either operational or information warehouse environments change, integration and transformation programs are modified to reflect that change.

Archives

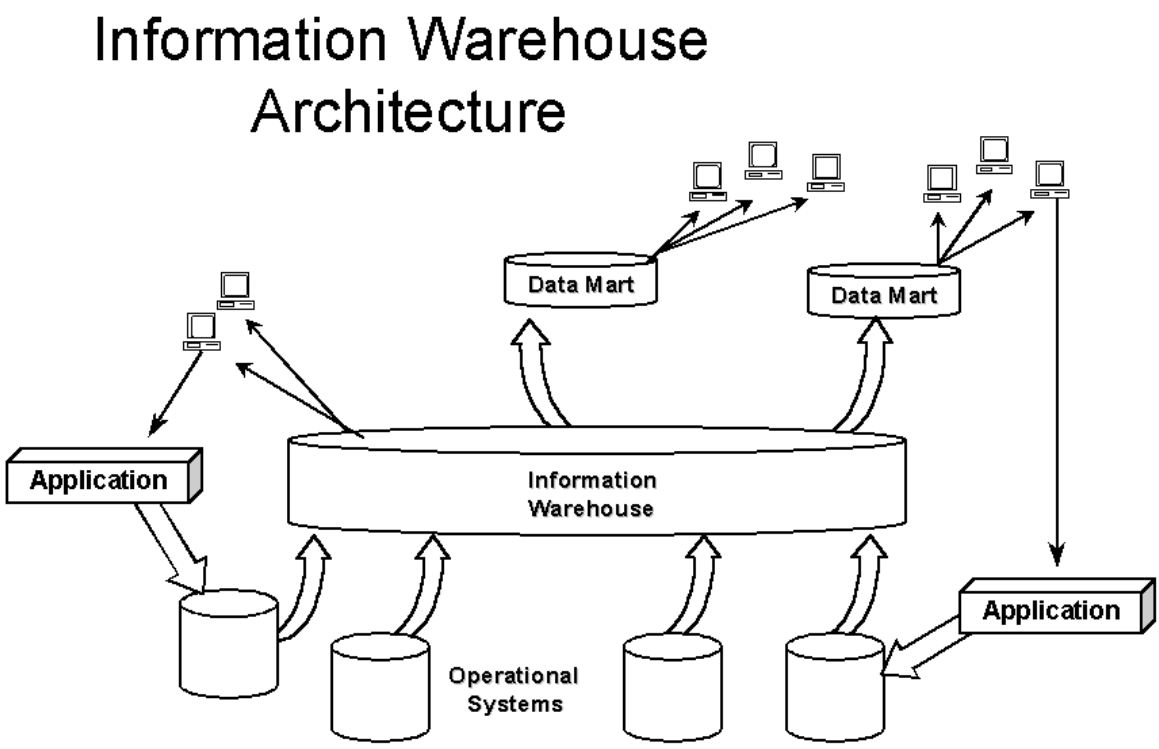
- Information warehouse archives contain old data (normally over two years old) of significant, continuing interest and value to the enterprise. There is usually a massive amount of data stored in the information warehouse archives, with a low incidence of access. Archive data are most often used for forecasting and trend analysis. Although archive data may be stored with the same level of granularity as current detail, it is more likely that archive data are aggregated as they are archived. Archives include not only old data (in raw or summarized form); they also include the metadata that describes the old data's characteristics.

Metadata

- One of the most important parts of an information warehouse is its metadata — or data about data. Also called information warehouse architecture, metadata is integral to all levels of the information warehouse, but exists and functions in a different dimension from other warehouse data. Metadata that is used by information warehouse developers to manage and control information warehouse creation and maintenance resides outside the information warehouse. Metadata for information warehouse users is part of the information warehouse itself and controls access and analysis of the information warehouse contents. To an information warehouse user, metadata is like a "card catalog" to the subjects available.

Information Warehouse Structure

An information warehouse may have any of several structures:



- **Physical Information Warehouse** - physical database in which all the data for the information warehouse are stored, along with metadata and processing logic for scrubbing, organizing, packaging and processing the detail data.
- **Logical Information Warehouse** - also contains metadata, including enterprise rules and processing logic for scrubbing, organizing, packaging and processing the data, but does not contain actual data. Instead, it contains the information necessary to access the data wherever they reside. This structure is effective only when there is a single source for the data and they are known to be accurate and timely.
- **Data Mart** - subset of an enterprise-wide information warehouse, which typically supports an enterprise element (department, region, function, etc.). As part of an iterative information warehouse development process, an enterprise builds a series of physical data marts over time and links them via an enterprise-wide logical information warehouse or feeds them from a single physical warehouse.

Information Warehouse Development

There are three popular "approaches" for information warehousing. Unfortunately, two of them are quick-fix solutions that ultimately waste resources and do not fully meet enterprise information needs.

- *Data Dump* -- all enterprise data are replicated or made available with no attempt to "scrub" or even categorize the data. This is like dumping all the contents of a physical warehouse in the middle of the floor – new stuff, old stuff, and broken stuff -- and asking your customers to pick out what they need from the pile.
- *Magic Window* -- to the data wherever they exist in the enterprise, again without ensuring data quality. This is like a big sack in which there are rubies and emeralds and gold nuggets and broken glass and rat droppings and poisonous snakes. Sometimes you can "mine" a gem, but at some point you will quit putting your hand in the bag.
- *Strategic Information Warehouse* -- results in enterprise information based upon business requirements and a common data architecture!

The *Visible* methodology and computer-based tools provide flexibility and capability to easily develop an enterprise-wide, strategic information warehouse.

What is Visible Advantage*?*

Visible has pioneered a business-driven, data-centric Enterprise Engineering methodology uniquely suited for information warehouse development. Coupled with *Visible*'s highly sophisticated, Computer-Assisted System Engineering (CASE) tool, *Visible Advantage* ä , the methodology provides a practical and effective way to develop an information warehouse.

Visible Advantage is a computer-based, enterprise engineering support system that can be a valuable asset to any enterprise involved in information warehouse development. *Visible Advantage* includes an integrated encyclopedia (see box: "What Is a *Visible Advantage* Encyclopedia?"), extensive reporting capability, and state-of-the-art modeling, charting, analysis and information system design tools.

Visible Advantage includes *Visible*-developed database applications, reports, utilities, and interfaces. *Visible Advantage* has menus and forms that provide easy access to its powerful tools. These features, along with automatic prompts and on-line "Help," make *Visible Advantage* very user-friendly. *Visible Advantage* is Windows™-based and is available in both stand-alone and enterprise (Novellä and WindowsNTä) versions.

For those enterprises that have not begun to develop an Enterprise Information Architecture, *Visible*'s *Universal Model* accelerates the development of the architecture and provides a foundation for the information warehouse. The *Universal Model* reflects *Visible*'s over 20 years of business and *Enterprise Engineering* experience. The *Universal Model* is a high-level data model containing nearly 50 business subject areas and encompassing over 400 entities with 1,000 attributes.

The *Visible* Universal Model is based on the premise that there are a common set of functions performed by all enterprises -- business and government. In the *Universal*

Model, these functions are grouped into subject areas (business objects). The *Universal Model* shows the relationships between the business objects, as well as the relationships between the data entities that are necessary to support the object.

By starting to build its enterprise data architecture with the *Universal Model*, an enterprise will significantly reduce the time and resources necessary to develop its information warehouse. Only the specific detailed data elements that reflect the enterprises unique information requirements (and possibly its competitive advantage) need to be added to the model.

What is the Visible Approach?

Visible has discovered that the key to success in information warehouse development is using an iterative approach that includes active participation of potential information warehouse users.

Like any other large information systems project, information warehouse development can get bogged down if the scope is too broad and the number of people involved is too large. A clear purpose and scope is necessary to manage the application of information systems resources, as well as the expectations of potential information warehouse users. *Visible* limits the scope by building an information warehouse one data mart at a time. Each data mart supports a single organizational element, enterprise function or business object (e.g., customer, product, account, etc.), and the scope of development is limited by the data mart requirements. For the initial data mart, which usually provides the information warehouse proof-of-concept, the scope must be sufficient to provide real, immediate, and high profile benefits. After the first data mart is developed and implemented, additional data marts can be developed and integrated over time as enterprise needs dictate and as resources are available.

Designing and developing an information warehouse using the *Visible* Enterprise Engineering approach involves five very different activities: (1) establish sponsorship; (2) identify enterprise needs; (3) design information warehouse architecture; (4) apply appropriate technology; and (5) implement the information warehouse.

1. Establish Sponsorship

- The first step is to establish sponsorship for the information warehouse, if it does not already exist. Establishing the right sponsorship chain will help ensure successful development and implementation. The sponsorship chain includes an information warehousing manager and two other key individuals. At the top of the chain is an executive sponsor with resources to invest in information infrastructure improvement. A project "driver" between the executive sponsor and the warehousing manager keeps the project moving and on schedule.

  An important aspect of establishing sponsorship is ensuring everyone in the

enterprise understands the purpose of the information warehouse, its potential benefits, and the enterprise's plan for implementation. The plan should be developed early in the information warehouse engineering cycle and should address all of the remaining activities.

2. Identify Enterprise Needs

- Identifying enterprise needs is a major component in the engineering life cycle for any information system, and it is crucial when engineering an information warehouse. When developing operational systems, there is often one single enterprise sponsor or one group of users with a clear view of what they need, what the system should look like, and how it should function. Conversely, when developing an information warehouse, there are normally multiple potential users, each with a different idea of what an information warehouse is and what it should provide, and all requesting or demanding action. Because of this lack of a single focused direction, identifying precise enterprise needs is critical to the success of an information warehouse project.

  Visible expresses enterprise information warehouse needs in terms of enterprise measures and critical success factors. An enterprise's business plans typically provide the basis for defining preliminary enterprise needs. *Visible* also interviews key enterprise managers and analyzes other pertinent documentation to determine whether the enterprise is ready to begin developing a strategic information warehouse. *Visible*'s findings are presented to enterprise management in the form of a *Visible Information Warehouse Evaluation Report* that describes the critical success factors for information warehouse development, how the enterprise currently addresses the success factors, and a preliminary plan for overcoming shortfalls.

  Once, information warehouse development actually begins, *Visible* conducts a series of facilitated focus group sessions to refine preliminary enterprise information needs gathered from business plans and executives. (If no business or performance plans exist, similar sessions can be used to create the plans.) The participants in any these sessions are the potential information warehouse users for whom the information is important.

Determine Measurement Cycles

- Completely defining an enterprise measure includes describing the cycles or time periods used for the measure. Are quarters, months, or hours appropriate for capturing useful measurement data? How much historical data will be needed? These vary greatly by enterprise. The United States Federal Reserve Bank views enterprise measures in monthly, quarterly and annual increments and uses years of historical data to determine trends in the economy. An insurance company requires decades of actuarial data for meaningful measures. A telephone sales operation, on the other hand, uses hourly enterprise measures and may only keep a few weeks of information.

Validate Measures

- After identifying and defining enterprise needs, it is advantageous to communicate them throughout the enterprise. One of the best justifications for undertaking an architecture project is the synergy achieved through the process of defining and then communicating its critical success factors and measures. Everyone becomes aware of precisely what defines success and how it is measured. In addition, the measures undergo a "reality check" by people who were not involved in their development, but who may be measured by them and who will be involved in creating the raw data from which the measures will be derived. Their feedback is used for refining the measures.

Resolve Data Conflicts

- A well-defined information warehouse model cannot contain homonyms, synonyms, and other data definition conflicts. The reason these data conflicts may exist is because most enterprises have one or more major terms that are used by everyone in the enterprise, but mean different things in different organizational units. One of the most commonly misused terms is "customer."

  To the Accounting Department, "customer" could mean the organization (or individual) that receives a bill. "Customer" could also mean an individual receiving service or buying a product. To the Sales Department, "customer" could mean the organizations on which the salesperson calls. Providing any one of these interpretations as the enterprise definition of "customer" would not meet the needs of the enterprise and would doom its information warehouse effort to failure. Additionally, each department could use different names to describe the same data entity (Customer vs. Client vs. Prospect vs…).

  Visible takes great pains to resolve all data conflicts in the information warehouse model before continuing with the next phase of the development cycle.

Build an Enterprise Model

- *Visible* documents enterprise measures and critical success factors as planning statements in an *Visible Advantage* encyclopedia, and documents the supporting information warehouse data entities in a corresponding data model. Information warehouse data entities are those that, at any point in time, tell information warehouse users how well their enterprise is performing. Providing a clear and unambiguous definition of every warehouse data entity, describing the way each is used, as well as defining derivation formulas, aggregation categories and time periods, are activities critical to capturing a clear understanding of an enterprise's measures. The resulting enterprise architecture model (see "Blueprint for an Information Warehouse"), which links enterprise needs with information warehouse data entities and enterprise rules, becomes both requirements documentation and a source for communicating the contents of the information warehouse (its metadata) to its users.

Blueprint for an Information Warehouse

"Engineering" an information warehouse is a lot like "engineering" a physical warehouse. Both involve a rigorous development cycle and require the right tools.

A building is constructed using architectural diagrams (blueprints) that clearly depict the building's infrastructure (structural elements, walls, electrical wiring, plumbing, etc.). *Visible* builds information warehouses from architectural models of enterprise infrastructure (policies, goals, measures, critical success factors, etc.).

Blueprints are also used to enlarge a building or make any significant modifications. Without a diagram of the infrastructure, such changes are quite difficult and very costly. It is the same with information warehouses. *Visible* first updates an enterprise's architecture model so that it reflects changes (new product lines or services, for example) and then modifies the information warehouse to support the changed enterprise.

Information warehouse engineering is easier and less costly when based upon an accurate architectural model of the enterprise. Further, an information warehouse is easier to use and consistently produces desired outcomes when decision-makers have access to an enterprise architecture (metadata) that accurately reflects enterprise infrastructure.

Identify Systems of Record

- Clearly defining enterprise information warehouse architecture also involves identifying the correct source of raw operational data to populate the information warehouse. This effort also addresses possible integration and transformation logic. Identifying the systems of record for information warehouse data entities is one means of validating enterprise measures.

3. Design Information Warehouse Architecture

- After defining and thoroughly documenting enterprise needs (measures and critical success factors), *Visible* begins actual information warehouse architecture (metadata) design. This activity also involves active user participation in facilitated design sessions. There are two types of information warehouse metadata: structural and access.

  Structural metadata is used for creation and maintenance of the information warehouse. It fully describes information warehouse structure and content. The basic building block of structural metadata is a model that describes its data entities, their characteristics, and how they are related to one another. The way potential information warehouse users currently use, or intend to use, enterprise

measures provides insight into how to best serve them from the information warehouse, i.e., what data entities to include and how to aggregate detailed data entities. A *Visible Advantage* information warehouse data model provides a means of documenting and identifying both strategic and operational uses of enterprise measures. It also provides the capability to document multi-dimensional summarization of detail data.

Naturally, the number and specificity of data aggregation categories in an information warehouse will depend directly on the types of individuals who participate in design sessions.

- *Strategic thinkers* tend to look for "big picture" answers, and therefore need very few aggregation categories. The "roll-ups" for each strategic aggregation of data, however, can be quite complex.
- *Operational thinkers* have a tendency to want to dissect and review every measure by every category used in their part of the enterprise, and thus tend to require large numbers of less complex aggregation categories.

Structural metadata identifies the system of record for all information warehouse data entities. It also fully describes the integration and transformation logic for moving each information warehouse entity from its system of record to the information warehouse. In addition, structural metadata defines the refreshment schedule and archive requirements for every data entity.

When the information warehouse structure changes, its metadata is changed accordingly. Old versions of the structural metadata are kept to document the changing nature of the information warehouse and allow access to archive data.

Structural metadata also includes performance metrics for programs and queries so that users and developers know how long programs and queries should run. Information warehouse performance tuning also uses these metrics.

Access metadata is the dynamic link between the information warehouse and end-user applications. It generally contains the enterprise measures supported by the information warehouse and a dictionary of standard terms including user-defined custom names and aliases. Access metadata also includes the location and description of information warehouse servers, databases, tables, detailed data, and summaries along with descriptions of original data sources and transformations.

Access metadata provides rules for drill up, drill down and views across enterprise dimensions and subject hierarchies like products, markets, and customers. Access metadata also allows rules for user-defined custom calculations and queries. In addition, access metadata contains individual, work group, and enterprise security for viewing, changing, and distributing custom calculations, summaries, or other analyses.

Apply the Correct Technology Solution

- Only after fully defining enterprise requirements and designing the information warehouse architecture should an enterprise begin to select the technology for the information warehouse. Key technology issues, in addition to determining the hardware/software platform for the information warehouse, include developing programs for loading information into the information warehouse, implementing access control (security) mechanisms and selecting one or more user interface tool sets.

Determine Hardware/Software Platforms

- The following are some important considerations for determining a hardware platform:

  How much data will be in the information warehouse and how much can the platform accommodate economically? How scaleable is the platform? Is it optimized for information warehouse performance? Will the platform support the software selected for the information warehouse?

  Concurrent with hardware selection is the selection of system software to support the information warehouse. Among the choices are operating systems, development software, and database management systems. The structure and size of the information warehouse will determine system software requirements. For example, an information warehouse that includes data marts will require not only relational technology, but also multidimensional access and a client/server architecture.

Develop Integration and Transformation Programs

- Integration and transformation programs are necessary to extract information from operational systems and databases for both initial load and subsequent updates of the information warehouse. Sometimes, it is possible to develop a single program for both initial load and periodic updates of the information warehouse, but often circumstances make this an unacceptable development option.

- A separate initial load program is necessary when the volume of initial data is so large that it cannot be transferred without adversely impacting other users of the operational systems. This is particularly true when initial load and update volumes are significantly different.
- Separate programs also should be considered for capturing historical data from the operational systems for loading into the information warehouse, because this is usually a one-time process.
- An additional reason for separate initial warehouse loading programs involves historical data maintained separately from the operational systems (many operational systems only maintain the most recent values for data). This situation usually requires retrieval of historical data from archive and backup files.

- Under either of these circumstances, one set of integration and transformation programs initially loads the information warehouse, and a second set periodically updates the information warehouse. Update programs are generally smaller and simpler than programs developed to load the information warehouse. Update programs often are built into operational systems to trap new occurrences of data as they are added. This works best for well-documented, in-house operational systems. Update programs that extract data from commercial off-the-shelf software or from older, poorly documented, legacy systems typically capture and transform just the changes made since the last update.

Security

- An information warehouse is a read-only source of enterprise information, therefore developers need not be concerned unduly with controlling create, update and delete capabilities. However, developers will need to address the trade off between protecting a valuable corporate asset against unauthorized access and making the data accessible to anyone within the enterprise who can put it to good use. The best solution *Visible* has found is to allow everyone in the enterprise to have access to the enterprise measure definitions and derivations, but only allow access to the underlying detailed data only on an approved, need-to-know basis.

  In addition to access security, an enterprise must be concerned with physical security for its information warehouse. Because its contents are an extremely valuable corporate resource, they must be protected against loss and damage. This protection is available in many forms ranging from simple backup and off-site storage strategies to installation of no-break power and redundant disk storage and computer systems.

User Interfaces

- Information warehouse users get useful information from the information warehouse through user interfaces. It is these user interfaces that have the most impact on how effective and useful the information warehouse will be perceived by its users. Two criteria for selecting an effective user interface are ease of use and performance. For ease of use, most enterprises turn to graphical user interfaces. For performance, developers must ensure that the hardware/software platform fully supports and is optimized for every chosen user interface.

  The most important selection criteria for user interfaces are the information needs and the level of computer literacy of potential users. A general rule is that users of highly summarized data need simple, extremely graphical interfaces, and detail data users need more complex, but less graphical tools.

  The final user interface criterion is that it supports the access metadata designed for the information warehouse. If a user interface is easy to use, allows all potential users to get the information they need in the format they need, and does it in an acceptable amount of time, it is the right interface.

5. Implement the Information Warehouse

- Information warehouse implementation includes loading the preliminary data, implementing transformation programs, designing a user interface "look and feel," developing standard queries and reports, and thoroughly training information warehouse users.

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Visible Provides Skills Transfer

Although "information warehouse" is a relatively new term, many Executive Information Systems (EIS), Decision Support Systems (DSS) and Management Information Systems (MIS) were developed by *Visible* and its clients using the underlying concepts described in this paper long before the term existed. *Visible* perfected its approach to information warehouse development through years of experience.

The *Visible* Enterprise Engineering methodology and tools are uniquely suited to support development of an enterprise information warehouse. *Visible Advantage* is the only integrated CASE tool that allows enterprise needs and measures to be linked directly to the information warehouse data model, data dictionary, integration and transformation process models, and the information warehouse database design in a single relational architecture.

Just as a powerful word processing system is not very useful to someone who does not write, *Visible Advantage* is not useful without appropriate knowledge and skills. The skills include the acquisition, interpretation and representation of all the details that go together to make up a model of an enterprise and transform the model into an information warehouse architecture. *Visible* helps clients gain the necessary expertise to use *Visible Advantage* for effectively information warehouse development through facilitation, training, education and consulting. *Visible* prides itself on its ability to transfer the skills and knowledge that allow clients to gain mastery of *Visible*'s methodology and tools. Generally, this requires three complete development cycles of defining and modeling enterprise needs, designing the information warehouse architecture, applying appropriate technology, and implementing a data mart.

1. During the first cycle, one or more *Visible* consultants help the enterprise complete a prototype data mart for the information warehouse while training enterprise personnel on an information warehouse "Action Team." *Visible* consultants are actively involved in every aspect of this initial development cycle. During this and every phase of information warehouse development, enterprise analysts, developers, and information warehouse users receive appropriate training to ensure they have the skills and knowledge to participate effectively. This "just-in-time" training is a hallmark of *Visible*.
2. In the second cycle, *Visible* consultants closely monitor and coach enterprise

personnel as the Action Team completes the next information warehouse element.

3. Finally, internal enterprise personnel perform a complete information warehouse development cycle with minimal assistance from *Visible*, typically in the form of progress and quality assurance reviews. By the end of this third cycle, enterprise personnel are fully capable of developing information warehouse components on their own.

The enterprise is ultimately responsible for ensuring that their information warehouse is developed, implemented and becomes an enterprise asset. We provide the guidance and expertise that allows the enterprise to develop a superior information warehouse effectively and efficiently.

Visible's approach to information warehouse development results in a useable, effective information management tool that exactly meets the needs of an enterprise, business or government, large or small. More information about our methodology and tools can be found in the *Visible Solution*, "Enterprise Engineering."

Information is a valuable resource. A well-defined information warehouse, properly implemented, can be a valuable tool for managing and using that resource. It translates the vast volumes of detailed, unorganized data an enterprise captures via its operational systems into useful feedback, predictors, and warnings that help information warehouse users at every organizational level make informed decisions.

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More Information

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