Data Mart/Warehouse: Progress and Vision

Institutional Research and Planning
University Information Systems

1/2/2007
A data warehouse:

- is a single place that contains *complete*, *accurate* data from multiple sources, making data analysis easier.
- can streamline complex administrative functions and support the decision-making process.
- is specifically designed for querying and reporting.
- is separate from operational/legacy systems (e.g. SIS).
How data warehousing works

- Information is collected from a variety of different sources and formats.
- The data is “cleaned” – transformed into a common format.
- The cleaned data is added to the warehouse, and made available through data marts.
- Data is frozen in time for comparative and forecasting purposes.
- Users can then write queries or make reports using the data warehouse, instead of linking separate databases.
IRP Data Mart/Warehouse

- SIS (completed)
- HRS data
- FRS data

IRP data selection and design

Data Warehouse

UIS
Software/hardware support and tools

Queries
Reports

President
Administration
Provost
Deans
Chairs

1/2/2007
Use of data warehousing

- **Reporting**
  Consistency and standardization of data. Users only have to learn how to use one database to write queries and reports and display data in graphical form.

- **Internal** – Enrollment, retention & graduation rates, etc.

Data Driven Decision Making

- Monitor data
  - Data warehousing helps monitor important university processes.
- Rapid queries
  - Users can generate ad-hoc reports “on the fly” without needing to spend time writing and re-writing the code needed to extract data from multiple sources.
- Trend Analysis
  - Administrators can easily analyze admissions and enrollment trends using historical data.
- Daily Decision Making
  - Increase the efficiency of the daily functioning of departments and services.
Benefits of Data Warehouse

- Competitive advantage
  - Administrators can respond to changing conditions based on data.
  - Consistent public image
- Reputation for quality and excellence
  - Enhance public image
- Facilitates accreditation
  - By using the data warehouse to “drill down” into the college level and department level, more detailed reports can be generated for accreditation
IRP’s Data Mart

Current data

- SIS
  - Enrollment
- Degrees
- Admissions
- Graduation
- Retention

Databases to be added

- Research expenditures (2 years)
- Course distribution (2 semesters w/ ability to go back further)
- Faculty file to 1995 (in progress)
- Staff file (in process of being cleaned)
- Budget file (in conceptual design stage)
- Athletics (in progress)
- Faculty Load (in development)
- Student services (in the future)
- Housing (in the future)
Data source analysis diagram

NJIT

Student Information System (SIS)

Enrollment & Degree Data

Other Data

Commission of Higher Education (CHE)

Official Data

Student Information Data Warehouse (SIDW)
Current IRP Data Mart Screens
Screenshot: Predefined query

- Pre-Defined Query -

- Common Data Set
- Enrollment Data
- Degree Data
- Admission Data
- Graduation Rate
- Retention Rate
- Student Life
- Miscellaneous

Note: This data is provided for internal purposes. In some cases, official data may vary slightly.
Screenshot: Enrollment data query

- Enrollment Data -

Variable to Choose:  
Gender  
Ethnicity / Citizenship  
Program / School  
Class Level  
AttStatus / MatStatus

Variable Chosen:  
Gender  
Ethnicity / Citizenship  
Class Level

Year:  
2004

Special Group:  
All Student

1/2/2007
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- Graduation Rate -

Variable to Choose:  
- Gender  
- Ethnicity / Citizenship  
- Program  
- School

Variable Chosen:  
- Gender

Year: 1997

Period: 6-year Graduation Rate

Special Group:  
- All Student  
- AMP Student  
- EOP Student  
- Honor Student

Note: Overall Graduation Rate =  
Graduation Rate of "Graduated in School/Program" +  
Graduation Rate of "Graduated in Other School/Program"
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- Retention Rate -

Variable to Choose: Gender, Ethnicity/Citizenship, Program, School

Variable Chosen: Ethnicity/Citizenship School

Year: 2002

Period: 2nd Year Retention Rate

Special Group: All Student

Note: Overall Retention Rate = Retention Rate of "Retained in School/Program" + Retention Rate of "Retained in Other School/Program"
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Screenshot: Student life query

- Student Life -

- Residence Hall
- State of Residence
- Age

Submit
Screenshot: Miscellaneous queries

- Miscellaneous -

- SAT Score
- GRE Score
- High School Rank Percentile
- Current Accumulated GPA
- Full-time Equivalent Enrollments (FTE)

Submit
Components of Data Warehouse

Metadata Repository

Enterprise Data Warehouse

Target Database(s) (RDB, MDDB)

Replication

Data Mart
Marketing
Risk Management
Engineering

Data Mining

OLAP/ROLAP

Relational Query Tools

Production Reporting Tools

Custom-Built Applications (4GL tools)

EIS/DSS

Access

Middleware

Applications

Select
Extract
Transform
Integrate
Prepare

Legacy
OLTP
External
Operational Systems/Data

Operational Systems/Data

NJLT

1/2/2007
Extract, Transform and Load (ETL)

Moving and Improving Data

**EXTRACT**
The process of reading data from a database.

- Packaged applications (CRM, ERP)
- Legacy systems
- Other internal applications (C++, Java, Visual Basic)

**TRANSFORM**
The process of converting the extracted data from its original state into the form it needs to be in so it can be placed into another database. Transformation occurs by using rules or lookup tables or by combining the data with other data.

**CLEANSE**

**LOAD**
The process of writing the data into the target database.

ETL software is used to migrate data from one database to another or to data marts and data warehouses. The central part of the process, the “transform” function, cleanses the data, eliminates duplicates and reformats the data for the target repository.
Subject-orientation
integrated
non-volatile (i.e. not updated)
time variant (kept for long periods, for forecasting and trend analysis)
summarized
large volume
not normalized
metadata
data sources
Data Warehouse Process

Data Warehousing

Data Sources → Collection → Data Storage → Target Data → Pre-processing

Preprocessed Data → Transformation → Transformed Data → Data Mining

Patterns → Interpretation/Evaluation → Knowledge

Use → Presentation → Knowledge Base
Data Warehouse Tools

- Intelligent Agents and Agencies - tools work and think for user.
- Query Facilities and Managed Query environments.
- Statistical Analysis - One of the biggest surprises in the data warehousing marketplace is the resurgence of interest in traditional statistical analysis, and the concomitant resurrection of the popularity to products like SAS and SPSS.
Data Discovery -

- A large class of tools formerly classified as decision support, artificial intelligence and expert systems. They now make use of neural networks, fuzzy logic, decision trees, and other tools from advanced mathematics to allow a user to “sift” through massive amounts of raw data to “discover” new, interesting, insightful, and in many cases useful things about the organization, its operations, and its markets.

- There are many different data discovery tools/products on the market.
Data Warehouse Tools

- **OLAP - On-line Analytical Processing:**
  - Often uses multi-dimensional spreadsheet tools allowing users to look at information from many different angles.
  - Users are able to “slice and dice” reports and to look at the same kinds of information at different levels at the same time.
  - Typical OLAP application might allow a product manager to view sales figures for a given product at the national level, see them broken down by division, drill down to see territories within a division, check sales numbers for each store within a territory, and then compare them against sales of stores from another territory.
Data Mining

Provides for:
- Knowledge discovery in databases
- Knowledge extraction
- Data archeology
- Data exploration
- Data pattern processing
- Data dredging
- Information harvesting
## Data Mart Timeline:

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