Managed Meta Data Environment (MME)

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By John Faulkenberry
Managing Partner
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**EWSolutions** is a Chicago-headquartered strategic partner and full life-cycle systems integrator focused entirely on providing best-in-class enterprise architecture, managed meta data environment, and data warehousing services.

**EWSolutions** provides both strategic consulting and **full-service implementation services**. This combination affords our clients a full range of services for any size enterprise architecture, managed meta data environment, and/or data warehouse/business intelligence initiative. Our client list includes:

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- American Management Systems
- Arizona Supreme Court
- Becton, Dickinson and Company
- Branch Banking & Trust (BB&T)
- California DMV
- Corning Cable Systems
- Defense Logistics Agency (DLA)
- Delta Dental
- Department of Defense (DoD)
- Driehaus Capital Management
- Eli Lilly and Company
- Fair Isaac
- Federal Bureau of Investigation (FBI)
- Fidelity Information Services
- Ford Motor Company
- GlaxoSmithKline
- Guidant
- Harris Bank
- Harvard Pilgrim HealthCare
- HP (Hewlett-Packard)
- Janus Mutual Funds
- Johnson Controls
- Key Bank
- Loyola Medical Center
- Microsoft
- National City Bank
- Neighborhood Health Plan
- Norc
- Pillsbury
- Singapore Defense Science & Technology
- Secretary of Defense/Logistics
- Target Corporation
- Thomson Multimedia (RCA)
- The Regence Group
- United States Air Force
- United States Navy
- United States Transportation Command
- USAA
- Wells Fargo
- Wisconsin Department of Transportation
- Zurich Cantonal Bank

For more information on our Strategic Consulting Services, Implementation Services, or World-Class Training, call toll free at 866.EWS.1100, 866.397.1100, main number 630.920.0005 or email us at Info@EWSolutions.com
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Presentation materials adapted from David Marco’s books...

**Universal Meta Data Models (Wiley, 2004)**

Agenda

- What is Meta Data?
- Managed Meta Data Environment (MME) Fundamentals
- Managed Meta Data Environment ROI
- What to avoid when building a MME
- Real-World MME Implementations
Meta Data
**Meta Data**

By definition meta data is

1. “Data about data”.
2. “Everything that data is not”.

What is Meta Data?
What is Meta Data?

Meta Data Definition

*All physical data (contained in software and other media) and knowledge (contained in employees and various media) from within and outside an organization, containing information about your company’s physical data, industry, technical processes, and business processes.*

*Meta Data Is Knowledge*
Meta Data vs. Data

- **Meta Data:** Meta data contains the knowledge that 1) a field is called “Customer_Name”, is 40 characters in length, and exists in systems A, B, and C; 2) our company has 3 systems containing customer master data. These systems are…

- **Data:** Data would be a specific instance of “Customer_Name” equaling “EWSolutions”

“Meta data gives context to data”
Managed Meta Data Environment (MME) Fundamentals
When talking about meta data management we always talk about the meta data repository.

When implementing a meta data management system there is a lot more to it then just the meta data repository.

Hence the Managed Meta Data Environment (MME) and its six components were born.
**Managed Meta Data Environment (MME):**
The managed meta data environment represents the architectural components, people and processes that are required to properly and systematically gather, retain and disseminate meta data throughout the enterprise.
Six Components Of The MME

- Meta Data Sourcing Layer
- Meta Data Integration Layer
- Meta Data Management Layer
- Meta Data Repository
- Meta Data Marts
- Meta Data Delivery Layer
MME – Meta Data Sourcing Layer
MME: Meta Data Sourcing Layer

- **Purpose:** The meta data sourcing layer extracts meta data from its source(s) and brings it into the Meta Data Integration Layer or directly into the meta data repository.
- The first component of the MME architecture.
- The number and variety of meta data sources will vary greatly based on the business requirements of your MME.
MME: Meta Data Sourcing Layer

Software Tools

Documents/Spreadsheets

Messaging/Transactions (EAI, web services, XML, etc.)

Applications (CRM, ERP, data warehouses, etc.)

Websites/E-Commerce

Third Parties (business partners, vendors, customers, government agencies)

End Users (business and technical)
Common Meta Data Sources

- Software Tools
- End Users
- Documents/Spreadsheets
- Messaging/Transactions
- Applications
- Websites/E-Commerce
- Third Parties
Common meta data locations and the types of meta data that they typically contain

<table>
<thead>
<tr>
<th>Common Meta Data Locations</th>
<th>Types of Meta Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETL tool/process</td>
<td>Data transformation rules</td>
</tr>
<tr>
<td></td>
<td>Program job dependencies</td>
</tr>
<tr>
<td></td>
<td>Data warehouse balancing statistics</td>
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<tr>
<td></td>
<td>Data warehouse load statistics</td>
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<tr>
<td></td>
<td>Data lineage</td>
</tr>
<tr>
<td>Data modeling tools</td>
<td>Logical and physical data models</td>
</tr>
<tr>
<td></td>
<td>Technical entity definitions</td>
</tr>
<tr>
<td></td>
<td>Technical attribute definitions</td>
</tr>
<tr>
<td></td>
<td>Domain values</td>
</tr>
<tr>
<td>Documents</td>
<td>Business policies</td>
</tr>
<tr>
<td>Employees</td>
<td>Business policies</td>
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<td></td>
<td>Business entity definitions</td>
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<td>Business attribute definitions</td>
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<td></td>
<td>Data stewardship</td>
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<tr>
<td></td>
<td>Data lineage</td>
</tr>
<tr>
<td>Reporting and OLAP tools</td>
<td>User access patterns</td>
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<tr>
<td></td>
<td>Report execution time</td>
</tr>
<tr>
<td>Vendor applications</td>
<td>Logical and physical data models</td>
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<tr>
<td></td>
<td>Data dictionary</td>
</tr>
<tr>
<td>Data quality tools</td>
<td>Audit controls</td>
</tr>
</tbody>
</table>
MME – Meta Data Integration Layer
MME: Meta Data Integration Layer

- **Purpose:** The meta data integration layer takes meta data from the various sources, integrates the meta data, and loads it into the meta data repository in the proper manner.

- Differs slightly from the common techniques used in data warehousing, as the data warehouse clearly separates the transformation (part of integration) process from the load process.

- Steps are combined in the MME because, unlike a data warehouse, the volume of meta data is not nearly that of data warehousing data.

- Also, data warehouses capture data that is time-variant. MMEs capture historical meta data, but not in slices of time.
How the meta data integration layer is built is greatly impacted by whether or not you are using a meta data tool.

It is important to ensure that you have:
- Checkpoint and restart capabilities
- Meta data quality checking
- Error logging
MME – Meta Data Repository
Meta Data Repository

- **Purpose:** A meta data repository is a database designed to gather, retain and disseminate meta data.

- Responsible for the cataloging and persistent physical storage of the meta data.

- **Implementation Tip:** Consider how readily the meta data in the repository can be accessed and potentially ported to a different environment?
Meta Data Repository
A meta data repository should be generic, integrated, current and historical.
How large are MMEs?

**General Rule:** MMEs hold between 5 – 20 gigabytes of meta data

In the late 1990s MMEs were focused primarily on data warehousing and on a much smaller scope

Over the last 4 years MMEs have often focused on an enterprise level

Currently there are several MMEs that store more than 100 gigabytes of meta data

**Prediction:** By 2007 you will see terabyte sized MMEs
MME – Meta Data Management Layer
Purpose: The meta data management layer provides the systematic management of the meta data repository and the other MME components.

The approach to this component greatly differs whether a meta data integration tool is used or if the entire MME is custom built.

If an enterprise meta data integration tool is used for the construction of the MME, that tool will come with a meta data management interface built within the product.
MME: Meta Data Management Layer

Meta Data Management Layer

Meta Data Repository
MME: Meta Data Management Layer

Common Meta Data Management Layer Functions

- Archive
- Backup
- Database Modifications
- Database Tuning
- Environment Management
- Job Scheduling
- Load Statistics
- Purging
- Query Statistics
- Query/Report Generation
- Recovery
- Security Processes
- Source Mapping/Movement
- User Interface Management
- Versioning
MME – Meta Data Marts
Purpose: Meta data marts are a database structure, usually sourced from a meta data repository, that are designed for a homogenous meta data user group (meta data users with like needs)
Meta Data Marts

Meta Data Repository

End Users (business and technical)

Meta Data Marts
Reasons to build meta data marts:

- A particular meta data user community may require meta data organized in a manner other than what is in the meta data repository.
- An MME with a larger user base often experiences performance problems because of the number of table joins that are required for the meta data reports.
  - The meta data marts will not experience the performance degradation because they will be modeled multi-dimensionally.
- A separate meta data mart provides a buffer layer between the end users from the meta data repository.
  - This allows routine maintenance, upgrades, and backup and recovery to the meta data repository without impacting the availability of the meta data mart.
MME – Meta Data Delivery Layer
MME: Meta Data Delivery Layer

- **Purpose:** The meta data delivery layer is responsible for the delivery of the meta data from the MME to the end users and any applications or tools that require meta data feeds to them.
MME: Meta Data Delivery Layer

- Meta Data Repository
- Websites/E-Commerce
- Messaging/Transactions (EAI, web services, XML, etc.)
- Business Users
- End Users (business and technical)
- Third Parties (vendors, customers, government agencies)
- Data Warehouse/Data Mart(s)
- Software Tools
- Meta Data Marts
- Applications (CRM, ERP, etc.)

End Users (business and technical)
MME – Meta Data Delivery Layer

- Applications
- Data warehouses and data marts
- End users (business and technical)
- Messaging and transactions
- Software tools
- Third parties
- Websites and e-commerce
Managed Meta Data Environment ROI
“The key to your company’s prosperity is how well you gather, retain and disseminate knowledge”

“Managed meta data environments are the key to gathering, retaining and disseminating knowledge”
 Managed Meta Data Environment ROI

- Meta Data for the Business (business meta data)
- Meta Data for the IT Department (technical meta data)
Business Meta Data
“The greatest problem in communication is the illusion that it has been accomplished.”

George Bernard Shaw
Meta Data for the Business (business meta data)

- Provides the semantic layer between a company’s systems (operational and business intelligence) and their business users
Meta Data for the Business

- Reduces training costs
- Makes the data warehouse/data mart information much more valuable as it aids analysts in making more profitable decisions
- Limits incorrect decisions
- Assists business analysts in finding the information they need, in a timely manner
- Bridges the gap between business users and IT professionals
- Increases confidence in the IT system data
Business
Meta Data In Action
1. “Global Sales by Month”
This report shows a year's worth of U.S., international, and Totals, of summarized sales figures by product category, on a monthly basis.

2. “Global Sales by Region, by Month”
This report shows a year's worth of U.S., international, and Totals, of summarized sales figures by product category, on a monthly basis by region.

3. “Global Product Sales by Region, by Month”
This report shows a year's worth of U.S., international, and Totals, of detailed product sales figures, on a monthly basis by region.
### 2003 Monthly Global Sales Report

<table>
<thead>
<tr>
<th>Month</th>
<th>Product Category</th>
<th>Sales $ (in thousands)</th>
<th>Sales $ (in thousands)</th>
<th>Sales $ (in thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>U.S.</td>
<td>International</td>
<td>Total</td>
</tr>
<tr>
<td>December</td>
<td>TV</td>
<td>22,101</td>
<td>10,200</td>
<td>32,301</td>
</tr>
<tr>
<td></td>
<td>VCR</td>
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<td>4,300</td>
<td>15,490</td>
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<td>Cellular Phone</td>
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<td>7,193</td>
<td>19,383</td>
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<td></td>
<td>Digital</td>
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<td>1,301</td>
<td>5,303</td>
</tr>
<tr>
<td></td>
<td>Miscellaneous</td>
<td>1,209</td>
<td>870</td>
<td>2,079</td>
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<tr>
<td>November</td>
<td>TV</td>
<td>42,000</td>
<td>22,200</td>
<td>64,200</td>
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<td>Miscellaneous</td>
<td>2,730</td>
<td>1,700</td>
<td>4,260</td>
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<tr>
<td>October</td>
<td>TV</td>
<td>70,100</td>
<td>32,950</td>
<td>103,050</td>
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*Sales $ U.S.* is comprised of aggregated sales revenues from the United States, Canada, and Mexico, but does not subtract sales dollars from returned orders.
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<td>7,700</td>
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</table>

## Data Quality Tracking Statistics
- 8.4% of the dollar values were not loaded
- 1.7% of the records were not loaded
December 11, 1998 the Mars Climate Orbiter was launched

Engineers calculated rocket firing using feet-per-second, the orbiter was programmed in meters-per-second (metric system) of thrust

The difference was 4.4 feet per second

“Each time there was a burn (rocket firing) the error built up,” said Art Stephenson, Director of the Marshall Spaceflight Center and Head of the NASA Investigation Team

“We entered the Mars atmosphere at a much lower altitude (than planned),” said Ed Weiler, NASA's chief scientist. “It (the spacecraft) either burned up in the Martian atmosphere or sped out (into space). We're not sure which happened.”

The cost of this mission was $250 - $300 million

Security And Regulatory MME Applications
## Meta Data for the Business

### Audit Compliance Report

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Who Changed Data?</th>
<th>When Changed</th>
<th>Current Value</th>
<th>Prior Value</th>
<th>Reason For Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject’s Date of Birth</td>
<td>Data Screener A</td>
<td>May 1, 2003</td>
<td>July 2, 1985</td>
<td>July 2, 1958</td>
<td>Input error, transposed last 2 digits of year</td>
</tr>
<tr>
<td>DateTime Treatment Given</td>
<td>Data Screener B</td>
<td>May 10, 2003</td>
<td>March 9, 2002 10:05AM</td>
<td>March 9, 2002 10:05PM</td>
<td>Input error, should have been PM instead of AM</td>
</tr>
<tr>
<td>Subject’s Weight at Screening</td>
<td>Data Screener C</td>
<td>May 12, 2003</td>
<td>210 pounds</td>
<td>195 pounds</td>
<td>Equipment error, scale wasn’t calibrated correctly</td>
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<tr>
<td>Subject’s Height at Screening</td>
<td>Data Screener D</td>
<td>June 18, 2003</td>
<td>64.2 inches</td>
<td>42.6 inches</td>
<td>Input error, reversed the numbers</td>
</tr>
</tbody>
</table>

### The Great Pharma Company

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Who Changed Data?</th>
<th>When Changed</th>
<th>Current Value</th>
<th>Prior Value</th>
<th>Reason For Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject’s Date of Birth</td>
<td>Data Screener 1</td>
<td>June 4, 2003</td>
<td>April 4, 1955</td>
<td>July 4, 1945</td>
<td>Input error, entered wrong value</td>
</tr>
<tr>
<td>DateTime Treatment Given</td>
<td>Data Screener 2</td>
<td>May 10, 2003</td>
<td>March 9, 2002 10:05AM</td>
<td>March 9, 2002 10:05PM</td>
<td>Input error, should have been PM instead of AM</td>
</tr>
<tr>
<td>Subject’s Weight at Screening</td>
<td>Data Screener 3</td>
<td>May 14, 2003</td>
<td>210 pounds</td>
<td>195 pounds</td>
<td>Equipment error, scale wasn’t calibrated correctly</td>
</tr>
<tr>
<td>Subject’s Height at Screening</td>
<td>Data Screener 4</td>
<td>June 21, 2003</td>
<td>55.5 inches</td>
<td>555 inches</td>
<td>Input error, skipped decimal point</td>
</tr>
</tbody>
</table>

### Clinical Research Organization

<table>
<thead>
<tr>
<th>Attribute Name</th>
<th>Who Changed Data?</th>
<th>When Changed</th>
<th>Current Value</th>
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<td>555 inches</td>
<td>Input error, skipped decimal point</td>
</tr>
</tbody>
</table>
Technical Meta Data
Meta Data for the IT Department (technical meta data)

- IT departments need to better manage their systems as business’ demands are increasing
What Do Our Current IT Systems Look Like?
Islands of Data

Operational Applications

End User Reporting Systems

Islands of Data

Legend

Multiple colors indicate the system is used by multiple divisions.
Meta Data for the IT Department

IT Project Failure
- 1998 the Standish Group surveyed 7,000 IT projects
- 26% Successful
- 28% Failed
- 46% Significant Cost Overruns

1999 Standish Group IT Survey
- 17% Successful
- 34% Failed
- 49% Significant Cost Overruns

2000 Standish Group IT Survey
- 28% Successful
- 23% Failed
- 49% Significant Cost Overruns
Meta Data for the IT Department

- **Dramatically reduce the probability of project failure**
- Speed system’s time-to-market
- Reduce system development life-cycle time
- Limit redundant data
- Limit redundant processes
- Manage IT portfolios
- Leverage work done by other teams
- Reduce rework
- Reduce research time
- Reduce unproductive work
- Lower the impact of staff turnover
When multiple data warehouses exist many problems tend to occur:

- **Duplicate data** (assessed a client that had 80% data redundancy between two multi-terabyte data warehouses)
- **Redundant analysis** by data warehousing teams
- Multiple versions of the truth
- **Duplication** of reports/queries
- **Increased strain** on operational batch windows

Managed meta data environments (MME) addresses the excessive redundancies (data, process, analysis, etc.) that exist in this type of environment.

The MME acts as the “**glue**” that binds the data warehouses together.

Meta data becomes even more vital in these type of environments.
Impact Analysis
### Meta Data for the IT Department

**Question:** Show all systems, tables/files, fields, and their domains impacted by a change to the length of all occurrences of the Customer_Name field

<table>
<thead>
<tr>
<th>Impact Analysis Report</th>
<th>January 7, 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Field</strong></td>
<td><strong>System</strong></td>
</tr>
<tr>
<td>Customer Name</td>
<td>Order Entry</td>
</tr>
<tr>
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<td></td>
<td></td>
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<tr>
<td>General Ledger</td>
<td></td>
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<tr>
<td>EXPENSES</td>
<td></td>
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<tr>
<td>Cust_ACCOUNTS</td>
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<tr>
<td>Data Warehouse</td>
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“We build systems to manage every aspect of our business, except one to manage the systems themselves.”

“A managed meta data environment is a system that manages our systems.”
What To Avoid When Building A MME
Top 10 List

#10 MME team creates standards none of the supporting teams can follow

#9 Not creating a MME team and/or trivializing the MME effort

#8 Failing to have an experienced meta data project manager/architect leading the project

#7 Neglecting to change the “status quo”
What To Avoid

#6 Creating meta data silos – “Islands of Meta Data”
#5 Too many manual meta data integration processes
#4 Not providing EASY access to the meta data
#3 Selecting a meta data tool without conducting an evaluation or defining requirements
#2 Trying to do a “Big Bang” (waterfall) implementation… **Boiling the Ocean**
What To Avoid

Number #1 Reason
Not defining tangible business/technical objectives of the managed meta data environment!!

Good Business Drivers

- Increase Revenue
- Ensure Public Safety
- Save Lives
- Decrease Costs
- Educate
- Assist Warfighter
- Regulation Adherence
Real-World MME Implementations
Scoring

**Value**
- 1 = You’ve just earned a promotion
- 2 = Highly valuable
- 3 = Moderate value
- 4 = Low to moderate value
- 5 = Little to no value

**Development Effort**
- 1 = Trivial
- 2 = Fairly small
- 3 = Moderate
- 4 = Fairly large and complex
- 5 = Parting the Red Sea
Large Insurance Company

- Large insurance company
- Company is highly respected by CEOs
- Multi-channel organization

- The MME was part of a larger Data Asset Management effort
Large Insurance Company

Problem/Opportunity
- Lower IT costs
- Enable data integration across all of the channels

Meta Data Solution
- Manage “code” data
- Manage XML schemas
- Manage technical meta data support applications
- Assist change management process
ROI

- No longer has a “word-of-mouth” change management
- Over **300% ROI** was realized from reusing the results of the data research and from reusing the research process, without taking into account the value of expediting time to market
- 300% ROI does not include the estimation of the analytical time saved
- End-users have indicated that it is significant
Large Insurance Company

Value =

Development Effort =

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Strategic Partner & Systems Integrator
Intelligent Business Intelligence™
One of the largest financial companies in the U.S. and one of the largest financial institutions in the world

Company is highly respected by CEOs

MME was the enabling technology of a Data Assets Management team

CIO was directly involved
Problem/Opportunity
- Lower IT costs
- Enable data integration
- Ensure the success of the data warehousing projects

Meta Data Solution
- Manage “code” data
- Manage XML schemas
- Store and manage *business meta data*
- Manage technical meta data support applications
- Enable overseas system support
- Entity/attribute naming standards for all new applications
Large Financial Institution

ROI

- **Business users have grown to depend on the business meta data**
- The IT project teams are reporting considerable cost savings
- Needed to provide to **state regulators** a data trail for information that was provided to policyholders. The MME stored the mappings for a data trail from legacy systems through to the fields on letters that were sent to each policyholder
- This satisfied the requirements set forth by the **public auditors**
Value =

Development Effort =
Information Provider

- Large corporation that provides data to banks and other financial institutions
- Data is delivered in a data mart-like structure
- Competes in a marketplace against other large information providers
Problem/Opportunity

- Clients required a great deal of training to understand the data that they have

Meta Data Solution

- Integrate business meta data onto the data structures
ROI

- Competition does not have business meta data
- Sales team now has a competitive differentiator in the marketplace
- Charge a premium for the business meta data, so their MME is directly generating revenues
Value =

Development Effort =
Large Retailer

- Large retail corporation that has multiple, terabyte plus size data warehouses
- Their data warehouses have over 5,000 users. Most of these people are frequent users
- Entity/attribute naming standards for all new applications
Problem/Opportunity

- Users want to know how long it will take to retrieve a data warehouse report/query before they decide to request it
- Pre-table scans are not an option as the data volumes and number of users are too high

Meta Data Solution

- Capture technical meta data on the data warehousing reports
- Average the last five report’s elapsed time and display to the user a message showing this time and ask them if they still want to run the report
Large Retailer

**ROI**

- Wasn’t the greatest productivity enhancer
- End users wanted this option for a long-time
- Built **goodwill** between the data warehouse team and the end users
Large Retailer

Value =

Development Effort =
Manufacturer

- Large manufacturer of computer equipment
- Has a significant web presence
Problem/Opportunity
- Users would make erroneous report requests because they didn’t know where the information they needed was located
- Large number of help desk calls
- Development teams were not as productive as they should be, kept “reinventing the wheel”

Meta Data Solution
- Capture technical and business meta data on the data warehouse
- Built a **fun** meta data web site
- Business users could browse through business meta data and sign up for online training
- Developers can view and share technical meta data (project document and source code)
ROI

- Saved over $1.5 million just in the reduction of unneeded report requests and help desk calls
- Data warehouse code ran more efficiently because of leveraging other teams work
Value =

Development Effort =
Large Package Delivery Company

- Large package delivery company
- One of the largest companies in the world
- Large data warehouse
- "Gold-Standard" MME
Large Package Delivery Company

Problem/Opportunity
- Very difficult for IT to manage computer systems

Meta Data Solution
- Integrated technical meta data across the entire enterprise
- Can generate impact analysis
- Took 6 years to build
- Entity/attribute naming standards for all new applications
Large Package Delivery Company

**ROI**

- Saves **1.5 internal auditor resources**
- New package system reused 70% of existing data elements
- Replaced all paper dictionaries in the hubs and distribution center
- Reduced an IT analysis task from 90 hours to 3 hours
- **Reportedly took only 2 months to change the bar code across all of the systems in the company**
Large Package Delivery Company

Value =

Development Effort =
Large Bank

- Very large bank
- Over 60,000 employees serve over 12 million customers through over 1,600 branches and offices in 30 countries
- “Gold Standard” in meta data management
Large Bank

Problem/Opportunity
- IT costs were too high (data and application redundancy)
- Speed up IT development life-cycles

Meta Data Solution
- Integrate technical meta data from across the enterprise
- Identification, publication and maintenance of over 4900 batch interfaces between more than 200 applications, 1.35 million data elements, and over 20 million data relationships
- The MME provides more than 1,000 unique end users 24x7 access to the meta data
- Create **enterprise-wide impact analysis**
- Managing XML schemas
- Support a large data warehouse environment consisting of many databases and many terabytes of data
- Entity/attribute naming standards for all new applications
Large Bank

ROI

- Estimated 28,000 pieces of information were extracted from the MME via the web site. The estimated cost to obtain this information manually (one person talking to another) is over $2,500,000.

- Impact analysis across 200 applications can be completed in hours or days as opposed to weeks or months.

- Measured that manual impact analysis accounts for 60% to 70% of their application's support and maintenance budget.
Value =

Development Effort =
Don’t Limit Yourself